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Harmonization of Educational Reforms, the Role of Leadership in Transforming Mother Tongue Teaching and Learning

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Abstract: In the context of global educational reforms, effective leadership in educational institutions significantly impacts the implementation of policies aimed at improving teaching and preserving cultural and linguistic diversity. This study analyzes the role of leadership in transforming mother tongue teaching and learning, providing a sustainable foundation for quality education (SDG4).To examine the role of leadership in implementing national strategies that support quality and innovation in mother tongue teaching. The study draws on key educational documents, including the National Education Strategy (2021–2026), the Pre-University Education Legislation, and the Pre-University Education Curriculum of Albania. It also analyzes global leadership practices in pre-university schools, providing a comparative framework for the development of quality education and the implementation of educational policies. The research uses the analysis of official documents and empirical data, integrating years of personal experience in teaching and leadership in pre-university education, alongside a review of global policies and practices. Effective leadership directly influences the implementation of national strategies, the promotion of innovation, and the professional development of teachers. These elements are essential for the development of language skills and the preparation of responsible citizens within a European framework. The study highlights the need to strengthen leadership to ensure sustainable, development-oriented mother tongue education.

Keywords: Mother tongue, Teaching and Learning, Educational Leadership, Educational Reform, Innovation.

Introduction

This study aims to analyze the impact of leadership on transforming the teaching and learning of the mother tongue in pre-university schools in the Republic of Albania. It explores leadership as a key factor in developing students' communication and critical thinking skills within the context of cultural diversity, enabling them to face global challenges. In recent years, educational reforms have placed significant emphasis on improving the quality of education and developing school leaders as key agents in implementing educational policies. These reforms focus on transforming teaching pedagogy, the integration of technology, and enhancing the learning environment. They also aim to create a motivated and supportive atmosphere for both teachers and students, supported by a legal framework that empowers leaders of educational institutions to play a pivotal role in implementing national strategies and improving education quality.

Leadership with a clear mission and vision guides schools towards success, directly influencing teaching and learning. It facilitates the creation and implementation of approaches that support the preservation of the mother tongue, an essential component of the country's identity and culture. The research questions that will guide this study include: How can global leadership practices be used to improve pre-university education and support the development of an inclusive and quality society, in line with SDG4 (Sustainable Development Goal)? How can successful international practices be adapted to the specific Albanian context to enhance education? Additionally, how does leadership influence the quality of teaching and learning of the Albanian language in schools?

Theoretical Framework

Recent educational reforms emphasize the importance of improving the quality of education, as outlined in key national documents such as the National Education Strategy 2021–2026, the Pre-University Education Legislation (Law no. 69/2012), and the Pre-University Education Curriculum of Albania. These documents are essential in shaping educational policy approaches and implementing objectives for quality education as part of Sustainable Development Goal 4 (SDG4). Policies supported by organizations such as UNICEF (2020, 2016), OECD (2024), and ASCD (1983) focus on sustainable development and the modernization of education.

Institutional leaders bear primary responsibility for the effective management of human and financial resources to establish standards and implement the curriculum in ways that meet the needs of students and the community. This leadership role is crucial in helping to achieve the goals of SDG4, aiming for inclusive and quality education. The formulation of these policy goals is closely linked to international efforts aimed at promoting quality and inclusive education.

UNICEF (2015) underscores the importance of inclusive education, which embraces cultural and linguistic diversity, and advocates for adapting curricula and pedagogy to meet the diverse needs of students. It also highlights the need for conducting assessments and self-evaluations of school performance. According to MAS (2022), high-performing schools focus on the integrated development of students, where teaching and learning are closely tied to enhancing academic performance.

Global practices and leadership experiences from various countries in Europe and around the world demonstrate that educational leadership is pivotal in ensuring the successful implementation of effective practices in educational institutions. A solid leadership framework is essential for the successful execution of educational reforms. It emphasizes that school leaders must be capable of developing a vision and cultivating an environment that promotes creativity and collaboration.

Studies by Maxwell (2007) and Bass and Avolio (1991) stress that successful leaders inspire their teams and foster environments conducive to creativity and innovation. Maxwell asserts that true leadership is defined by the impact a leader has on followers. Bass and Avolio highlight the importance of vision, motivation, and idealized behaviors to achieve success.

Elmore (2011) argues that educational reform should begin within institutions and be grounded in tangible, measurable practices. Marzano (2007) suggests that a leader's performance directly influences student achievement by enhancing teacher motivation and professionalism. Successful international experiences, such as those implemented in high-performing schools (MAS, 2022), indicate that community involvement and parental engagement are crucial for achieving educational goals.

In Europe and beyond, multicultural and inclusive education promotes diversity and equity in teaching. According to Gardner (2000) and Goleman (2000), leaders must develop emotional intelligence and team-building skills. This requires strategic leaders with vision and strong intellectual capabilities, qualities described by Warren Bennis (1989) as essential for addressing global challenges and fostering the intellectual development of students.

Hargreaves and Fink (2004) emphasize the importance of sustainable leadership in education, which aims to achieve significant goals and inspires others to contribute to their realization. Other studies, such as those by Gabriel and Farmer (2009), evaluate the importance of a leader's vision for the success and quality of teaching and learning. Similarly, Tahiri (2025a) highlights the role of teachers in integrating creativity and critical thinking through technology, while Tahiri (2025b) analyzes the impact of educational policies and mother tongue teaching on achieving the global objective of quality education (SDG4). The mission and vision of a leader serve as guiding principles for schools, outlining the steps necessary to attain desired goals and outcomes.

Elmore (2011) asserts that educational policies must be closely linked to the daily realities of schools, ensuring that leaders and teachers effectively implement these policies in practice. Bush (2007) emphasizes the direction and management of effective educational leadership to improve teaching quality and student outcomes, as well as the development of a qualified workforce.

If we refer to John Maxwell's (2007) laws of leadership, he emphasizes that "insecure leaders often keep others down to maintain their positions, while great leaders help their followers reach their maximum potential." Maxwell further asserts that a leader should "reflect priorities, passion, skills, and vision in their daily agenda." Regarding leadership as a role model, Maxwell highlights that "a leader should be an example to others and embody their values. They should challenge wrongdoing and fight for the community, the nation, and collective goals."

Research Methodology

This study employs a mixed methodology, combining the analysis of official documents and empirical research, while also integrating the author's extensive experience in the fields of teaching and leadership in pre-university education.

Analysis of Official Documents

A key component of the research involves analyzing the Pre-University Education Legislation, the Curriculum of Pre-University Education of the Republic of Albania, and the National Education Strategy (2021-2026). The literature reviewed was selected through a systematic search in major academic databases, including Google Scholar, ERIC,

and JSTOR. This approach allowed for the collection of scholarly materials and relevant research on educational reforms, educational leadership, and global educational practices.

The author's many years of personal experience in teaching and leadership played a crucial role in analyzing practices implemented in Albanian schools, connecting theory with practice. This has enabled a deep reflection on how educational leadership has influenced the development of teaching and learning, as well as on the challenges encountered during the implementation of new policies. Drawing on successful international experiences, this study identifies opportunities for improving education in Albania. It addresses methods and research questions that will contribute to providing accurate answers regarding the impact of leadership in education and the improvement of mother tongue teaching and learning in Albania.

Results and Discussion

The Role of the Teacher and Leadership in Mother Tongue Development

Our study highlights that school performance is significantly influenced by school leaders. However, the direct impact of these leaders on the development of language policies remains a critical area that requires further examination. School leaders play an essential role in creating favorable conditions for the implementation of educational policies that support the most effective practices for quality and sustainable education (SDG4). This can be achieved through the development and support of policies that promote linguistic diversity.

The Council of Europe (2020) underscores the necessity of developing clear language learning policies, integrating the plurilingual and multicultural profile of countries. The European Union has undertaken numerous initiatives to promote the spread of different languages as carriers of cultural heritage. Tulasiewicz and Adams (2005) argue that teachers must possess advanced communication skills in their mother tongue to foster a positive educational process in environments that embrace linguistic diversity.

UNICEF (2015) emphasizes the importance of increasing opportunities for equitable learning by creating pathways for all students to advance their language skills. Tahiri and Hadaj (2022) stress that educational policies supporting mother tongue learning are vital for developing teachers' professional competencies and improving teaching accountability. According to Tahiri & Rama (2024), these policies contribute to the cultural and linguistic integration of students, helping to overcome barriers faced by students from diverse cultural backgrounds.

Hargreaves and Fink (2004) emphasize that educational leadership is a key element in improving educational institutions by creating environments sensitive to cultural and linguistic diversity. Bennett (2013), in his book *Comprehensive Multicultural Education: Theory and Practice*, presents a model for multicultural education that highlights the importance of strategies that support cultural diversity and the development of the mother tongue in schools. He also discusses the role of educational leadership in crafting an inclusive curriculum that not only reflects cultural diversity but also promotes the values of equity and justice for all students. Tahiri and Shegani (2017, p.120) argue that promoting intercultural dialogue helps create an environment where dialogue between cultures serves as a bridge to strengthen a shared national identity.

The Role of Leadership in Preschool Education

Leadership in preschool education can have a direct influence on the development of children's language competencies, thus linking leadership with teachers' experiences in creating spaces for effective teaching. Muñoz, Figlar, & Rust (2013) argue that leadership in preschool education is a crucial factor in children's development, particularly in creating favorable conditions for the development of the mother tongue from an early age.

Tahiri (2021) asserts that teachers serve as role models for students and are key figures in building a global society. Through their authority and ability to transmit knowledge, teachers significantly influence students' lives and promote the development of language competencies. Tahiri, Kuliçi & Hasani (2023) emphasize the importance of integrating curricular projects and creative methods in preschool education, further strengthening the role of the mother tongue.

The Role of the Albanian Language in Interdisciplinary Learning

The correct use of the Albanian language equips students with the knowledge, skills, abilities, values, and attitudes necessary for effective communication, both orally and in writing. It enhances their vocabulary, worldview, and the clarity of their thoughts. Additionally, the use of the mother tongue in various disciplines has notable benefits.

The application of the language in subjects like mathematics, chemistry, and other sciences not only aids in understanding academic content but also contributes to the development of students' analytical and critical skills. The integration of art and music with language can further illustrate the benefits of interdisciplinary learning. A strong command of the language is essential for understanding and analyzing scientific texts, while knowledge of natural sciences can inspire imaginative and creative writing.

Language in Education and its Role in Interdisciplinary Learning

According to researcher Duka (2015), language is the primary tool for transferring knowledge in science. Activities that strengthen students' expression and analytical skills help them develop effective communication abilities and a deeper understanding of scientific content. Gjokutaj (2012) suggests that reading and analyzing literary texts contribute to the understanding of historical events, figures, and social relationships, offering insight into the cultural and social developments of specific periods. Folk songs and folklore, integral to Albanian culture, connect the Albanian language with the arts, promoting the integration of literary and musical traditions. Key competencies such as listening, thinking, speaking, reading, and writing correctly form the foundation for interdisciplinary learning and the development of essential life skills.

Language Games in Education

Language games play an important role in developing critical and creative thinking, conceptual understanding, and the acquisition of knowledge. These activities create a rich learning environment that encourages collaboration and

strengthens analytical skills. By integrating language games, students enhance their expressive skills while acquiring knowledge.

As Radi (2008) emphasizes, "Language games are bridges between technical knowledge and the expressive skills of students." For example, interactive quizzes and games involving chemical terms and their formulas make learning more enjoyable and engaging. Language games are an effective method for connecting theoretical concepts with practical applications. According to Vygotsky (1978), language is a crucial tool for cognitive development. Open discussions foster dialogue between teachers and students, further strengthening critical thinking skills.

The Role of Leadership and Teachers in Mother Tongue Education

Leadership plays a pivotal role in transforming the teaching and learning of the mother tongue. By creating enabling policies, motivating staff, and supporting cultural and linguistic diversity, school leaders can foster language development and improve the quality of education. This integration is an essential step toward building a sustainable and inclusive education system.

According to Tahiri (2021), collaboration between leaders and teachers fosters the implementation of innovations in teaching. This creates opportunities for developing new didactic methods that enhance the learning process and increase student engagement. Diamond (2014) highlights that leaders who offer professional support to native language teachers create an environment conducive to the development of their pedagogical skills and the improvement of teaching methods.

Teachers who feel supported and motivated are more likely to implement innovative practices that include all students, regardless of their language proficiency levels. Teaching is the heart of the school and the foundation of the education system. Teachers breathe life into it through their work and creativity, influencing and changing students' lives. The methods teachers use to create a productive learning environment promote creative and intercultural learning, including through extracurricular activities, as noted by Tahiri & Hadaj (2024).

The Role of Technology and Contemporary Teaching Methods

Tahiri (2021) emphasizes that contemporary teaching methods, including the use of digital platforms and educational applications, require teachers to build their capacities through continuous training. Increasing teachers' professionalism and technological skills, as well as effectively utilizing technology in language teaching, will support and enrich the teaching and learning process.

Tahiri and Hadaj (2022) underscore that developing critical thinking should be a continuous part of all language components—listening, speaking, reading, and writing. Competency-based learning is a current trend, and its successful implementation depends on effective strategies.

The Need for Cohesion in Curricula

Tahiri and Strori (2024) stress that mother tongue curricula should remain coherent with European standards and continually align with evolving programs. Effective teaching practices are being transformed and enriched with new elements, helping to advance the teaching process.

Teacher Qualification and Continuous Training

Teachers must possess advanced communication skills to effectively promote the educational process. This requirement is closely tied to ongoing professional development to meet the challenges of multilingual and multicultural classrooms. Motivating staff and creating strategies for quality education are essential for sustainable education, as outlined in SDG4. Leaders can play a crucial role by offering opportunities for teacher training and professional development, preparing them to manage the linguistic and cultural diversity of students. This approach supports students from various linguistic and cultural backgrounds, helping them progress in language skills and contributing to an equitable and inclusive education system.

Encouraging Teacher Training and Community Involvement

In conclusion, the success of the educational system depends on fostering teacher innovation, encouraging continuous professional development, and involving the community. These elements are key factors in ensuring the effectiveness and sustainability of mother tongue education and in achieving the goals of SDG4.

Conclusion

Reflecting on the importance of leadership in the development of the mother tongue, it becomes evident that leadership is a key component in achieving sustainable success in the learning process. This process is not solely the responsibility of teachers but requires a collective commitment supported by clear leadership from school leaders and educational policies.

Effective leadership is closely linked to the creation of sustainable policies and the continuous professional development of teachers, ensuring they are equipped to face the challenges of an ever-evolving educational landscape. Leaders create opportunities for integrating linguistic and cultural diversity into the school environment, enabling teachers to use inclusive methods that support the development of students' language skills. This approach fosters an equitable and inclusive education system, which is crucial for preserving and developing the mother tongue.

In conclusion, visionary leadership has a profound impact on the preservation of the mother tongue. It not only enhances students' language skills but also helps preserve cultural identity and promotes a more integrated and equitable society. Such leadership is essential for developing an education system that supports and empowers students, preparing them for the future while safeguarding cultural and linguistic heritage.

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Abstract: Early breast lesion detection is crucial for women. According to WHO, breast cancer caused 670 000 deaths globally in 2022. Mammography is one of the best screening tools for early breast cancer detection. Still, with a dose between 3 and 5 mGy to the glandular tissue for a typical mammographic screening examination involving two views of each breast, alternatives might be used if not necessary. Breast ultrasound is an option, especially in young patients and those with dense breasts. This paper aims to present the little-known automated breast ultrasound (ABUS) as a viable alternative to the conventional handheld ultrasound. A literature review was conducted using the keywords "automated breast ultrasound," "ABUS," "ABVUS," and "sonotomography" in the online databases Google Scholar, PubMed, and Web of Science. The review yielded a total of n=267 studies, of which n=83 was considered pertinent. The review was also based on the clinical experience using an ABUS machine at St. Marina University Hospital—Varna (UMHAT "St. Marina Varna"). ABUS is not widely used in most radiology clinics, even dedicated breast clinics. Automated ultrasound is a machine controlled by an X-ray technician or an ultrasonographer, which records a series of breast ultrasound images. The main advantage of the modality is the elimination of operator dependence (with some caveats, which are expanded upon in the "discussion section"), as well as the reduction of subjectivity. If previous studies are available, precise follow-up of the size and localization of breast lesions is possible. However, a suitable additional screening method, ABUS, demonstrates some disadvantages as a diagnostic tool. Some of the limitations are the absence of information for vascularization and the elasticity of a lesion. Possible artefacts include, but are not limited to, retro-areolar shadowing, breathing artefacts, and air interposition between the probe and the skin. ABUS is applicable for screening and follow-up modality, especially in settings with a large patient base or an absence of trained personnel.

Keywords: ABUS, Breast ultrasound, AI in Radiology, Breast Cancer, Cancer Screening

Introduction

Breast cancer occurs in every country in the world and affects women of all ages, with the incidence increasing after the age of 50. Although screening programs vary between countries, mammography is recognized as the gold standard for breast cancer detection, having demonstrated a 20% reduction in mortality (Icanervilia et al., 2025). However, mammography is not always sensitive enough, and additional imaging is often needed in women with dense breasts. Tomosynthesis, ultrasound and magnetic resonance imaging are the most widespread modalities. A disadvantage of mammography and tomosynthesis is exposing the patient to ionizing radiation - mean glandular dose between 3 and 5 mGy per view. Although radiation-free, MRI is an expensive and time-consuming method. Ultrasonography is an inexpensive and widely used method of supplementary imaging and consists of two subtypes: handheld ultrasound and automated breast ultrasound.

Automated breast ultrasound (ABUS) represents a new imaging technique approved by the Food and Drug Administration (FDA) in 2012 as a supplemental screening tool for women with heterogeneously and extremely dense breasts (Boca et al., 2021). It is a standardized technique that is operator-independent and reproducible and has a similar diagnostic performance to handheld ultrasound (HHUS) (Al Jahed et al., 2022). The examination can be performed in the supine or prone position and lasts from 5 to 20 minutes depending on the number of volumes obtained - a minimum of 3 and up to 6 views. A trained ABUS radiographer uses a specialized probe to obtain three-dimensional images of the breast. A special water-based gel, different from the standard ultrasonography gel, is used to maximize skin contact.

With ABUS, there is little radiologist operator dependency and unlike HHUS, there is no limited set of stored images. ABUS allows evaluation of the whole volume of breast tissue uncoupled from the time of image acquisition, enabling a double reading approach (Lee et al., 2019). Software allows images to be stored and compared at follow-up. To our knowledge, ABUS has relatively limited familiarity among radiologists. In this article, we aim to summaries some of the available literature on the subject and share our experience with the method.

Method

A literature review was conducted using the keywords "automated breast ultrasound", "ABUS", and "sonotomography" in the online databases Google Scholar, PubMed, and Web of Science. The review yielded a total of n=267 studies, and n=83 were considered pertinent. The review was also based on the clinical experience using an ABUS machine at St. Marina University Hospital—Varna.

Results

History of breast ultrasound

High-frequency ultrasound was first used in World War II to detect metal particles during operations. After years of research, the first ultrasound for the diagnosis of breast lesions in clinical work was introduced in 1954. In the beginning, expectations for the method did not include making it a screening one but rather differentiating malignant from benign lesions. In the following decades, research into the technique spread internationally, particularly in Australia, the USA and Japan. A significant improvement was the introduction of greyscale ultrasound in 1969 - an innovation that allows differentiation of the soft tissues of the mammary gland. The first studies to look for breast lesions in asymptomatic patients are concluded.

During the 1960s, Wells and his group in England constructed a machine, unique at the time, which used a prone scanning technique with the patient's breast suspended in a temperature-controlled water bath (Dempsey, 2004). A supine version was designed by Kossoff, Jellins - breast scanner, in which an enclosed water bath with a probe within is being lowered to the patient's chest, (Goldberg, 1988) reminiscent of the modern ABUS.

Switching from analogue to digital signal in the 1980s provided better image resolution. In the following years, the most significant technical advances in breast imaging are made by developing the tissue-harmonic and Doppler signal. One of the most commonly used features of modern ultrasound equipment is elastography. It is a preferred method for characterizing lesion stiffness - often providing valuable information about the potential malignancy of the finding. There are two main types of ultrasound-based elastography - strain elastography (where mechanical pressure is applied) and shear wave elastography (which uses an additional source of ultrasound waves).

Nowadays, ultrasound also plays an essential role in detecting and characterizing axillary lymph nodes. Direct visualization of lymph nodes and cystic or solid lesions in the mammary gland allows biopsies to be performed under ultrasound guidance. These are subdivided into fine-needle, tru-cut and vacuum-assisted.

ABUS vs Conventional Breast Imaging: Clinical and Technical Comparison

Breast imaging is a mainstay in the early detection and diagnosis of breast cancer. For women with dense breast tissue, conventional imaging methods such as mammography and handheld ultrasound (HHUS) often fall short in sensitivity. Automated Breast Ultrasound (ABUS) is an emerging alternative (Vourtsis, 2019).

Mammography is almost universally applied as a gold standard in breast cancer screening owing to its high reproducibility, availability and cheap cost. Studies indicate that the sensitivity of mammography decreases from approximately 86% in fatty breasts to less than 61% in dense breasts. Dense breast tissue not only obscures lesions but also independently increases the risk of breast cancer, with women having extremely dense breasts (ACR categories C and D) facing a 4.7-fold higher risk compared to those with fatty breasts (Hooley et al., 2012). Mammography is generally reproducible and consistent across users but does not adapt well to individual breast tissue composition (Brem et al., 2015).

HHUS is commonly used as a supplemental technique to mammography. It is capable of detecting cancers that mammography may miss in dense breast tissue. It is non-ionizing and offers improved sensitivity (~70–80%) compared to mammography in dense breasts. However, HHUS is highly operator-dependent, requiring skilled technologists or radiologists to scan and interpret the images, which affects reproducibility. The quality of imaging and completeness of examination can vary significantly.

ABUS is a machine-operated imaging modality designed to reduce operator variability. It offers standardized imaging and higher reproducibility. Recent data show that ABUS has a sensitivity of 80–95% and a specificity of 85–90% in women with dense breasts. ABUS provides improved diagnostic accuracy, as demonstrated in studies such as Winkelman et al. (2024) (Winkelman et al., 2024) and Xu et al. (2025) (Xu et al., 2024), with ABUS showing higher specificity and lower biopsy recommendation rates compared to HHUS. Though it does not provide vascular information like contrast-enhanced ultrasound (CEUS), its standardization makes it ideal for large-scale screening programs. It provides three-dimensional imaging capabilities, enhancing lesion detection, especially in dense breast tissue (Skaane et al., 2013).

ABUS distinguishes itself from HHUS through its automated image acquisition process. HHUS is highly reliant on the operator's skill (a radiologist or trained sonographer in some instances), leading to variability in image quality and interpretation. ABUS, on the other hand, utilizes a mechanized transducer to scan the entire breast systematically. While this process reduces differences in acquisition, it does not completely eliminate operator dependency but merely shifts it in the way of the radiographer. This automation itself ensures relatively consistent image quality and reproducible measuring parameters (Wilczek et al., 2016).

Technical specifications

• Imaging Planes: ABUS acquires volumetric data that can be reconstructed into multiple planes, including transverse, sagittal, and coronal views. The coronal plane, in particular, offers a 'surgical view' that aids in the assessment of architectural distortions and lesion margins.

• Transducer Types: ABUS systems typically employ high-frequency linear array transducers ranging from 6 to 14 MHz. These transducers are attached to a rigid compression plate to ensure uniform contact and compression across the breast tissue.

• 3D Reconstructions: The automated scanning process captures hundreds of sequential images, which are then reconstructed into a three-dimensional dataset. This 3D volume provides an additional perspective that increases interpretation speed and offers invaluable surgical planning.

Imaging physics and technique

• Mammography: This X-ray-based modality relies on compression. It is best for detecting microcalcifications but loses sensitivity in dense tissue. It is important to note that variations such as tomosynthesis and contrast-enhanced mammography exist but are beyond the scope of this presentation.

• HHUS: Uses real-time high-frequency sound waves (5–15 MHz), offering high precision in cystic vs. solid mass differentiation, but highly operator-dependent. Complementary methods such as Doppler ultrasound and elastography can only be used in HHUS (for the time being)

• ABUS: Automated 3D ultrasound using 7–14 MHz, standardizes acquisition with volumetric reconstruction, excellent for the screening of dense breasts, but somewhat anatomy-dependent.

Operator influence and reproducibility

• Mammography: Minimal operator variation and quick training time. Least influenced by breast size, most influenced by breast density.

• HHUS: High operator variability; interpretation depends on radiologist skill. Most influenced by breast size, least influenced by breast density.

• ABUS: Low to medium acquisition variability; radiologist still interprets 2D/3D dataset. Moderately influenced by breast size and breast density.

Our experience

As part of the Radiology Department of the University Multiprofile Hospital for Active Treatment "St. Marina" in Varna (UMHAT "St. Marina"), we have the opportunity to work with ABUS on a daily basis. The machine was installed in 2017, and since then, about 840 examinations have been performed, mainly for screening and follow-up of breast lesions. The main target group of patients are women under 50 years of age (starting age for mammograms in Bulgaria). If further clarification of a finding is needed, HHUS, MRI in the facility or mammography in the outpatient setting is performed. Our hospital is the second largest in Bulgaria, so the daily flow of patients is significant. At the same time, there is a shortage of board-certified radiologists. Routine HHUS by experienced radiologists is impossible due to the extremely high workload. The ability to read images at a time independent of their acquisition is the most significant advantage of ABUS that we benefit from.

The examination is performed by a specially trained X-ray technician on a pre-specified date -10-12 days of the menstruation cycle of the patient. Before the start of the ultrasonography, the laboratory technician takes a patient's history using a specially prepared questionnaire. After that, the patient removes her clothing from her upper body and lies supine on the bed with her hands above her head. The laboratory technician coats the breasts with a specially tailored ABUS gel and applies the transducer. Both breasts are sequentially scanned in 6 projections: superior, inferior, medial, lateral, frontal, and axillary. Depending on the size of the breasts, the scan takes 20 to 30 minutes. The images are sent to a station specifically suited to interpretation.

Discussion
Pros of ABUS

Multiple studies suggest that ABUS is an effective screening modality in dense breasts.

EUSOBI (European Society of Breast Imaging) guidelines suggest the possible usage of supplemental ultrasound screening in women at average or intermediate risk with dense breasts and negative mammography (Marcon et al., 2024).

SomoInsight is the most extensive study that assessed the diagnostic performance of ABUS in a screening scenario, including 15.318 asymptomatic women with dense breasts. By associating ABUS with FFDM, the increase in the detection rate was 1.9 per 1000 women, increasing sensitivity by 26.7% (Boca et al., 2021).

Saving time and money

In contrast to the HHUS, which requires 15 to 20 minutes for the examination, the interpretation time for the ABUS is much shorter. A study from Huppe et al. reported an average ABUS interpretation time of 3 minutes by radiologists of all experience levels (Huppe et al., 2018).

The fact that ultrasonography does not put an additional and unnecessary burden on the health system budget is controversial, and several extensive studies have been done on the issue. Foglia et al. compared three scenarios: mammography with a further examination if a finding is detected, mammography in combination with HHUS and mammography in combination with ABUS. The results show that the latter scenario could save the Italian healthcare system €54 million (Foglia et al., 2020).

Possibility of reconstructions and use of CAD (Computer-Aided Detection)

ABUS software provides coronal reconstructions. These images are instrumental in visualizing and tracking dilated ducts. They are beneficial when planning surgery.

Integrating AI (artificial intelligence), specifically CAD, into breast disease diagnosis aims to reduce interpretation time and increase accuracy. One of the studies comparing the two parameters in ABUS is by Jiang et al. (Jiang et al., 2018) It is a retrospective study in which 185 screening ABUS cases were evaluated with and without the aid of CAD. The results show that while accuracy was not affected, the interpreting time was reduced by about one minute. A study by Lee et al. (Lee, Kang, Kim, & Park, 2022), including 846 cases, analyzed the characteristics of CAD markers and the causes of false-positive markings. A large number of false-positive markings is found - 530 out of 1032. A significant proportion of these are clearly distinguishable as pseudolesions, e.g. shadowing from Cooper's ligament, periareolar shadowing.

Reproducibility of images and follow-up

ABUS has excellent reproducibility in terms of lesion location, size, and characteristics. This feature makes it very suitable for following up on findings. Junk et al. (Chang et al., 2015) performed ABUS scanning of both breasts twice with a mean interval of 1.3 days in 24 patients. The localization (clockwise orientation and distance from the mamillae) and size indices showed excellent reliability—the corresponding ICCs were 0.994, 0.926, and 0,980.

According to a study by Hatzipanagiotou et al. (Hatzipanagiotou et al., 2022), ABUS is non-inferior to HHUS in predicting pathological complete response after neoadjuvant chemotherapy.

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Artifacts

Some of the known ABUS artefacts are presented, accompanied by images from our PACS.
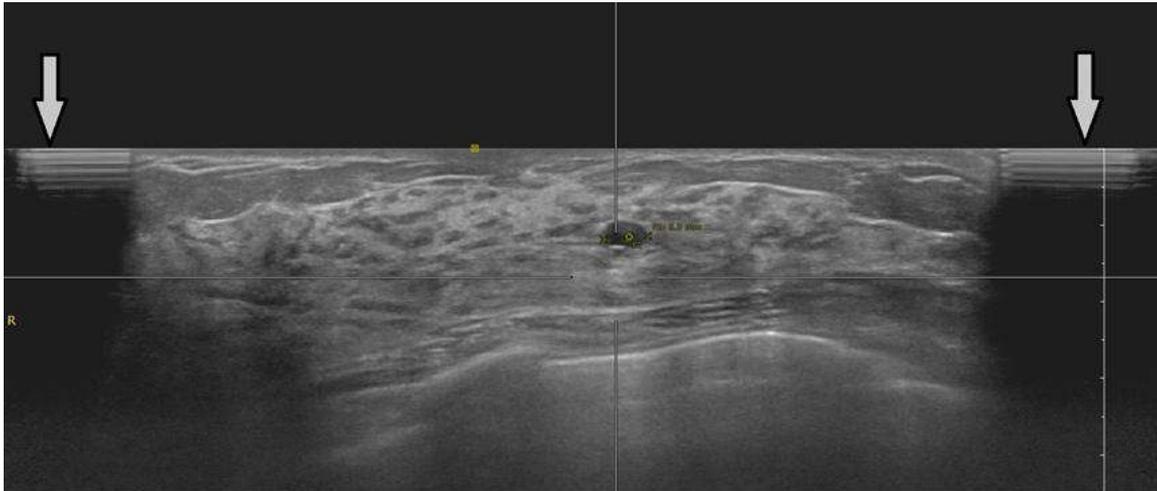
Fig. 1 Compression artefact in an image with a fibroadenoma

A compression artefact (Fig. 1) occurs in cases of insufficient tissue compression. Anechoic zones due to air interposition appear at the edges of the image, severely hampered interpretation of the breast tissue beneath these artifacts.

Fig. 2 Air interposition artefact in a 3D reconstruction.

An air interposition artefact (Fig. 2) occurs in cases of unevenly distributed ultrasound gel over the skin. Air pockets that remain in the gel scatter the ultrasound rays and appear as anechoic zones.
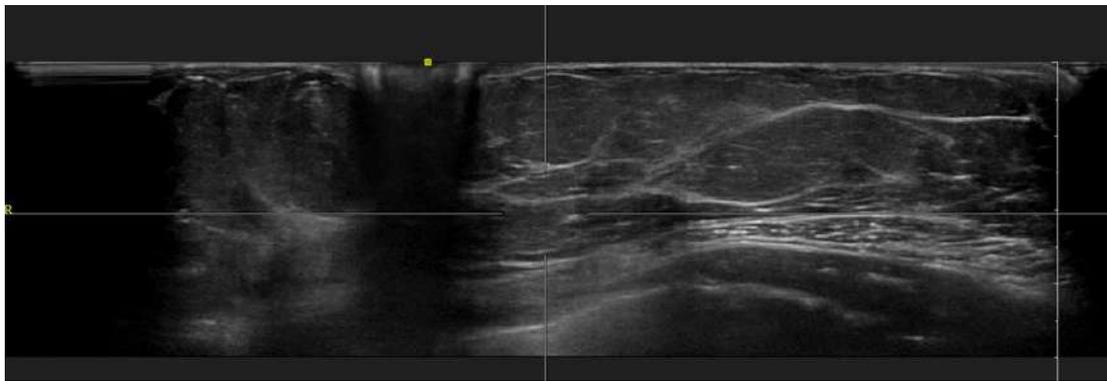
Fig. 3 Retroareolar shadowing.

66A retroareolar shadowing artefact (Fig. 3) occurs in cases of irregular or inverted nipples and represents zones of posterior shadowing which obscure the underlying parenchyma. This specific artefact frequently requires HHUS follow-up due to the particular area where it occurs.
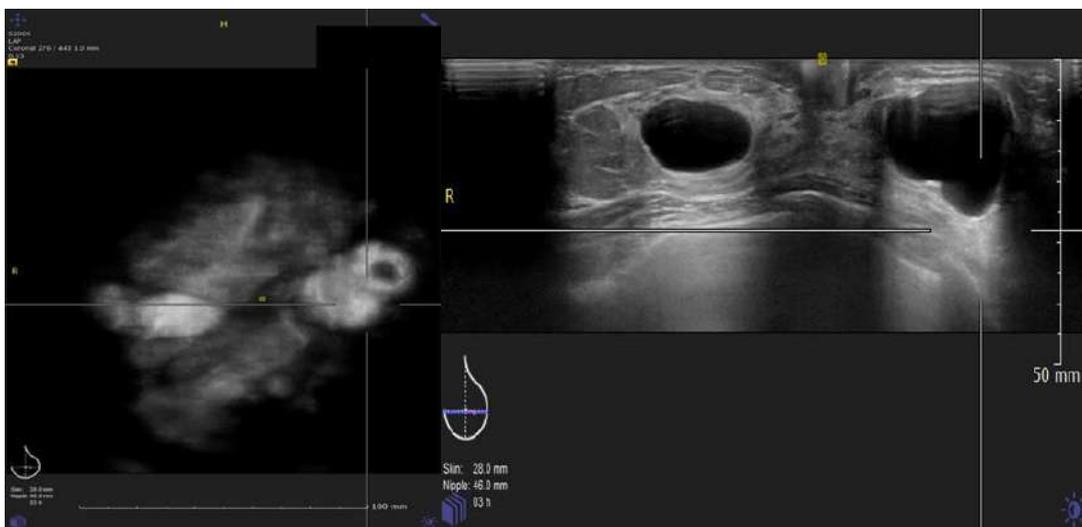
Fig. 4 White wall artefact

A white wall artefact (also referred to as a white wall sign) surrounds lesions/zones of liquid. It is analogous to zones of "posterior enhancement" or "waterfall sign" due to the amplification of ultrasound waves when passing through the liquid.

Conclusion

In conclusion, while mammography remains the first-line screening tool, its limitations in dense breast tissue highlight the need for supplemental imaging. HHUS, although valuable, introduces variability due to its operator dependency. ABUS offers a compelling solution with higher reproducibility, improved cancer detection rates, and better integration into standardized clinical workflows. ABUS should be viewed as a vital component in the future of breast cancer screening, especially for women with dense breasts. A further, previously unexplored aspect of ABUS is the ease of

integrating AI and neuronal network solutions. Further studies are needed to explore the possibilities of implementing such options.

Recommendations

ABUS is a useful supplementary screening tool to mammography for breast cancer in women with an ACR density >B as it could save both time and resources in comparison to HHUS. ABUS could be used interchangeably with HHUS in the screening of women with a high-risk profile for breast cancer when the patients are too young for mammography, as it could save both time and resources in comparison to HHUS. Due to the high reproducibility of results, ABUS could be a useful tool in following up on Bi-RADS 3 lesions. Any suspected new lesion or suspected change of lesion morphology should be confirmed by HHUS before changes to patient management are made (except for very high suspicions of malignancy or inflammatory changes, which could prove to be time-dependent). ABUS should be viewed as a supplementary tool to HHUS rather than a complete replacement, and there should be an emphasis on integrating it with AI solutions.

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Balancing Excellence: Highlights of The Relationship Between Education and Sport

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Abstract: There is a somewhat complicated relationship between education and sport has long been a topic which has been and still is an understudied relationship in the literature. In a world characterized by ever-increasing competitiveness, the search for excellence in both the academic and sports spheres has presented a deep challenge and many shortages, especially in our country. Through an exhaustive review of the methods used in past research, this article aims to delve into the different approaches and methodologies embraced by researchers in their exploration of the interaction between academic pursuits and athletic endeavors or sports. For the above, this article seeks to present an overview of studies from a variety of fields, including sports science, education, psychology, sociology, and more, to integrate them under the umbrella of excellence and balancing excellence. The analysis actually presents some key factors that connect these two approaches to each other, such as time management, motivation, stress and social support, which are factors examined in more detail in various research studies to discover the mechanisms that actually facilitate individuals in their pursuit of academic excellence while actively engaging in sports. The analysis also sheds some light on the so-called potential "traps" related to balancing individuals' academic and sporting commitments, especially challenges related to time constraints and overload. The analysis of this article concluded that the importance of contextual factors, such as cultural norms and educational systems, are among the essential components for understanding the complex interaction between sport and education. By synthesizing existing findings, the article provides valuable insights for educators, athletes, policy makers, and parents who are constantly faced with the delicate balance between academic excellence and sports engagement. In addition, the article pointed out the gaps in the research of this field in our country, suggesting directions for more in-depth studies in the coming years.

Keywords: Education, Sports, Relationships, Psychology, Educators, Excellence

Introduction

In today's dynamic and highly competitive world, the pursuit of excellence is a common aspiration shared by individuals across various spheres of life. Two distinct paths that often converge in the pursuit of personal excellence are education and sports. The complex relationship between these fields has drawn the attention of scholars, educators, athletes, policymakers, and parents alike. As emphasized by Smith and Johnson (2018:12), *"The intersection of academic pursuits and athletic endeavors remains a subject of enduring fascination."* Indeed, the intricate dance

between education and sports resonates not only with student-athletes but also with a broader audience eager to understand how individuals navigate the dual challenges of academic achievement and athletic success.

Previous research initiatives have been focused to uncovering the complexity of this relationship, and findings have been as diverse as the approaches employed. Scholars have diligently explored the balance between education and sports, employing various research methods to illuminate the nuances within this intersection. As observed by Smith and Johnson (2018:55), *"Researchers have employed a range of methodologies, from longitudinal studies to surveys and interviews, to examine the effects of sports participation on academic performance and vice versa."*

The benefits of involvement in sports activities in fostering attributes like for instance discipline, teamwork, and personal growth are widely acknowledged (Jones et al., 2019). Conversely, challenges associated with maintaining balance, including time management, stress, and the risk of burnout, are also well-documented (Brown & White, 2017). Furthermore, the link between education and recreation is not static but deeply influenced by contextual factors, including cultural norms and the structure of educational systems (Smith & Robinson, 2020). Understanding these contextual nuances is crucial for comprehending the holistic impact of sports on education and vice versa.

As asserted by Williams and Martinez (2016:5), *"Education and sports need not be mutually exclusive; rather, they can mutually reinforce each other."* This article, through an exploration of various methodological approaches, key findings, and critical insights from previous research, seeks to unravel the complex relationship between education and sports. It aims to provide valuable insights for a broad audience including educators, athletes, policymakers, and parents. Moreover, as we navigate the landscape of existing knowledge, we will identify promising avenues for future exploration. This underscores the need for a comprehensive approach that recognizes and harnesses the potential synergy between education and sports in the quest of personal perfection.

Exploring Challenges and Strategies of the Academic Athlete

In higher education, it is the responsibility of institutional leaders to ensure success for everybody students (Tinto, 1993), even those who do not meet the general admission requirements. Debates regarding the importance of athleticism in college currently dominate headlines. Initially conceived to enhance the student-athlete experience and the overall student body, athletic programs were created to complement students' education and experience (Smith, 2005). When compared to the highly publicized multibillion-dollar college athletics industry of today, it has become increasingly clear that the long days of athletics simply adding to the college experience for the student body are a distant memory. Issues of payment for playing (Berri, 2013), cheating controversies, and educational fraud (Delsohn, 2014; Ganim, 2014) trouble current college athletic programs.

Furthermore, experts often assert that these athletics courses and the associated institutions exploit for financial purposes student-athletes provide them with little hope of obtaining a degree for their efforts (Ganim, 2014). Pursuing excellence both in education and in sports can be a significant endeavor, often requiring individuals to navigate a challenging path of dual commitments.

Challenges Facing Academic Athletes

Efforts to manage time, in fact, envision the life of an academic athlete—a relentless schedule filled with rigorous training sessions, practical exercises, intensive competitions, and frequent travel. While managing these demanding and exhausting commitments, the perpetual challenge that arises is excellent scheduling. Every minute becomes precious as they strive to balance the relentless flow of hours with academic responsibilities (Brown & White, 2017). The obligation to excel both on the field, and in educational settings leaves them with limited hours to dedicate to studies. It is an ongoing battle against the "clock," a challenge they must face head-on.

The first pressure individuals encounter is academic pressure. Pursuing academic excellence is a cornerstone of an academic athlete's journey. However, this pursuit is not without its trials. The dedication of considerable time and energy to sports often leads to considerable academic pressure. During peak competitive seasons, the burden of maintaining high academic standards intensifies. The balancing act between athletic commitments and academic expectations can feel like walking a tightrope, with the risk of academic hurdles lurking at every step (Smith & Vaughn, 2018). The under pressure to succeed both on the field and in the classroom can be, at times, overwhelming.

Secondly, difficulties in this aspect also arise against the desire to balance social life. Beyond demanding schedules and academic pressure, academic athletes must also face another challenge maintaining a social life. Engagements and social relationships are an integral part of the human experience, but these too may be "compromised" due to their rigorous schedules. The delicate art of establishing a balance among academic achievements, sports, and social life becomes a complex task. Juggling social events, gatherings, and personal relationships with their academic and athletic endeavors is an ongoing challenge (Jones et al., 2019). It is a balancing act that requires finesse and adaptability.

Strategies used by Academic Athletes

One of the primary strategies employed, and among the most crucial, time management is quite effective. Faced with these challenges, many academic athletes develop exceptional time management abilities. They become masters of their schedules, meticulously structuring their days to allocate specific time blocks for studying, training, and personal activities (Smith & Robinson, 2020). It is a choreographed dance where every moment is accounted for, allowing them to maximize their limited time.

Secondly, an important and highly effective strategy is setting priorities. Successful academic athletes understand the significance of establishing clear priorities. They acknowledge that academic and athletic aspirations must take precedence in their lives. Setting goals becomes a driving force, providing them with the required focus and motivation to excel both off and on the field (Martinez et al., 2016). Priority becomes a guiding principle, helping them stay on the right track.

However, besides the two aforementioned strategies, it is essential to emphasize that these individuals must also be able to effectively utilize support systems. Knowing that they cannot go it alone, academic athletes often seek support

from coaches, teachers, and family members. They communicate their challenges, fears, and needs within these support networks, Developing a favorable environment for success (Smith & Johnson, 2018). It is through this network of encouragement and assistance that they find the strength to overcome obstacles.

It is also worth noting that maintaining mental resilience is a highly important but challenging strategy to achieve. Increasing mental resilience is a cornerstone of an academic athlete's toolkit. They employ methods such as mindfulness, stress management, and, when necessary, seek counseling to cope with the relentless pressures of their dual commitments (Brown & White, 2017). This mental strength becomes a shield against the stresses and strains that threaten to overwhelm them. It is an invisible force that keeps them going even in the toughest times.

In the entire globe of "academic athletes," challenges and strategies intertwine in an unrelenting pursuit of excellence. It is a travel where time is a valuable resource and a constant adversary, where academic and athletic pressures can be overwhelming, and where the balancing act extends into social life and personal relationships. However, armed with effective time management, clear priorities, supportive systems, and unwavering mental resilience, these individuals navigate this complex terrain with determination and grace. It is a journey where the pursuit of perfection knows no bounds and where the challenges they face are met with steadfast resolve.

The Effects of Sport on Academic Performance

The link between athletic involvement and academic performance has been a subject of intensive study, with researchers aiming to understand how involvement in sports influences students' educational outcomes. This relationship has shown to bring many benefits and positive effects to individuals. For example, improved time management skills can be mentioned. Engagement in sports often requires effective time management. Student-athletes must balance practice sessions, competitions, and travel fulfill their educational obligations. Research suggests that this experience can enhance their time administration skills, allowing them to allocate their time more efficiently for studying (Muñoz-Bullón et al., 2017). Furthermore, another highly positive effect is increasing concentration and work ethic: Participation in sports often instills discipline and a strong work ethic. Athletes learn the significance of dedication, practice, and perseverance. These qualities can transfer their academic aspirations, contributing help enhance studying habits and academic performance (Bradley et al., 2013). Thirdly, it is worth emphasizing improved physical and mental health as another significant positive effect. Regular physical activity associated with sports can lead to overall health improvement, including cognitive function enhancement. Studies have shown that physically active students tend to achieve well academically and demonstrate increased focus and attention in class (Muñoz-Bullón et al., 2017).

However, among the numerous studies, negative effects have also been observed. For example, time constraints of these individuals can be mentioned. Although sports may teach time management, the needs of intensive training and frequent competitions can sometimes lead to time constraints. Balancing these commitments with academic responsibilities could occur in reduced study time and potentially lower academic performance, especially during peak sports seasons (Yukhymenko-Lescroart, 2022). Furthermore, high workload can eventually lead to fatigue and increased stress for the individual. The Physical and psychological demands of sports can lead to fatigue and stress.

Athletes may find themselves exhausted after training sessions or intensive competitions, affecting their ability to focus on their studies (Trudeau & Shephard, 2008). Chronic stress can further hinder academic performance. It is also worth mentioning the risk of excessive overload leading to nervous exhaustion. Pursuing excellence in both sports and academics can put student-athletes at risk of burnout. The relentless demands and pressure to perform at high levels in both fields can result in physical and emotional exhaustion, potentially leading to decreased motivation and academic barriers (Trudeau & Shephard, 2008).

The impact of athletics on academic success is complicated interplay of various factors. While there are undoubtedly positive aspects, such as improved time management, enhanced discipline, and the advantages of physical and mental wellness, there are also potential drawbacks, including time constraints, fatigue, stress, and the possibility of burnout. Recognizing the multifaceted the nature of the relationship is crucial. Ultimately, the impacts of sports about academic achievement are highly individualized, with outcomes varying based on factors like intensity of sports involvement, personal resilience, and the ability to achieve a healthy balance. The key lies in understanding these dynamics and harnessing the positive aspects of sports to mitigate potential negative effects to promote intellectual success.

Strategies for Balance and Excellence

Balancing the demands of education and sports can be a significant challenge, but it is a challenge that many individuals willingly embrace in their pursuit of excellence. Among the most valuable and equally difficult strategies to achieve is efficient scheduling. This entails meticulous planning. A student-athlete's daily routine, a whirlwind of academic tasks, rigorous training sessions, and constant pressure to excel both in class and on the field. In this high-stakes balancing act, structured planning emerges as a cornerstone of success. Student-athletes must be equipped with discipline, creating detailed schedules that segment their days into designated time blocks. These blocks are carefully divided for studying, training, and personal activities. These schedules are not just plans; they are visual guides that navigate them through the labyrinth of commitments (Mazerolle & Goodman, 2013).

Secondly, as mentioned earlier, setting priorities is crucial. In the world of the significance of academic and athletic excellence setting clear priorities cannot be overstated. Successful individuals understand that education and sports require dedication and effort. They recognize the need discern between what genuinely important and what can wait. By identifying key priorities, they channel their energy and time into tasks aligned with their aspirations. This discerning ability fuels their relentless pursuit of excellence (Mazerolle et al., 2013). Additionally, they must have the ability cultivate effective methods for studying. Academic success hinges on effective study habits. For student-athletes, this means adopting strategies that maximize productivity. Techniques like active learning, breaking study sessions into manageable segments, and reducing interruptions during study time become invaluable allies. These habits transform study sessions into focused, efficient endeavors, leaving no room for wasted efforts (Pitney et al., 2018).

Moreover, it should be emphasized that individuals need to set 'SMART' goals. Goal-setting is the compass that guides individuals towards their desired destinations. For student-athletes, these aspirations are not mere dreams but specific, measurable, achievable, relevant, and time-bound (SMART) objectives. Applying the SMART framework to

academic and athletic aspirations ensures that these goals are clear and actionable. It is a blueprint for achievement, providing direction in the pursuit of excellence (Dimitropoulos et al., 2017).

However, these goals require regular review, as goals are not static; they evolve, much like the journey towards excellence. Student-athletes understand the significance of regularly reviewing their goals. They periodically review their academic and athletic objectives, assessing progress and making adjustments as necessary. This iterative process ensures that their goals remain in line with their ever-evolving aspirations (Eason et al., 2014).

Lastly, mental visualization is also crucial. The power of visualization cannot be underestimated. Athletes often harness the power of mental imagery to see themselves triumphing in their sport. The same approach can be applied to academic pursuits. Visualizing success becomes a powerful tool to boost motivation and self-confidence. This strategy actually helps individuals turn distant dreams into tangible realities (Eason et al., 2014).

Conclusions

When we talk about balancing excellence, there are many shades of gray that connect the connection between education and sports, and between individuals or students who seek to achieve excellence in each these areas. In this respect, structured planning is essential. These individuals must meticulously plan every step, allocating specific blocks of time for academic life, training and personal sports activities. The priority they set and the time we set for it is essential. Habits for successful studying, including active learning and minimizing distractions, promote academic success. Smart goals (specific, measurable, attainable, relevant, time-bound) guide their aspirations, evolving through regular review. Mental visualization is an aspect and concept as new as it is important in individuals with such a load, as it increases Motivating both sports and academics. To maintain balance, they prioritize rest and recovery, recognizing its importance. Communication with coaches, teachers and family strengthens their support network. Flexibility and adaptability are vital in this unpredictable journey. Student-athletes embrace change, understanding rigid plans can crumble in the face of obstacles. In this quest of excellence, these skills are their foundation.

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Combating Compassion Fatigue in Counselors: Enhancing Student Achievement

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Abstract: The challenges in achieving student learning success are complex and involve various factors, including the psychological condition of school counselors. Counselors often engage in intense emotional interactions with students facing issues. This can lead to compassion fatigue, which refers to emotional, mental, and physical exhaustion resulting from repeatedly feeling or witnessing others' suffering and difficulties. This study discusses the importance of intervening in compassion fatigue among school counselors and its impact on student learning success. This case study involved five school counselors as participants. Data collection techniques included focus groups and open questionnaires. The results indicate that (1) compassion fatigue affects counselor performance; without appropriate intervention, counselors' ability to provide support and guidance becomes ineffective; (2) counselors experiencing compassion fatigue encounter difficulties in delivering counseling services; (3) their emotional and mental well-being can influence how they interact with students as well as their level of empathy; (4) when students do not receive optimal counseling support, their ability to reach academic potential is hindered. The limitations of this study include a small sample size that may restrict generalization of findings and limited data collection techniques that do not capture all dimensions of compassion fatigue effectively. Recommendations for future research include expanding sample sizes to encompass more school counselors from diverse backgrounds and experiences while utilizing varied data collection methods to explore specific strategies that can assist school counselors in managing their compassion fatigue.

Keywords: Compassion Fatigue, School Counselor, Student Success

Introduction

The success of student learning is the primary objective in education. However, achieving this success is not a straightforward endeavor, as it involves various complex factors, including the psychological conditions of school counselors. School counselors play a crucial role in supporting students' mental health and academic performance, particularly by providing guidance and counseling to those facing emotional challenges (Darren Couillard et al., 2006) Counselors are often engaged in intense emotional interactions with students who are experiencing a range of issues, from academic stress to personal problems. This continuous and intense interaction can lead counselors to experience empathy fatigue or compassion fatigue.

Empathy fatigue is a condition characterized by emotional, mental, and physical exhaustion that arises from repeatedly feeling, witnessing, or experiencing the suffering and difficulties of others (Figley, 1995) This condition can lead to prolonged physical, emotional, and cognitive fatigue, resulting in diminished performance and personal well-being (Stamm, 1995;Stebnicki, 2007). Empathy fatigue is often overlooked within the educational context; however, school counselors play a vital role in supporting students' mental health and academic achievement. In the educational setting, empathy fatigue among counselors can disrupt the quality of counseling services they provide, which in turn may affect student performance (Maslach & Leiter, 2016)

Counselors experiencing empathy fatigue may encounter difficulties in providing effective support to students, which can result in a decline in the quality of interactions, levels of empathy, and their ability to assist students in reaching their academic potential (Linley & Joseph, 2007); Harr et al., 2014;Kim & Lambie, 2018). Research indicates that counselors who are emotionally and psychologically healthy are capable of delivering more effective guidance, thereby enabling students to achieve better academic performance (Skovholt & Mathison, 2011)

Furthermore, relaxation techniques such as meditation and yoga have been demonstrated to be effective in reducing stress and enhancing the well-being of counselors (Felton et al., 2015; Montero-Marin et al., 2019)Support from colleagues and management is also crucial in assisting counselors in coping with empathy fatigue (Can & Watson, 2019; Robino, 2019). Additionally, self-development training equips counselors with supplementary skills to manage stress and fatigue effectively (Duncan & Pond, 2024;Choi & Hyun, 2023; Cibotaru, 2023)

This research focuses on the following key areas: (1) the identification of factors contributing to compassion fatigue among school counselors in Indonesia, (2) the examination of how compassion fatigue affects the personal well-being of school counselors, (3) the assessment of the impact of compassion fatigue on the performance of school counselors, and (4) an analysis of how compassion fatigue among school counselors influences students' academic success. Consequently, research questions have been formulated as follows:

- **RQ1:** What are the factors contributing to compassion fatigue among school counselors in Indonesia?
- **RQ2:** How does compassion fatigue affect the personal well-being of school counselors?
- **RQ3:** What is the impact of compassion fatigue on the performance of school counselors?
- **RQ4:** How does compassion fatigue among school counselors affect students' academic success?

Research Methodology

The qualitative phenomenological study serves as an effective approach to understanding the dynamics of empathy fatigue among counselors. This methodology enables researchers to delve deeply into the experiences of counselors who are facing empathy fatigue, while also exploring the factors that contribute to this condition and its impact on student performance. Furthermore, the researcher will identify alternative strategies for addressing this issue by employing a descriptive method aimed at comprehending the structure of individual experiences based on normative questions posed (Cibotaru, 2023).

Research Subjects and Data Collection

The research subjects will consist of five counselors who have experienced empathy fatigue in their professional practice. Data will be collected through focus group discussions and open-ended questionnaires (Aspers & Corte, 2019). The focus group discussions will emphasize discursive interactions rather than merely structured or semi-structured interviews that do not engage the researcher with the participants (Slovák et al., 2023). This approach aims to explore the phenomenon of empathy fatigue in a more flexible and in-depth manner. The open-ended questionnaires will contain questions relevant to the research objectives and will be distributed directly to the subjects. The results from both methods will be combined to address the research problems effectively.

Data Analysis

The data analysis in this study will employ thematic analysis, which aims to understand the complexity of meanings within the data rather than merely measuring their frequency. The researcher will be actively involved in the analysis process, seeking patterns of meaning that can be further explored and describing the data based on predetermined themes. This approach allows for a nuanced understanding of empathy fatigue among counselors. To enhance the validity of the research, triangulation of data sources will be utilized (Carter et al., 2014) by comparing findings from interviews and discussions across various participants. Ethical considerations will also be a primary focus; ethical approval will be obtained from participants before interviews commence, ensuring strict confidentiality and anonymity throughout the research process.

RQ1: What are the Factors Contributing to Compassion Fatigue among School Counselors in Indonesia?

Based on the interviews, it was found that some of the main factors causing compassion fatigue in school counsellors in Indonesia include high workload, lack of support from colleagues and management, and frequent emotionally charged cases. Administrative overload and high expectations from schools and parents also contribute to increased

levels of stress and burnout in counsellors.

RQ2: How Does Compassion Fatigue Affect the Personal Well-Being of School Counselors?

Compassion fatigue has a negative impact on the personal well-being of counselors. They often experience emotional exhaustion, prolonged stress, and sleep disturbances. Some counselors also report feeling helpless and experiencing a decline in motivation to perform their duties. This condition leads to a decrease in both mental and physical health, as well as reducing the counselors' ability to enjoy their personal lives.

RQ3: How Does Compassion Fatigue Affect the Performance of School Counselors?

Compassion fatigue leads to a decline in the performance of counselors. Without appropriate interventions, counselors' ability to provide support and guidance becomes ineffective. Counselors experiencing empathy fatigue report difficulties in maintaining focus during counseling sessions, a decrease in the quality of interactions with students, and an increase in absenteeism due to health issues. This results in a reduction in the effectiveness of counseling services provided to students.

RQ4: How Does Compassion Fatigue among School Counselors Affect Students' Academic Success?

When counselors experience compassion fatigue, the counseling support they provide to students becomes less effective. Students who do not receive adequate counseling support tend to exhibit decreased motivation to learn, increased stress levels, and difficulties in managing academic and personal issues. As a result, students' ability to reach their full academic potential is hindered, leading to a decline in their academic performance.

Discussion

In general, this study aims to understand how the experiences of compassion fatigue among school counselors in Indonesia can influence students' academic success. It is essential to discuss the dynamics of compassion fatigue in detail so that school counselors can be more vigilant about the threats it poses to their well-being and professional practice. Based on the findings, four key results were identified regarding the factors contributing to compassion fatigue, its impact on personal well-being, its effect on counselor performance, and its influence on students' academic success.

The first finding indicates that several key factors contributing to compassion fatigue among school counselors in Indonesia include high workloads, a lack of support from colleagues and management, and frequent exposure to heavy emotional cases. Excessive administrative burdens and high expectations from the school administration and parents also contribute to increased stress levels and fatigue among counselors.

High Workload: A high workload is one of the primary factors contributing to compassion fatigue among school counselors. School counselors often have to manage numerous students with a range of issues (Dekruyf et al., 2013),

from academic challenges to complex personal problems (Paolini, 2019) (Shi & Brown, 2020). The large number of students that counselors must attend to within a limited timeframe creates significant pressure to meet the needs of each individual student. This overwhelming demand can lead to emotional exhaustion and a diminished capacity for empathy, ultimately affecting both the counselors' well-being and the quality of support they provide.

Lack of Support from Colleagues and Management: A lack of support from colleagues and management is also an important factor contributing to compassion fatigue. Social support in the workplace, including emotional and instrumental support from coworkers and supervisors, has been shown to reduce stress levels and fatigue among counselors (Holman et al., 2019a). When counselors feel they are not receiving adequate support, they become more vulnerable to emotional and physical exhaustion.

Facing Heavy Emotional Cases: Counselors often have to deal with heavy emotional cases, such as students experiencing trauma, violence, or serious family issues (Levkovich & Ricon, 2020). Repeated experiences in handling these cases can lead to deep empathy fatigue among counselors (Paterson et al., 2021). Continuous contact with the suffering of others can drain the emotional and mental energy of counselors.

Excessive Administrative Burdens: In addition to addressing student issues, counselors are also burdened with administrative tasks that often consume time and energy (Holman et al., 2019b;Rock & Curry, 2021). Excessive administrative burdens reduce the time they can spend focusing on direct interactions with students, thereby increasing stress levels and fatigue (Culbreth et al., 2005).

High Expectations from School Administration and Parents: High expectations from school administration and parents also contribute to compassion fatigue (Yu et al., 2022). Counselors are often expected to provide quick and effective solutions to various student issues (Hofmann et al., 2015), which adds pressure and increases their workload (Culbreth et al., 2005). The pressure to meet these high expectations can lead counselors to feel overwhelmed and experience emotional exhaustion.

The second finding indicates that compassion fatigue has a significant impact on the personal well-being of school counselors. Based on the research and interviews conducted, the following are some effects of compassion fatigue on the personal welfare of school counselors:

Emotional and Mental Exhaustion: Counselors experiencing compassion fatigue often report profound emotional exhaustion. This condition is characterized by chronic feelings of fatigue, an inability to relax, and a diminished interest in activities that are typically enjoyable (Figley, 1995). Such emotional exhaustion can lead counselors to feel helpless and lose motivation for their work (Stamm, 1995)

Prolonged Stress: Compassion fatigue can result in prolonged stress among counselors. This stress not only affects their professional performance but also spills over into their personal lives (Sylvester-Nwosu et al., 2024). Counselors experiencing chronic stress may encounter sleep disturbances, increased anxiety levels, and a decline in overall physical health (Mullen & Gutierrez, 2016a).

Decline in Physical Well-Being: The physical repercussions of compassion fatigue are also quite evident. Counselors suffering from this condition may experience various health issues such as headaches, digestive problems, and other chronic illnesses exacerbated by excessive stress (Sylvester-Nwosu et al., 2024; Chinnery et al., 1995). Deteriorating physical health can further aggravate emotional and mental conditions, creating a negative cycle that is challenging to break (Bali-Mahomed et al., 2022).

Feelings of Helplessness and Burnout: Counselors experiencing compassion fatigue often find themselves feeling helpless in the face of their workload (Erbe, 2022). This sense of helplessness can lead to burnout, a condition characterized by emotional exhaustion, depersonalization, and a decline in personal accomplishment (Levkovich & Ricon, 2020). Burnout results in counselors feeling incapable of performing their duties effectively and frequently leads them to feel undervalued in their professional roles (Wilkerson, 2009; Bardhoshi & Um, 2021).

Disruption of Personal Relationships: The impact of compassion fatigue also extends to the personal relationships of counselors. They may experience difficulties in maintaining healthy relationships with family and friends due to the emotional and mental exhaustion they endure (Can & Watson, 2019b). This disruption in relationships can lead to social isolation, which further exacerbates the emotional and mental conditions of counselors (Izadi et al., 2023; Tehranin, 2010).

Challenges in Maintaining Work-Life Balance: Compassion fatigue significantly hinders counselors' ability to maintain a balance between their professional and personal lives (Levkovich & Ricon, 2020). The high demands of their work, coupled with the heavy emotional burden they carry, often leave counselors feeling overwhelmed and devoid of the time or energy necessary for activities outside of their professional responsibilities (Guler & Ceyhan, 2020; Bardhoshi & Um, 2021b). This inability to achieve a healthy work-life balance can lead to an overall decline in quality of life.

The third finding of this research indicates that compassion fatigue has a significant impact on the performance of school counselors. Based on the research findings and existing literature, compassion fatigue affects various aspects of counselors' performance, ranging from the effectiveness of counseling services to their ability to maintain professional relationships with students and colleagues.

Decline in the Effectiveness of Counseling Services: Compassion fatigue diminishes the effectiveness of counseling services provided by school counselors. Counselors experiencing empathy fatigue often feel overwhelmed and unable to be fully present emotionally during counseling sessions (Garnett et al., 2023). This results in a decline in the quality of interactions with students, making the guidance offered less effective (Yu et al., 2022) (Kounenou et al., 2023). Emotionally fatigued counselors tend to find it more challenging to listen actively and provide the necessary support that students require.

Challenges in Maintaining Focus and Concentration: Counselors experiencing compassion fatigue often encounter difficulties in maintaining focus and concentration during counseling sessions (Rahayu et al., 2024). Emotional and mental exhaustion can disrupt their ability to process information effectively and make sound decisions (Lyon &

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Galbraith, 2023). This impairment may lead counselors to overlook important details during sessions, thereby diminishing the effectiveness of the interventions they provide.

Decline in Motivation and Productivity: Compassion fatigue also adversely affects the motivation and productivity of counselors. Counselors experiencing empathy fatigue often find themselves feeling unenthusiastic and lacking the drive to perform their duties effectively (Levkovich & Ricon, 2020). This decline in motivation can lead to decreased productivity (Rehman et al., 2022), where counselors may procrastinate on important tasks or struggle to complete their work within designated timeframes (Mullen & Gutierrez, 2016b). Consequently, the quality of counseling services provided becomes suboptimal, impacting both the counselors' professional satisfaction and the support available to students.

Disruption in Professional Relationships: Compassion fatigue can disrupt the professional relationships between school counselors and both students and colleagues. Counselors experiencing empathy fatigue may exhibit signs of irritability, exhaustion, and reluctance to engage with others (Ormiston et al., 2022). This behavior can lead to tension in working relationships and diminish the collaboration necessary for providing effective services.

Increased Absenteeism and Turnover: Compassion fatigue can lead to increased absenteeism and turnover among counselors (Sprang et al., 2007). The emotional and physical exhaustion experienced by counselors may result in them frequently taking sick leave or even seeking employment elsewhere that is perceived as less emotionally demanding (Kim & Lambie, 2018). This high rate of absenteeism and turnover can disrupt the continuity of counseling services provided to students and create instability within the counseling team.

The fourth finding indicates that compassion fatigue among school counselors has a significant impact on students' academic success. When counselors experience empathy fatigue, their ability to provide effective support to students diminishes, which can ultimately affect students' academic performance. The following are some key impacts of compassion fatigue on counselors and its effects on students' academic success.

Decline in the Quality of Emotional and Academic Support: Counselors experiencing compassion fatigue often struggle to provide optimal emotional and academic support to students. Emotional exhaustion makes it difficult for counselors to fully engage in interactions with students, meaning that students may not receive the attention and guidance they need to address academic and personal issues (Hines et al., 2020). This ineffective support can hinder students from reaching their academic potential.

Increased Stress and Anxiety Among Students: Students who do not receive adequate counseling support are likely to experience heightened stress and anxiety (Couillard et al., 2006). Counselors suffering from compassion fatigue may be unable to provide timely and effective interventions to help students manage their stress (Jones & Pijanowski, 2023). As a result, students may struggle to focus on learning and academic tasks, negatively impacting their performance.

Decline in Student Motivation and Engagement: Counselors who are unable to function optimally due to

compassion fatigue can lead to a decline in student motivation and engagement in the learning process. When students feel that they are not receiving adequate support from their counselors, they may become disheartened and less motivated to achieve their academic goals (Purnama et al., 2020). This can result in decreased participation in school activities.

Disruption in the Development of Social and Emotional Skills: Effective counseling support is crucial for the development of students' social and emotional skills (Ogunwole, 2019). Counselors experiencing compassion fatigue may be unable to provide the necessary guidance to help students develop these skills (Paterson et al., 2021). A lack of strong social and emotional skills can affect students' interactions with peers and teachers, as well as hinder their overall personal growth.

Difficulty in Addressing Academic Issues: Compassion fatigue among counselors can also diminish their ability to help students address specific academic problems. Emotionally exhausted counselors may struggle to provide effective strategies and advice for improving students' study skills and time management (Sylvester-Nwosu et al., 2024). Without adequate guidance, students may find it challenging to cope with academic challenges, which negatively impacts their performance.

Conclusion and Recommendations

The conclusion of this study indicates that compassion fatigue has a significant impact on the performance of school counselors and the academic achievement of students. First, compassion fatigue among school counselors in Indonesia is caused by various factors, including high workloads, lack of support from colleagues and management, frequent exposure to heavy emotional cases, excessive administrative burdens, and high expectations from the school administration. Second, compassion fatigue negatively impacts the personal well-being of counselors, leading to emotional and mental exhaustion, prolonged stress, decline in physical health, feelings of helplessness, burnout, disruption in personal relationships, and difficulties in maintaining a work-life balance. This condition results in an overall decrease in the quality of life for counselors.

To address the negative impact of compassion fatigue on school counsellors, comprehensive and sustainable intervention strategies are required. Firstly, it is important to increase social support in the workplace through training and team building that encourages cooperation and mutual support among counsellors. Second, reducing administrative overload can allow counsellors to focus more on direct interactions with students, allowing them to provide more effective guidance and support. Third, providing stress management training and relaxation techniques such as meditation and yoga can help counsellors better manage their stress and improve their emotional and mental well-being. Finally, the active involvement of school management in supporting counsellors' well-being is crucial. Management should ensure that counsellors have access to necessary resources and feel valued in their work. By implementing these strategies, it is expected that counsellors' well-being will improve, which in turn will improve the quality of counselling services provided to students and support their academic achievement.

The recommendation to develop training programmes that focus on stress management skills and self-care techniques

for counsellors is highly relevant. Such programmes can help counsellors to better manage their emotional burdens and improve overall well-being. In addition, creating a supportive work culture, where counsellors can share their experiences and get support from their peers, can contribute to the reduction of empathy fatigue. By implementing these strategies, it is expected that counsellors can be more effective in supporting students, which in turn can improve their academic performance. This research highlights the importance of attention to counselors'-being as an integral part of efforts to improve students' educational outcomes.

Acknowledgments

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Unveiling Psychological Well-being in College Students: Gender-based Analysis Utilizing the Rasch Model

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Abstract: Psychological well-being is a complex depiction of the mental state that is essential for every individual to possess. College students, who are experiencing the phase of emerging adulthood, face various challenges during transition and adjustment, significantly influencing their psychological well-being. The difference in environment between campus life and previous school experiences also impacts students' psychological well-being. Gender-wise, psychological well-being may vary due to factors such as stress, social support, self-perception, and environmental perception. This study aims to explore the levels of psychological well-being among college students, specifically examining differences based on gender. A total of 244 students participated in the survey, utilizing the 42-item Psychological Well-Being Scale. The Ryff Psychological Well-being Scale served as the basis for this scale, which underwent an adaptation process to Indonesian, including validity and reliability testing. It comprises six dimensions: self-acceptance, purpose in life, personal growth, environmental mastery, autonomy, and positive relations with others. Data analysis was conducted using the Rasch model. The research findings indicate that the majority of students exhibited a moderate level of psychological well-being, with no significant difference observed between male and female students. Considering that a moderate level of psychological well-being may not be optimal, this emphasizes the need for intervention strategies in future research.

Keywords: Psychological Well Being, College Student, Gender, Rasch

Introduction

Psychological well-being refers to an individual's perception of the extent to which he or she functions positively in life. (Ryff, 1989) developed six main dimensions of PWB, namely autonomy, personal growth, environmental mastery, life goals, positive relationships with others, and self-acceptance. College, which is part of the transition to adulthood (emerging adulthood), is a crucial period in the development of psychological well-being because students are faced with complex academic, social, and emotional demands (Arnett, 2000, 2014; Ryff & Keyes, 1995). In this phase, PWB plays an important role in helping students adjust to change and greater responsibility.

Various studies show that gender is one of the factors that influence psychological well-being (Matud et al., 2022; Schiffrin & Nelson, 2010). In the context of Indonesian culture, which is still influenced by the values of collectivism and traditional gender norms, the social construction of the roles of men and women can shape the way students understand and express their well-being (Hasyim, 2017). A number of studies in Indonesia have examined the psychological well-being of students (Apriansyah et al., 2024; Ayu et al., 2020; Handayani et al., 2023; Ramadani et al., 2023). Most studies have used a quantitative approach that provides a strong statistical picture, but there is an opportunity to deepen understanding with a more detailed analytical approach. In this study, we will use the Rasch Model approach to provide an in-depth analysis of the psychological well-being of students and the differences based on gender.

This study aims to analyze the psychological well-being of students based on gender using the Rasch Model approach. This approach allows researchers to evaluate the level of item difficulty, the logit distribution of respondents, and the potential for measurement bias against certain groups (Linacre, 2022; Sumintono & Widhiarso, 2013). Through this analysis, it is hoped that it will be possible to identify whether there are differences in the level of well-being between male and female students in a more comprehensive way. The results of this study are expected to enrich the literature on gender and the psychological well-being of students in Indonesia and to serve as a reference for educational institutions in designing services and policies that are more inclusive and responsive to the psychological needs of students.

Method

Participants

There were 244 students from all provinces in Indonesia who participated in this study. There were 123 male participants and 121 female participants. The age range of the participants was 19-23 years with an average age of 21 years. The distribution of participants by region includes 4 universities from West Java, 5 universities from DKI Jakarta, 3 universities from Central Java, 4 universities from East Java, 1 university from Aceh, 2 universities from DI Yogyakarta, 2 universities from West Sumatra, 2 universities from South Sumatra, and 1 university from Lampung, Riau, South Sulawesi, and West Sulawesi respectively.

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Instrument

The instrument used in this study was the psychological well-being scale by Carol D. Ryff (D.Ryff, 1989; Ryff & Keyes, 1995; Ryff & Singer, 2008). The scale comprises 42 items representing six key indicators: self-acceptance, positive relations with others, purpose in life, environmental mastery, personal growth, and autonomy. Data collection was carried out online through the WhatsApp and Google Forms platforms from July to October 2024. The answer choices consisted of five options, namely (1) Strongly Agree; (2) Agree; (3) Neutral; (4) Disagree; and (5) Strongly Disagree. Before participating in the study, participants were given an explanation regarding the purpose of the study and were given an explanation that the filling in of personal data was voluntary. Information related to participant data is guaranteed confidentiality and is only used for research purposes.

Data Analysis

This study aims to measure the psychological well-being of students and look at it from a gender perspective. The data collected from Ryff's psychological well-being scale instrument is then scored according to the type of statement (favorable and unfavorable) from a range of 1-5. In order to evaluate the reliability and validity of Ryff's psychological well-being scale in Indonesia, data analysis was carried out using the RASCH modeling approach (Rangka et al., 2018; Sumintono & Widhiarso, 2013). Rasch analysis provides substantial advantages, such as producing linear measurements that are measurements with equal intervals and precise estimations (Aminah et al., 2024; Ariyanto et al., 2025). The tools used were Winstep software and user guides from (Linacre, 2022).

Results

Evaluation of Research Instruments for Theoretical Construction

Out of the 244 respondents, 239 were chosen whose data were fit for analysis. A global fit test was conducted to check how well the research instruments, respondent participation, and interaction of the instruments and respondents worked together to measure psychological well-being of the respondents. The outcomes pointed out that there was a particular model that was in line with the given theoretical foundation of the research. Findings of the study also showed that out of the 239 students who participated, the mean score on the psychological wellbeing scale was +0.70 logits, indicating that, on the average, students tend to endorse the statements concerning psychological well-being and welfare.

The overall measurement method bears a coefficient of reliability 0.84 which indicates a good level of agreement between the responses given to the instrument and the participants' expectations. Further evaluation reveals that reliability of the instrument items is 0.98 and the interdependent variability of the answers is 0.82. It is not a problem that the reliability value of a subset of respondents is lower than the reliability of items because the value of 0.82 is good. This indicates that respondents more often than not relatively stable and trustworthy answers.

The average rate of respondents' replies is +1.05 logit with regard to the results of INFIT Mean Square (MNSQ) analysis. On the other hand, the response rate associated with item's difficulty as identified by OUTFIT MNSQ was +1.10 logit. Both of these widths are said to be within the margins of optimal measurement accuracy, that is closer to

1.00, the better (Sumintono & Widhiarso, 2013). This indicates that the participants were able to engage interact meaningfully with the statement items as presented in the instrument.

Examination of the Statistics of INFIT and OUTFIT It can be noticed that the responses of the respondents to the psychological well-being questionnaire fit with the Rasch model. The Person INFIT MNSQ of 1.01 and OUTFIT MNSQ of 1.09 suggest that the respondents' level of psychological well-being of students' is described consistently. This underscores that the instrument captures individual differences with little interference from random answer patterns. For the items, the INFIT MNSQ of 1.05 and OUTFIT MNSQ of 1.10 indicate that the items within the scale adequately capture the psychological well-being construct, even though there is somewhat unpredictable respondent variance to the individual item statements.

Also, Z-standard (ZSTD) analysis indicates that Person INFIT ZSTD (-0.28) and OUTFIT ZSTD (-0.03) fall in an acceptable range of -1.9 to +1.9 Z-STD logits. This suggests that respondents' answer patterns are relatively stable and aligned with the expectations of the Rasch model. At the item level, INFIT ZSTD (0.11) and OUTFIT ZSTD (0.31) exceed the threshold for normalcy which suggests that the difference between items is not too small and the instrument functions properly in measuring students' psychological well-being. Hence, these results support the claim that the instrument has high measurement validity and can accurately capture the intended constructs.

Table 1. Summary Statistic of Person and Item (I= 42, N=239)

Item-Person Summary Measured			
Item-Person Reliability	0.84 -- Cronbach Alpha (KR-20) Person Raw Score "Test" Reliability		
Items		Person	
Mean	0.00	Mean	0.70
SD	0.62	SD	0.46
Reliability	0.98	Reliability	0.82
INFIT MNSQ	1.05	INFIT MNSQ	1.01
OUTFIT MNSQ	1.10	OUTFIT MNSQ	1.09
INFIT ZSTD	0.11	INFIT ZSTD	-0.28
OUTFIT ZSTD	0.31	OUTFIT ZSTD	-0.03
Separation Index	7.57	Separation Index	2.12
Standar Error Item Mean	0.10		

Source: Data processed from the results of research data collection

The separation index in rasch modeling shows the instrument's ability to distinguish individuals and items in measuring psychological well-being. The person separation index of 2.12 indicates that respondents can be categorized into two to three groups based on their psychological well-being. Meanwhile, the item separation index of 7.57 indicates that the instrument has varying levels of difficulty, so that it is able to measure various dimensions

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of psychological well-being well. The high values on both indices confirm that the instrument has good measurement quality.

The Principal Component Analysis (PCA) in Table 2 shows that the instrument is able to explain 31.6% of the total variance, with most coming from instrument items (25.0%) and persons (6.6%). The raw unexplained variance shows a figure of 68.4%, which indicates that there are other factors outside the model that influence the measurement results. In addition, the value of unexplained variance in contrast is smaller than expected, indicating that the instrument has a fairly good level of one-dimensionality, making it effective in measuring one main construct, namely psychological well-being.

Table 2. Principal Component Analysis (PCA)

Principal Component Analysis	**Observed**	**Expected**
Total raw variance in observations	100.0%	100.0%
Raw variance explained by measures	31.6%	31.1%
Raw variance explained by persons	6.6%	6.5%
Raw variance explained by items	25.0%	24.6%
Raw unexplained variance (total)	68.4%	68.9%
Unexplained variance in 1st contrast	9.4%	13.8%
Unexplained variance in 2st contrast	3.7%	5.4%
Unexplained variance in 3st contrast	3.2%	4.7%
Unexplained variance in 4st contrast	3.0%	4.4%
Unexplained variance in 5st contrast	2.6%	3.8%

Source: Data processed from the results of research data collection

Table 3. Rating Scale Test for Student Psychological Well Being (1=42, N=239)

	Observed Average	Andrich Threshold
Strongly Disagree (1)	-.13	None
Disagree (2)	.20	-.54
Not Sure (3)	.30	-.36
Agree (4)	.72	-.22
Strongly Disagree (5)	1.22	1.12

Note: Strongly Disagree (Score 1), Disagree (Score 2), Not Sure (Score 3), Agree (Score 4), Strongly Disagree (Score 5).

Test the Rating Scale in Table. 3 shows that the information on the average value of the observations starts from -.13 logit for answer choices that get a score of 1; +.20 log for answer choices that get a score of 2; +.30 log for answer choices that get a score of 3; +. 2 logits for answer choices that get a score of 4; and +1.22 logits for answer choices that get a score of 5. The logit value for each answer choice shows the difference from a small logit value for answer

choices with a minimum score, to a logit value for large answer choices with a maximum score. This shows that respondents can distinguish the differences between the answer choices given on the psychological well-being scale.The average observation value is relevant to the Andrich Threshold value, which moves monotonously from NONE, then shifts to negative logit and continues towards positive logit for each answer choice, which indicates that the given answer choice is declared valid (NONE → -0.54 logit → -0.36 logit → -2.22 logit → +1.12 logit). In this case, the correspondence between the question and the answer choice is ideal for measurement.

Psychological Well-Being in College Students: A Gender Analysis

Logit analysis in table 4 shows that item 9, *"I live life one day at a time and don't really think about the future"*, was the most difficult item for respondents to agree with (+0.72 logit), indicating that most students are not conscious of planning for the future. In contrast, the easiest item 2 was *"For me, life has been a continuous process of learning, changing, and growth"* (−0.89 logit), which reflects the dominance of the personal growth dimension in students' psychological well-being. The contrast between the most difficult and the most easily approved items is a depiction of the two sides of students' psychological well-being. On the one hand, the high level of agreement on the dimension of personal growth indicates a high level of adaptation and self-disclosure. On the other hand, the inability to think about the future indicates ambiguity that may be due to the fact that students are in the period of emerging adulthood which is still influenced by the clarity of career or systemic academic pressures (Arnett, 2000). In addition, in the aftermath of the COVID-19 pandemic, students in various countries report high levels of anxiety and uncertainty about the future, which significantly affects their psychological well-being (Bersia et al., 2024).

For some male students, the acquisition of higher order skills may reflect the way they internalize the concept of masculinity. Some of the male students may have already transformed the norm to be open to feelings and autonomy, which is reflected in their high psychological well-being scores (Perez, 2012). On the other hand, most are still oppressed by social norms that do not allow them to express vulnerability, which results in low psychological well-being scores. This polarized pattern shows that the existing support system must be more culturally nurtured and sensitive to the psychosocial diversity of each gender.

Table 4. College student's psychological wellbeing as measured by item logit (I = 42, N = 239)

No	Items	Value
	I live life one day at a time and don't really think about the future.	.94
Value		
9		
14	I gave up trying to make big improvements or changes in my life a long time ago.	.86
42	I often feel overwhelmed by my responsibilities.	.73
39	My daily activities often seem trivial and unimportant to me.	.72
26	I do not fit very well with the people and the community around me.	.71
24	I tend to be influenced by people with strong opinions.	.68
32	I don't have a good sense of what it is I'm trying to accomplish in life.	.60
15	The demands of everyday life often get me down.	.57

28	When I think about it, I haven't really improved much as a person over the years.	.54
33	I sometimes feel as if I've done all there is to do in life.	.54
16	I have not experienced many warm and trusting relationships with others.	.48
18	Maintaining close relationships has been difficult and frustrating for me.	.48
25	I do not enjoy being in new situations that require me to change my old familiar ways of doing things.	.46
12	I have difficulty arranging my life in a way that is satisfying to me.	.43
30	I often feel lonely because I have few close friends with whom to share my concerns.	.37
41	It's difficult for me to voice my own opinions on controversial matters.	.37
8	In many ways I feel disappointed about my achievements in life.	.33
35	I have confidence in my opinions, even if they are contrary to the general consensus.	.28
10	I tend to worry about what other people think of me.	.23
31	When I compare myself to friends and acquaintances, it makes me feel good about who I am.	.23
19	My attitude about myself is probably not as positive as most people feel about themselves.	.07
13	My decisions are not usually influenced by what everyone else is doing.	.00
34	I feel like many of the people I know have gotten more out of life than I have.	-.04
11	When I look at the story of my life, I am pleased with how things have turned out.	-.09
4	People would describe me as a giving person, willing to share my time with others.	-.11
27	I know that I can trust my friends, and they know they can trust me.	-.16
36	*I am quite good at managing the many responsibilities of my daily life.*	-.24
29	Some people wander aimlessly through life, but I am not one of them.	-.24
22	In general, I feel confident and positive about myself.	-.25
7	Most people see me as loving and affectionate.	-.26
40	I like most parts of my personality.	-.28
37	I have the sense that I have developed a lot as a person over time.	-.33
23	I have been able to build a living environment and a lifestyle for myself that is much to my liking.	-.33
38	I enjoy personal and mutual conversations with family members and friends.	-.44
1	I am not afraid to voice my opinions, even when they are in opposition to the opinions of most people.	-.47
21	I judge myself by what I think is important, not by the values of what others think is important.	-.62
20	I have a sense of direction and purpose in life	-.73
3	In general, I feel I am in charge of the situation in which I live.	-.87
17	I think it is important to have new experiences that challenge how you think about yourself and the world.	-1.00
6	I enjoy making plans for the future and working to make them a reality.	-1.13
5	I am not interested in activities that will expand my horizons.	-1.18
2	For me, life has been a continuous process of learning, changing, and growth.	-1.82

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Table 5. Measure order male and female college students (I = 42, N = 239)

Male				Female		
Person	**Total Score**	**Measure**		**Person**	**Total Score**	**Measure**
196 L	206	3.65		189 P	187	1.59
96 L	194	2.12		152 P	186	1.53
100 L	191	1.92		133 P	185	1.49
188 L	191	1.92		177 P	185	1.49
73 L	189	1.80		138 P	184	1.44
200 L	130	.05		89 P	133	.06
238 L	125	-.06		236 P	132	.04
239 L	122	-.12		141 P	127	-.06
86 L	108	-.43		124 P	126	-.08
26 L	105	-.50		43 P	123	-.13

Table 6. Person subtotal male dan female college students (I=42, N=239)

Gender	Person Count	Mean Score	Mean Measure	Model Separation	Model Reliability	True SD	F-test	Prob>F
Male	119	156.8	.67	2.79	.89	.48	1.64	.1991
Female	120	160.4	.74	2.16	.82	.36		

Note: L (male respondence), P (female respondence)
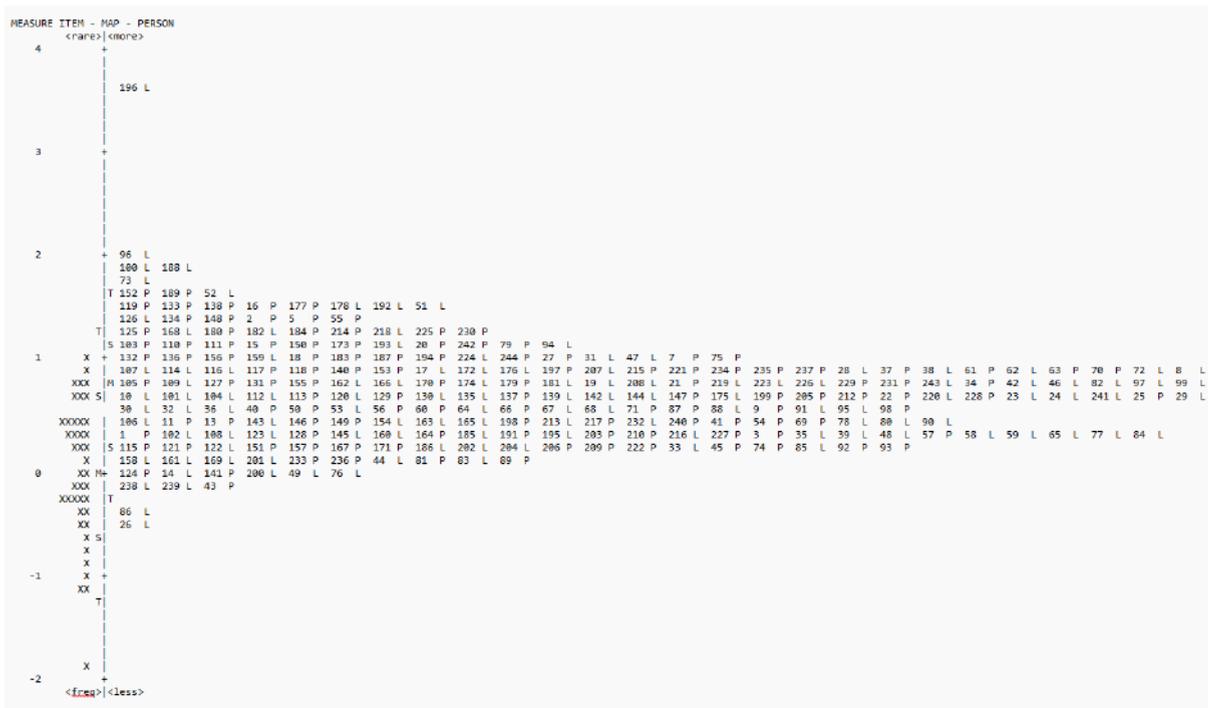
Figure 1. Wright Map: Logit distribution of students based on psychological well-being scores.

Table 5 shows a wider logit variation in male students, with 196 L respondents recording the highest score (+3.65 logit), while the highest female respondent 189 P was at logit (+1.59 logit). Although on average that shows in table 6 female have higher well-being scores, the distribution of male logits is more diverse. Figure 1 (Wright Map) reinforces this pattern, showing that the majority of students are at logit +1 to +2, but men tend to have a more extreme range. These findings reinforce the importance of gender analysis, not only in terms of differences in means, but also in understanding the distribution and dynamics of psychological well-being on an individual basis.

Discussion

Gender and Psychological Well-being: A Nuanced View

Based on the data analysis of 239 respondents, it is illustrated in Table 6 that female respondents scored higher in psychological well-being (mean score 160.4) compared to male respondents (mean score 156.8). Even though there is a discrepancy in the average score, the results of the statistical test show that this discrepancy is not significant ($p = 0.202 > 0.05$). Hence these findings imply that gender is not the sole determining factor for psychological well-being among students. Other factors such as the social context, emotional assistance, and academic experiences, may contribute to the variations. Moreover, this is consistent with the Gender Similarity Hypothesis (Hyde, 2005), which argues that men and women have more commonalities rather than differences in many psychological domains. Still, gender does tend to be an essential aspect in regard to discussions of psychological well-being due to their intersection with social norms, strategies for emotion regulation and coping behavior. Earlier studies have indicated that women tend to be more expressive and openly supported socially. This improves their mental health overall (Matud et al., 2019, 2022; Morales-Rodríguez et al., 2020). On the contrary, male students are subjected to social norms that limit their emotional expression, hence having an impact on mental health (Hasyim, 2017; Mahalik et al., 2007; Matud et al., 2022). This is in agreement with a study (Perez, 2012) that reported female students generally perform better on positive relations with other people and also on having a purpose in life, both of which are closely associated with dimensions of psychological well-being. This difference can be attributed to the greater degree of social support available to women (Shumaker & Hill, 1991), as well as women's greater use of emotion-focused coping and social interpersonal strategies (Tamres et al., 2002).

Interpretation of Logit Item Analysis

In estimating students' psychological functions, logit item analysis offers a measure of how respondents accept or disagree with a given proposition. A higher logit value means it is harder to agree with an item, while a lower logit value means that the item is most likely to be accepted by the majority of the people surveyed. In Table 4, it can be observed that item 9 was the most challenging for respondents while item 2 was the easiest. Most respondents had the hardest time agreeing with the statement, "I live life one day at a time and don't really think about the future." This suggests that for most students, there is still some consideration for future planning as opposed to simply existing. Earlier studies showed that students tend to feel heightened anxiety in regards to the future over their increased responsibilities (Awaliyah & Arruum Listiyandini, 2018; Yolanda & Primanita, 2023).

Concern over the future indicates that students understand the value of live planning as opposed to aimless living (Bersia et al., 2024). This goes in tandem with the other studies that say students typically exhibit a high level of future orientation and exhibit positive behaviors such as planning for their career goals or other objectives (Wu et al., 2024; Yan, 2024). The educational process is another factor that greatly contributes to the awareness of students towards identifying their life goals (Qomarudin et al., 2021).

Conversely, the least challenging item was, "For me, life has been a continuous process of learning, changing and growth," stating that life is a single sequential process. Students who wholeheartedly agree with this statement demonstrate an understanding that life is a dynamic process that changes through academic, social, and emotional experiences. These conclusions emphasize that self-improvement is key in regards to students' psychological health. It has been stated by Morales-Rodríguez et al. (2020), that students possessing a sound psychological well-being are able to see life as a never-ending process of development and transformation. This supports the concept that human life is not a state but a process that is always changing and evolving (Ryff, 1989; Kurniasari et al., 2019; Ramadani et al., 2023). Other studies demonstrated that university life facilitates a degree of openness, development, and accomplishment of educational and non-educational objectives (Chaudhry et al., 2024; Song, 2024).

Regarding gender differences, as shown in Table 5, male students have a higher variance in scores because there are respondents who have the highest and lowest scores within the sample compared to female students. Regardless, female students outperformed male students in average scores. Newer studies also confirm that the psychological wellbeing of female students appears to be better than that of their male counterparts (Arif, R., 2024). Female students are more competent in emotion expression and developing social relations (Arif, R., 2024; Ryff, 2014; Ryff & Singer, 2008).

Table 6 shows the results where the rasch model was applied with five responses of highest value and five of lowest value scored from 239 respondents. Respondent 196 L is the respondent with the highest score, which is the highest representation of psychological well-being among male respondents (+3.65 logit). Respondent 189 P is the respondent with the highest score with regards to psychological wellbeing among female respondents (+1.59 logit). These results indicated that solo variance was quite pronounced, particularly in the male group.

The results in Table 6 correspond with the visual representation in Figure 1 (Wright Map) which shows how the logit value of the respondents is distributed in a vertical axis. On the graph, the left indicates the level of difficulty of the item (not printed on this graph) while the right shows the logit distribution of the respondents. It can be observed that most students are in the medium to high logit range, which is between +1 and +2 logits, implying that most respondents have a moderately high level of psychological well-being. A male student (code: 196 L), has the highest logit of +3.65, which means he has very high psychological well-being. In contrast, some students have low logit 0, which represent the range of students' psychological states. This Wright Map supports the quantitative evidence stemming from Table 6 and serves as an illustration that the male group has a greater logit dispersion, irrespective of women having a higher mean score.

The variations in stereotypical patterns among almost all male students reflect the diverging degrees of internalization of masculinity. Some men exhibiting certain aspects of psychological well-being, like high scores on autonomy, may suggest that these men are shifting their gender role orientation towards a more self-directed and emotionally open one. On the other hand, some men are still bound by traditional masculinity norms that inhibit displaying weakness. This is consistent with Gilligan (1982) gendered moral development theory which differentiates care ethics associated with women and justice ethics assigned to men. Correspondingly, Geary et al. (2003) put forward the proposition that men, in general, tend to be more competition and self-sufficiency oriented as women are more social bond and nurturing focused. Through a functionalist lens, these discrepancies are maintained by social norms which channel men into productive roles and women into nurturing roles (Perez, 2012). These perspectives highlight the need for thoroughly sensitive culturally support systems with psychosocial construct diversity within each gender group.

Implications for Counselling and Higher Education Practice

Despite the fact that there are no statistically relevant variances in male and female welfare, the evidence suggests further investigation into the gender category differences. Consider male student 196L, for example. He received a logit score of +3.65, which far exceeds the highest female score of +1.59. This underscored the importance of a gender responsive approach which considers variation within groups as opposed to mean differences between two groups. The large variation in scores among male students is likely a reflection of how they experience and enact masculinity. Some may have begun to embody a more liberal and emotionally expressive masculine norm, while others remain constrained by societal norms that inhibit the display of vulnerable emotions. This corresponds with Gilligan (1982) position which differentiates the more caring 'ethics of care' typical with women and the dominating 'ethics of justice' more common in men. Geary et al. (2003) also pointed out that men have a biological predisposition towards competitive and aggressive social dominance, which serves to limit the scope for the development of interpersonal and emotional abilities.

Counsellors and student affairs practitioners need to use different strategies focus on holistic view of improving student wellness. It is imperative to enhance the underlying interpersonal and emotional skill set of female students, whereas male students require a safe space that allows for vulnerability and challenges masculine standards, thereby fostering emotional growth. The study by Sagar-Ouriaghli et al. (2023) supports this approach by reporting that gender sensitive mental health interventions were effective in changing attitudes and behaviors towards seeking psychological assistance among male students, particularly those who strongly identify with traditional masculinity norms. In this regard, the integration of cultural and gender sensitized components into counselling practice provides an opportunity to address developmental issues of students.

In addition, institutions can consider conducting psychoeducation workshops or organized group counselling that focuses on improving students' life goals, self-acceptance, personal growth, environmental mastery, autonomy, and positive relation with others, as some indicators of Ryff's psychological well-being model. These services should also be designed with appreciation and understanding of the diverse student population and the psychological needs that accompany these students.

Limitations

The generalizability of this research is limited due to the characteristics of the sample population. The first population limitation is sample size. This study does not take into account the socio-cultural and geographic diversity of Indonesia. Geographical and social representation limitations may impact the external validity of the findings for students in other universities. There is a need for more systemic primary data to allow more comprehensive conclusions (Bornstein et al., 2013). Further, with regard to the method of collecting information through the internet, students may be restricted from taking part in the study due to lack of sufficient internet connection. The gap between different regions and social classes can limit the validity and representation of the sample, as noted by earlier work on digital bias in online studies (Andrade, 2020; Gonzales et al., 2020). Another restriction is the insufficient consideration of the socio-cultural context, particularly the construction of masculinity and femininity and social norms related to gender expectations. Cultural factors that may affect students' psychological well-being, like the definitions and social norms of masculinity, femininity, and gender roles, have not been included in this study (Hasyim, 2017; Matud et al., 2019). Taken together, these findings highlight the importance of designing student support services that go beyond generalized gender-based strategies. A nuanced and culturally sensitive approach is key to promoting psychological well-being in diverse higher education environments.

Conclusion

This study shows that female students have a higher average psychological well-being score than male students, although the difference is not statistically significant. The dimensions of personal growth and purpose in life tend to be more easily responded to positively, which indicates a strong developmental orientation in emerging adulthood. Meanwhile, the dimension of positive relations with others presents its own challenges, especially for male students. Further research is recommended to involve a wider and more geographically and socio-culturally diverse sample in order to increase the generalizability of the findings and enrich the understanding of the dynamics of psychological well-being in the context of gender and culture.

Recommendations

Colleges are advised to strengthen services related to mental health such as gender-sensitive guidance and counselling services to support the optimization of students' psychological well-being. Supportive campus environment, as well as the active involvement of lecturers and education staff, are also important to create an ecosystem that encourages the psychological growth of students in a sustainable manner.

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Exploring High School Students' Engagement in Learning Activities: A Rasch Model Analysis in the Indonesian Context

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Abstract: Student engagement in class is an important concern in educational settings in Indonesia. Student engagement is the physical and psychological energy that students pour out during class activities. In fact, in Indonesia, there are still many students who are less involved in the learning process in class. The results of the PISA (Program for International Student Assessment) show that the reading literacy level of Indonesian students is still relatively minimal. This report is an indicator that indirectly students are less involved in the learning process in class. If this is left unchecked, it will certainly have an impact on students' academic achievement. Students who lack involvement have an impact on failing to complete their studies. There are many factors that cause students to be less involved in class activities, both internally and externally. Student engagement in class is seen from cognitive, emotional, behavioral, and agentic dimensions consisting of 22 items. This research aims to identify and describe student engagement in class. The data collection process involved 307 students in high school which was carried out online using Google Form. The data results were analyzed using the Rasch Model. The results of this research show the extent of student engagement in class. Apart from that, the results showed that student engagement between men and women was different. It is hoped that the results of this research can be a reference in preparing programs and creating a good learning environment to support full student engagement.

Keywords: Student Engagement, Senior High School, RASCH Model

Introduction

Education for all is a term that is often heard all over the world. Especially in the Sustainable Development Goals (SDGs) in the fourth point, quality education is written. This goal is of course the concern of all countries, including Indonesia. based on the Organization for Economic Co-operation and Development (OECD) assessment through PISA (Program for International Student Assessment) based on three aspects, namely Mathematics, Reading, and Science. The results show that Indonesia experienced a fairly drastic decline. Indonesia's reading literacy score was the lowest among the PISA scores in previous years.

Even though the score dropped, Indonesia recorded an increase in its global PISA ranking to 66th out of 81 countries in 2022 or the 15th lowest in the world. This achievement increased from the 2018 PISA position which was 72nd out of 79 participating countries (CNBC Indonesia, 2024). However, this means that education issues still need to receive more attention, considering that education is correlated with individual success in the future.

The government has indeed made efforts to create a golden generation capable in various fields, but the programs provided are still at the external level. Therefore, from the internal context, students also need attention. The problem of reading literacy and participation in mathematics and science is closely related to the learning process that occurs in class. Whereas, student participation is one of the issues related to learning that can arise (Hanurawan, 2012). Sometimes students are less able to be actively involved in the learning process because of the situations in them. Students are less able to involve themselves both physically and psychologically, which is defined as student engagement (Lin & Huang, 2018).

Student engagement refers to the context of what kind of involvement the researcher wants to see, whether socially involved, at school, in class, or in the learning process (Fredricks, 2015). Many experts say that student engagement is important for all students to have. It is explained in several sources that students who are involved tend to have academic achievement (Abla & Fraumeni, 2019; Dotterer & Lowe, 2011; Reyes et al., 2012), good socio-emotional relationships (Abla & Fraumeni, 2019), achieve better grades, have better target results (Gunuc & Kuzu, 2015; Reyes et al., 2012), and are able to improve their quality (Matsushita, 2017).

In addition, students who are involved tend to more easily complete their studies to graduate (Fredricks, 2015), lower delinquency, drug use, depression, and lower dropout rates (Li et al., 2011). Conversely, if students have low involvement, several problems will arise, including students who easily get the risk of failure at school, as a result of often leaving the learning process (Ream & Rumberger, 2008), students who are prone to dropping out (Archambault et al., 2009; Sagayadevan & Jeyaraj, 2012; (Ream & Rumberger, 2008), and are prone to punishment and suspension from the school.

Student engagement is a well-understood concept, because there is a general consensus that describes it into three components which include behavioral aspects (attention to task, effort, persistence, absence of behavioral problems), emotional (availability of interest and enthusiasm, absence of anger, anxiety, and boredom), and cognitive (use of intelligent and sophisticated learning strategies, active self-regulation) (Fredricks et al., 2004a; Jimerson et al., 2003).

As time goes by, there are experts who add various components to student engagement. However, in the context of involvement during learning, it is explained in detail into 4 components, namely involvement in behavioral, emotional, cognitive and agentic aspects (Reeve & Tseng, 2011). These four aspects adequately represent specific involvement in the field of learning.

Behavioral engagement indicates the level of students' seriousness in participating in learning activities, which is demonstrated through consistency in completing tasks, the effort they exert, and their persistence in learning (Skinner et al., 2009). Behaviorally engaged students allocate a significant portion of their energy to learning activities and maintain this effort over time, in other words, they engage in learning diligently. Emotional engagement reflects students' involvement from the perspective of positive feelings that arise during the learning process, such as enthusiasm and interest.

Emotionally engaged students feel comfortable and enjoy the learning activities they take part in, allowing them to approach the learning process with high enthusiasm. Cognitive engagement describes how students apply a structured and well-planned approach to learning, including the use of deep-thinking strategies such as connecting concepts and organizing information systematically (Walker et al., 2006). Cognitively engaged students typically think strategically, solve problems with thoughtful planning, and mentally envision the learning outcomes they aim to achieve.

Agentic engagement refers to the extent to which students consciously and actively takes part in shaping their learning experiences. This includes actions such as personalizing the learning material to fit their interests, improving the learning process, and creating more effective learning conditions (Reeve, 2013). Students who are agentically engaged interact actively with their teachers, contribute ideas, express their preferences or interests, and directly participate in decisions related to their learning, demonstrating a proactive learning attitude (Reeve et al., 2019).

The process of fostering student involvement in the learning process is certainly not easy. The process carried out is certainly influenced by several factors, both internal and external. Internal factors that influence student involvement in school are academic motivation (Christenson et al., 2012; Saeed & Zyngier, 2012; Zepke et al., 2010), self-efficacy (Afari et al., 2013; Christenson et al., 2012; Gibbs, n.d.), and goal orientation (Gibbs, n.d.; Lam et al., 2012). Apart from that, external factors that also influence student involvement in school are parental involvement (Al-alwan & Mahasneh, 2014; Christenson et al., 2012; Hill & Tyson, 2009), and school climate (Gibbs, n.d.; Klem & Connell, 2004; Reyes et al., 2012)

Both internal and external factors influence student involvement in participating in academic activities at school. This helps in the process of developing students' personal potential. Apart from that, in the learning process students are expected to become active, creative and constructive individuals in developing their knowledge. Furthermore, learning objectives are expected to be achieved if student involvement is maximum. In this research, researchers want to describe the extent of student involvement in learning in terms of age and gender.

Method

Participant

Researchers invited participants via google form. The researcher also explained the objectives to be carried out, explained regarding the confidentiality of the information provided. In the end, it was found that participants who were involved voluntarily were high school students consisting of 307 participants, both male and female, with an age range of 16-18 years.

Procedures

Instrument

The data collection process uses the student engagement scale developed by (Reeve & Tseng, 2011). The scale consists of 22 statement items which are divided into 4 indicators, namely behavioral (5 items), emotional (4 items), cognitive (8 items), and agentic (5 items). The response options in the scale use the same 1–7 bipolar response scale ranging from 'strongly disagree' to 'strongly agree' with 'agree and disagree equally' as the midpoint (4).

Data Analysis

The Rasch model, implemented in Winstep 5.1.5 (Linacre, 2006), will be used to conduct the analysis on the findings of the research. The Rasch analysis has the benefits of providing linear measurements, locating missing data, precisely measuring items, calculating outlier data, and providing instruments that are not dependent on the parameters that are being researched.

Results

Through the Global Test of Fit, some information was found regarding the quality of participants, the quality of the research instruments used, as well as interactions between participants and items, both separately and as a whole, which were used to measure high school student engagement.

Table 1. Uji Global Test of Fit (I: 22, P: 307)

Item-Person Summary Measured			
Item-Person Reliability Cronbach Alpha (KR-20) Person Raw Score "Test" Reliability: 0.92			
Item		Person	
Mean	0.00	Mean	0.66
SD	0.45	SD	0.74
Reliability	0.99	Reliability	0.90
INFIT MNSQ	0.99	INFIT MNSQ	1.03
OUTFIT MNSQ	1.05	OUTFIT MNSQ	1.05
Separation Index	8.81	Separation Index	3.01

Standar Error Item Mean = 0.10   Standar Error Item Mean = 0.04

According to Table 1 above, the overall reliability (both item and person) reached a score of 0.92. This indicates that the interaction between items and participants in the study was very strong. Separately, the item reliability scored 0.99, which reflects excellent item quality. Furthermore, person reliability reached a score of 0.90, indicating a good level of consistency in the participants' responses.

In addition, the average INFIT MNSQ (infit mean square) and OUTFIT MNSQ (outfit mean square) for all individuals were +1.03 and +1.05, respectively. These values fall within the ideal measurement distortion range (+0.5 to +1.5 logit), indicating that the participants were in an appropriate condition to respond to the instrument items.

Similarly, the average INFIT MNSQ and OUTFIT MNSQ for all items were +0.99 and +1.05, respectively—also within the ideal measurement distortion range—demonstrating that the items were of good quality for measurement purposes.

Additionally, the item separation index was 8.81, indicating a very strong category (> 5) and a high level of item variability. Meanwhile, the person separation index was 3.01, which falls into the good category (> 3), although slightly lower than the item separation index. Therefore, there is no need to add new items to improve the existing test.

Furthermore, a one-dimensionality test was conducted using Principal Component Analysis (PCA) to examine whether the instrument effectively measured the intended construct—in this case, student engagement. The results of the one-dimensionality test are presented in Table 2 below.

Table 2. Standardized Residual Variance (in Eigenvalue Units) (N = 22)

	Observed	Expected
Total raw variance in observations	100.0%	100.0%
Raw variance explained by measures	49.7%	49.9%
Raw variance explained by persons	17.3%	17.3%
Raw Variance explained by items	32.4%	32.6%
Raw unexplained variance (total)	50.3%	100%
Unexplained variance in 1st contrast	8.4%	16.7%
Unexplained variance in 2nd contrast	4.9%	9.8%
Unexplained variance in 3rd contrast	4.3%	8.6%
Unexplained variance in 4th contrast	3.1%	6.1%
Unexplained variance in 5th contras	2.8%	5.6%

Based on Table 2 above, the raw variance explained by the measures reached 49.7%, which meets the recommended threshold of ≥ 40% (Linacre, 2006). Additionally, the unexplained variance by the research instrument was recorded sequentially as 8.4%, 4.9%, 4.3%, 3.1%, and 2.8%. These values indicate that the ideal condition for measurement

has been fulfilled, as the percentage of unexplained variance does not exceed the acceptable measurement tolerance limit of 15% (Rangka et al., 2017).

Next, an analysis was carried out to see the participants' understanding of the answer choices provided. If there is an item that is felt to cause doubt, the item must be corrected or removed. The rating scale analysis is presented in table 3 below:

Table 3. Summary of Category Structure. Model="R"

Label	Observed Average	Andrich Threshold
Strongly Disagree (1)	- .51	NONE
Don't Agree (2)	- .52*	- .28
Slightly disagree (3)	- .23	-.73
Neutral (4)	.26	-1.26
Slightly Agree (5)	.61	.67
Agree (6)	1.04	.74
Strongly Agree (7)	1.36	.86

Table 3. Above shows that the average observation value starts from -0.51 logit for answer choices that get a score of 1, +0.52 for answer choices that get a score of 2, -0.23 for answer choices that get a score of 3, +0.26 for answer choices that get a score of 4, +0.61 for answer choices that get a score of 5, +1.04 for answer choices that get a score of 6, +1.36 for answer choices that get a score of 7.

The value of each logit shows differences ranging from a small logit value for the answer choice with the minimum score to the largest logit value for the answer choice with the maximum score. This shows that participants can distinguish the differences in answer choices for each item. The average observation value is relevant to the Andrisch threshold value which moves from NONE, negative, then positive. This means that the correspondence between the items and the answer choices is ideal for measurement.

The researcher further sought to examine the extent of students' engagement in the learning process. These findings provide a general overview of students' participation and engagement levels in classroom learning activities. Table 1 shows that the average individual measure (logit) is 0.66, indicating variability in students' engagement levels during the learning process. The differences in engagement levels among students are quite significant, as reflected by a standard deviation of 0.74. Moreover, the average item measure (logit) is 0.00, with a standard deviation of 0.45, suggesting that the difficulty levels of the items are widely distributed along the logit scale.

The research findings on high school students' engagement in learning are presented in a table. The results indicate that students' engagement levels are generally categorized into three groups: high, moderate, and low. Overall, the distribution suggests that the majority of high school students have a moderate level of engagement in learning.

Table 4. Logit Value of Person (LVP) of Student Engagement (N:307)

	High Level SE +1.4 >LVP	Moderate Level SE +1.4 ≤LVP> -0.08	Low Level SE -0.08 ≤LVP
Student Engagement in Learning	33 (10.75%)	237 (77.20)	37 (12.05%)

The analysis results show that the students' engagement levels, based on the Level of Person's Engagement (LPV), are distributed across three categories. A total of 33 students (610.75%) fall into the high engagement level category (LPV > +1.4), indicating that these students demonstrate strong and consistent involvement in learning activities. Meanwhile, 237 students (77.20%) are classified as having a moderate level of engagement (+1.4 ≥ LPV > -0.08), suggesting that the majority of students are fairly engaged but may still require encouragement or support to reach optimal involvement. Lastly, 37 students (12.05%) fall into the low engagement level category (LPV ≤ -0.08), reflecting limited participation and a possible need for targeted interventions to boost their engagement in learning (as shown in Figure 1).
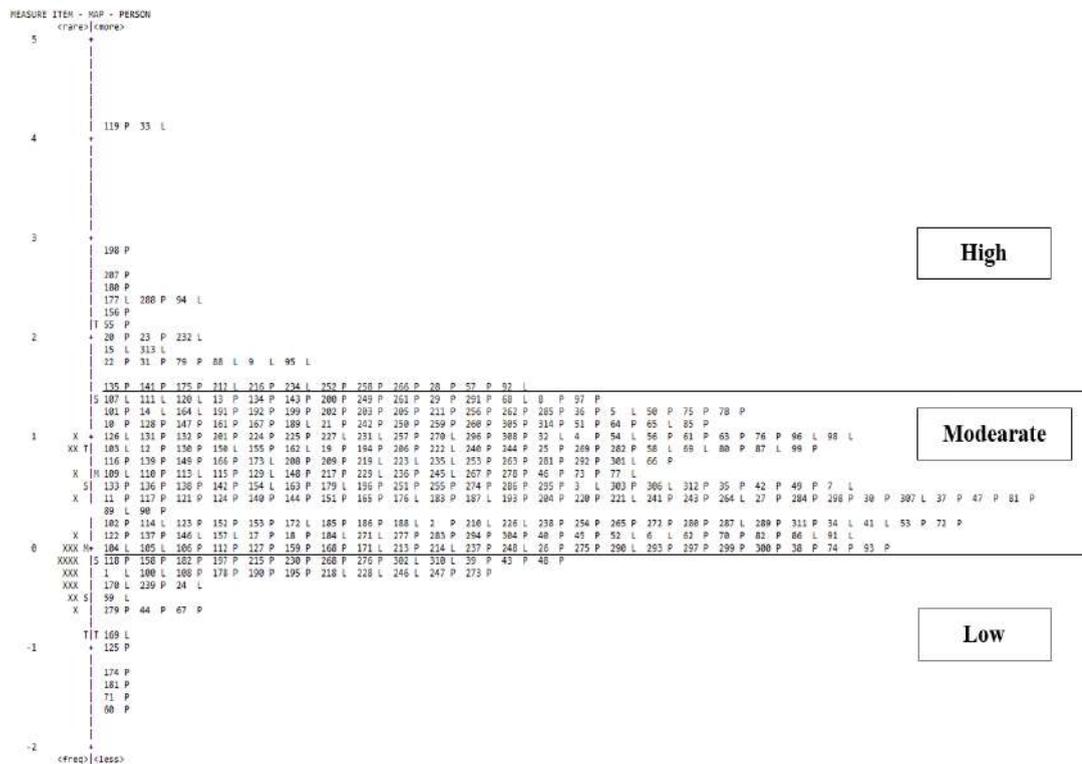
Figure 1. Wright Map Person Distribution on the Student Engagement in Learning

Furthermore, Table 3 categorizes the items based on their level of difficulty, measured using logit values. The classification process was carried out by dividing the distribution of item logit scores based on the mean and standard deviation. The analysis results show that 4 items (18.18%) fall into the very difficult category (LVI > 0.45), 15 items (68.18%) are classified as difficult (-0.45 ≥ LVI > 0.45), and 3 items (13.64%) fall into the easy category (LVI ≤ -0.45 logit) (as shown in Figure 2).

Figure 2. Wright Map Item Distribution on the Student Engagement in Learning Scale

Based on the analysis results, the highest logit value was found in item number 20, with a logit score of +1.01. This indicates that the item was the most difficult for participants to agree with or perform. In contrast, item number 3 had the lowest logit value of -0.62, meaning it was the easiest item for participants to agree with or carry out. The ranking of items from the most to the least difficult, as perceived by the participants, is presented in Table 4, while Table 5 displays the item difficulty levels based on each indicator.

Table 4. Item Logit-Based Student Engagement in Senior High School

No. Butir	Bunyi Pernyataan	Nilai Logit
20	I tell the teacher what I like and what I don't like	+1.01
19	During class, I ask questions	+0.88
21	I let my teacher know what I am interested in	+0.87
22	I offer suggestions about how to make the class better	+0.59
18	During class, I express my preferences and opinions	+0.39
17	Class is fun	+0.08

9	I make up my own examples to help me understand the important concepts I study	+0.02
12	As I study, I keep track of how much I understand not just if I am getting the right answers	-0.01
14	When I am in class, I feel curious about what we are learning	-0.03
8	I try to make all the different ideas fit together and make sense when I study	-0.07
10	When what I am working on is difficult to understand, I change the way I learn the material	-0.09
7	When I study, I try to connect what I am learning with my own experiences	-0.10
11	When I'm working on my schoolwork, I stop once in a while and go over what I have been doing	-0.19
15	When we work on something in class, I feel interested	-0.19
6	When doing schoolwork, I try to relate what I'm learning to what I already know	-0.21
16	I enjoy learning new things in class	-0.27
13	Before I begin to study, I think about what I want to get done	-0.35
1	I listen carefully in class	-0.36
2	I pay attention in class	-0.38
4	I try very hard in school	-0.48
5	I work hard when we start something new in class	-0.49
3	The first time my teacher talks about a new topic, I listen very carefully	-0.62

Table 5. Distribution of Student Engagement Items by Construct and Difficulty Level (N=307)

Construct/ Dimension	Difficulty Level		
	Very Difficult	Difficult	Easy
Behavioural Engagement	Item 1		Item 4
	Item 2		Item 5
			Item 3
Cognitive Engagement		Item 9	
		Item 12	
		Item 8	
		Item 10	
		Item 7	
		Item 11	
		Item 6	
		Item 13	
Emotional Engagementl		Item 17	

		Item 14
		Item 15
		Item 16
Agentic Engagement	Item 20	Item 18
	Item 19	
	Item 21	
	Item 22	

Discussion

The results of this study indicate that the engagement of senior high school students in learning activities falls within the moderate category. The majority of students (77.20%) demonstrated a moderate level of engagement, while only 10.75% showed high engagement and 12.05% were at a low level. These findings suggest that although most students are sufficiently engaged in the learning process, there remains a portion of students who require special attention to increase their classroom participation. In this context, it is essential for teachers to design instructional strategies that address all levels of student engagement in order to create an inclusive learning environment that supports optimal involvement.

The analysis of item difficulty levels revealed that agentic engagement is the most challenging dimension for students. This is evident from the highest logit values found in agentic items such as "I tell the teacher what I like and what I don't like" (+1.01), "During class, I ask questions" (+0.88), and "I let my teacher know what I am interested in" (+0.87). These results indicate that students are still relatively passive in expressing opinions, asking questions, and conveying personal preferences to their teachers. This is a significant indicator that students tend to be less proactive in directing their own learning process, which ideally should be a characteristic of active, participatory learning.

In contrast, the behavioral and cognitive engagement dimensions showed lower levels of difficulty. Items such as "The first time my teacher talks about a new topic, I listen very carefully" (-0.62) and "I work hard when we start something new in class" (-0.49) had the lowest logit values, suggesting that students generally find it easier to agree with learning behaviors that are responsive or obedient in nature. This reinforces the view that Indonesian students are still largely engaged in conventional learning models that emphasize compliance over independence in thinking or initiating.

Based on the analysis of the Logit Value of Person (LVP) related to student engagement in learning, as visualized through the person-item map and the distribution table of engagement levels (see Figure 1 and Table 4), it was found that student engagement generally differs by gender. In the distribution map, female students are marked with the letter "P" and male students with the letter "L". It appears that female students (P) are more frequently distributed in the upper to middle areas of the map, indicating high to moderate levels of engagement. Conversely, male students (L) tend to appear more in the middle to lower areas of the map, suggesting moderate to low levels of engagement.

This quantitative distribution is supported by Table 4, where students with a high level of engagement (LVP > +1.4) total 33 students (10.75%) and are visually dominated by female students. Meanwhile, the group with low engagement (LVP ≤ -0.08), consisting of 37 students (12.05%), is more populated by male students. This indicates that female students tend to demonstrate higher engagement in learning compared to their male counterparts.

These findings are consistent with several previous studies which suggest that student engagement in academic contexts is often influenced by gender. Female students are generally more likely to exhibit higher cognitive and affective engagement—such as attentiveness, discipline, and positive relationships with teachers—compared to male (Fredricks et al., 2004; Razaq Ahmad et al., 2014). Social and cultural factors may also contribute to this pattern, such as parental expectations and gender roles within the school environment, which often encourage female students to participate more actively in the learning process.

Overall, the findings of this study provide an understanding that student engagement in learning is influenced not only by instructional context but also by individual and social factors (Reeve, 2013). Emphasis on developing agentic engagement should be a primary focus, as this dimension directly relates to students' capacity to become active learners who can take charge of their own learning direction. Therefore, teachers and school counselors need to design interventions that not only facilitate learning but also empower students to engage actively in every aspect of the process—whether through collaborative, reflective, or project-based learning methods.

In the context of Indonesian education, student engagement is strongly influenced by teachers' instructional styles, classroom culture, and societal expectations brought into the school environment (Appleton et al., 2008; Krain, 2010). A learning culture still dominated by one-way instruction and limited space for agentic expression may hinder higher dimensions of engagement. Hence, there is a need for innovative instructional approaches that position students as active subjects, such as student-centered learning, project-based learning, or problem-based learning, which have been proven to enhance students' agentic and cognitive engagement.From the perspective of guidance and counseling, school counselors need to provide interventions that build on students' personal strengths. Although Indonesian students may still struggle to self-motivate academically, they ultimately need to develop the ability to push themselves toward active engagement in learning. They must realize that learning is their own responsibility as individuals. This aligns with the concept of academic motivation (Reeve et al., 2019; Ryan & Deci, 2000). Moreover, efforts by teachers, homeroom teachers, and counselors should be collaborative in developing school programs that not only emphasize academic outcomes but also nurture students' capacity to become active and reflective learners (Reeve et al., 2019).

Finally, it is important to note that the use of the Rasch model in this study offers methodological advantages, as it allows for the objective and comparable presentation of student engagement data in logit form (Rangka, et al., 2023; Folastri et al., 2023; Sumintono & Widhiarso, 2014; Aminah et al., 2025; Ariyanto et al., 2025). This approach enables researchers and educational practitioners to more accurately map students' engagement needs and to design data-driven interventions that are more targeted and effective. Future research is highly recommended to explore student engagement in broader contexts, such as culture-based engagement, digital engagement, and the dynamics of engagement in both online and offline learning environments.

Conclusion

This study aimed to explore the level of student engagement in high school learning activities using the Rasch model. The findings revealed that the majority of students demonstrated a moderate level of engagement, with a smaller proportion showing high or low levels. This suggests that while many students are fairly involved in their learning, targeted support is still needed for those at the lower end of the engagement spectrum.

The analysis also uncovered that student engagement levels differ by gender. Female students generally displayed higher levels of engagement compared to their male counterparts, as seen in the person-item map and engagement level distribution. This highlights the need for gender-sensitive teaching strategies that ensure inclusive participation.

In terms of item difficulty, the agentic engagement dimension appeared to be the most challenging, with items requiring students to express their preferences, opinions, and suggestions scoring the highest on the logit scale. This indicates a tendency among students to be more passive, particularly when it comes to taking initiative in shaping their learning experiences. Meanwhile, items related to behavioral and cognitive engagement were generally easier, reflecting a pattern of responsive rather than proactive involvement.

Although item difficulty was analyzed by dimension, this study did not further explore item difficulty in relation to gender within each dimension. Nonetheless, the results provide valuable insight into general engagement patterns and emphasize the importance of strengthening agentic engagement through classroom practices that promote student voice and autonomy.

Ultimately, these findings underline the significance of designing learning environments and school programs that actively support diverse student needs and empower all learners—regardless of gender—to become engaged participants in their education.

Acknowledgments

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The Most Common Causes of Academic Burnout of Working Students: Investigation in Capital City

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Abstract: The demands of both study and work make students exhausted in carrying out their activities. The purpose of this study is to describe the aspects that most affect academic burnout of students in the city of Jakarta, Indonesia. This research method is a survey with a sample of 451 people. The instrument used School burnout inventory (SBI) and analyzed with RASCH modeling and MS. Excel. Person reliability is 0.70 and item reliability is 1.00. The results of academic burnout of working students are 17% of students in the low category, the rest are in the medium category 59%, and high 24%. Emotional exhaustion and depersonalization are the most common causes of academic burnout in working students. Thus, the need for counseling in reducing academic burnout of working students in the city of Jakarta, Indonesia.

Keywords: Academic Burnout, Rasch Model, Students, Covid-19 Pandemic, Workers

Introduction

Academic burnout is a condition of physical and emotional exhaustion experienced by students, one of which is caused by prolonged stress conditions (Maslach & Schaufeli, et al., 2001, Oktasari et al., 2022.). Universities have begun to pay attention to this condition, including those faced by students. Academic burnout is also studied by various countries in the world, such as in China there are 86.6% of students experiencing severe academic stress to cause academic burnout, while in Iran, medical students who experience academic burnout are 76.8% and severe stress is 71.7% (Rad, et al., 2017). In addition, students in America (87%) feel that education is a significant source of stress (American Psychological Association, 2020). Meanwhile, in Indonesia, such as in the Special Region of Yogyakarta, it is known that the Academic burnout of Universitas Gajah Mada (UGM) students in 2021 is 59.36% (LM Psychology UGM, 2021). In addition, in West Java, as many as 11,131,500 students have experienced lecture stress, and a quarter of the students have been diagnosed with psychiatric disorders (Tiaranissa, & Rosiana, 2022).

Strengthening the data in the condition of academic burnout, Indonesia became the second-ranked country in the academic burnout study for the last 12 months, namely February 2022-February 2023 (https://trends.google.co.id). In this study, academic burnout conditions were revealed in students in Jakarta, Indonesia. Students who have activities in metropolitan cities have more pressure due to the demands and interactions of busier activities in their daily lives (Hairunnisa, & Pungkasane, 2021). This study can provide an overview of the extent of academic burnout of students who work in the city of Jakarta and the aspects that influence it the most.

Academic burnout has three aspects: 1) emotional exhaustion, caused by excessive emotional and psychological demands and usually coexisting with feelings of frustration and tension, 2) aversion to study or cynicism, refers to insensitivity or a cynical attitude towards the work at hand. Cynicism can also be defined as student apathy or indifference. 3) Reduced desire to achieve, reduced desire to achieve occurs when a person displays a tendency to evaluate themselves negatively, a decreased feeling of work competence, and increased feelings of inefficacy towards school work, tasks, and responsibilities. (Yang et al., 2017; Yang, 2004; Paloş, 2024; Khadijah, et. al., 2023)

Aspects that affect the occurrence of academic burnout need to be known as a prevention of worse conditions; in several countries the aspects that affect the occurrence of academic burnout have been discussed further. In Serbia, Romania, Korea, fatigue is more influential and dominates, followed by cynicism (Nikodijević, et al., 2012; Cazan & Nastasa, 2015; Lee, et al, 2010). In Taiwan "self- identity stress", "interpersonal stress", "future development stress", and "academic stress" can jointly predict students' academic burnout (Lin, & Huang, 2014). In China, life satisfaction is one of the most influential in academic burnout of students in higher education. The results of research from Rosales (2021) that from 20 literature review studies evaluated in a systematic review obtained information that emotional exhaustion is most influential in academic burnout in North America, Latin America, and in Europe. Based

on some of the results of these studies, describing the conditions of academic burnout of students in universities in various countries in the world but not with the conditions of students who study and work simultaneously, thus in this article the author reveals more details related to academic burnout in working students in the capital city of Indonesia. This research is also a preliminary study to determine the interventions and treatments that need to be prepared to overcome the academic burnout of working students.

Methods

This research method is a survey with respondents of employee class students at one of the Private Universities in Jakarta, Indonesia. The sample was 451 students who work. The sampling technique is incidental sampling. The instrument used is the school burnout inventory (SBI) academic burnout scale with a Likert scale model, with good instrument reliability results, while the academic burnout items are valid. Instrument distribution is done through g-form. The data analysis used is RASCH modeling analysis (Rangka et al., 2017; Sumintono & Widhiarso, 2014), and obtaining categorization results through Ms. Excel.

Results And Discussion

Based on the results of data processing, data information is obtained related to the level of academic burnout of working students, and analysis of student answer patterns in academic burnout conditions and seeing the condition of equalization of answers to the items analyzed. Regarding the level of academic burnout of working students, the information is obtained in the following figure:
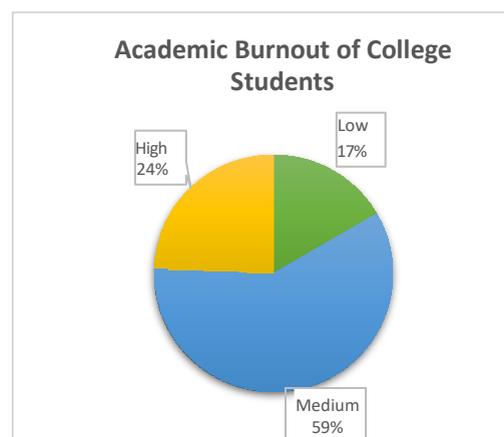
Picture 1 Academic Burnout of College Students

The data explains that the level of academic burnout of students in the moderate category is 59%, but what is of concern based on the data above is the low percentage of student academic burnout, thus it can be interpreted that students in general experience more burnout related to learning, especially for students who work. This is supported by the results of person reliability obtained as follows:

Table 1. Person reliability of Academic burnout

SUMMARY OF 451 MEASURED PERSON

	TOTAL SCORE	COUNT	MEASURE	MODEL ERROR	INFIT MNSQ	ZTSD	OUTFIT MNSQ	ZTSD
MEAN	37.7	15.0	.11	.47	.99	-.1	1.01	-.1
S.D.	4.2	.0	.93	.01	.47	1.3	.48	1.3
MAX.	49.0	15.0	2.66	.52	2.45	3.2	2.55	3.0
MIN.	24.0	15.0	-3.05	.46	.25	-3.0	.27	-2.8

REAL RMSE .51   TRUE SD   .77   SEPARATION 1.51   **PERSON   RELIABILITY .70**

MODEL RMSE .47   TRUE SD   .08   SEPARATION 1.70   PERSON RELIABILITY .74

PERSON RAW SCORE-TO-MEASURE CORRELATION = 1.00

CRONBACH ALPHA (KR-20) PERSON RAW SCORE "TEST" RELIABILITY = .73

Table 2. Item Reliability of Academic burnout

SUMMARY OF 15 MEASURED ITEM

	TOTAL SCORE	COUNT	MEASURE	MODEL ERROR	MNSQ	NFIT ZTSD	OUTFIT MNSQ	ZTSD
MEAN	1134.6	451.0	.00	.09	.99	-.3	1.01	-.1
S.D.	255.8	.0	1.80	.00	.20	3.3	.23	3.6
MAX.	1616.0	451.0	2.83	.10	1.23	3.5	1.37	4.7
MIN.	746.0	451.0	-3.43	.08	.60	-7.3	.60	-7.3

REALRMSE .09   TRUE 1.80   SEPARATI 20.16   **PERSON   RELIABILITY**

MODEL RMSE .09   TRUE 1.80   SEPARATI 20. 99   PERSON RELIABILITY 1.00

UMEAN=.0000 USCALE=1.0000

ITEM RAW SCORE-TO-MEASURE CORRELATION = -1.00

6765 DATA POINTS. LOG-LIKELIHOOD CHI-SQUARE: 10922.07 with 6298 d.f. p=.0000

Global Root-Mean-Square Residual (excluding extreme scores): .5459

Table 3. Item Dimensionality of Academic burnout

Table of STANDARDIZED RESIDUAL variance (in Eigenvalue units)

			-- Empirical --		Modeled
Total raw variance in observations	=	35.4	100.0%		100.0%
Raw variance explained by measures	=	20.4	57.6%		56.9%

Raw variance explained by persons	=	3.8	10.8%		10.6%
Raw Variance explained by items	=	16.6	46.9%		46.3%
Raw unexplained variance (total)	=	15.0	42.4%	100.0%	43.1%
Unexplned variance in 1st contrast	=	2.6	7.4%	17.4%	
Unexplned variance in 2nd contrast	=	1.8	5.0%	11.8%	
Unexplned variance in 3rd contrast	=	1.4	4.1%	9.6%	
Unexplned variance in 4th contrast	=	1.3	3.5%	8.3%	
Unexplned variance in 5th contrast	=	1.1	3.1%	7.3%	

Based on the information in the table above, it can be seen that person reliability is in the good category with a reliability coefficient of 0.70 and item reliability is in the high category of 1.00. This shows the suitability of items with respondents, namely working students, it can be seen that students are serious in filling out statement items in the good category, so that the reliability of the person is not much different from the overall test reliability coefficient value. For the validity of the item as a whole is valid, it can be concluded that the item and person have a match in filling. This suitability is also supported based on the results of the following item maps.
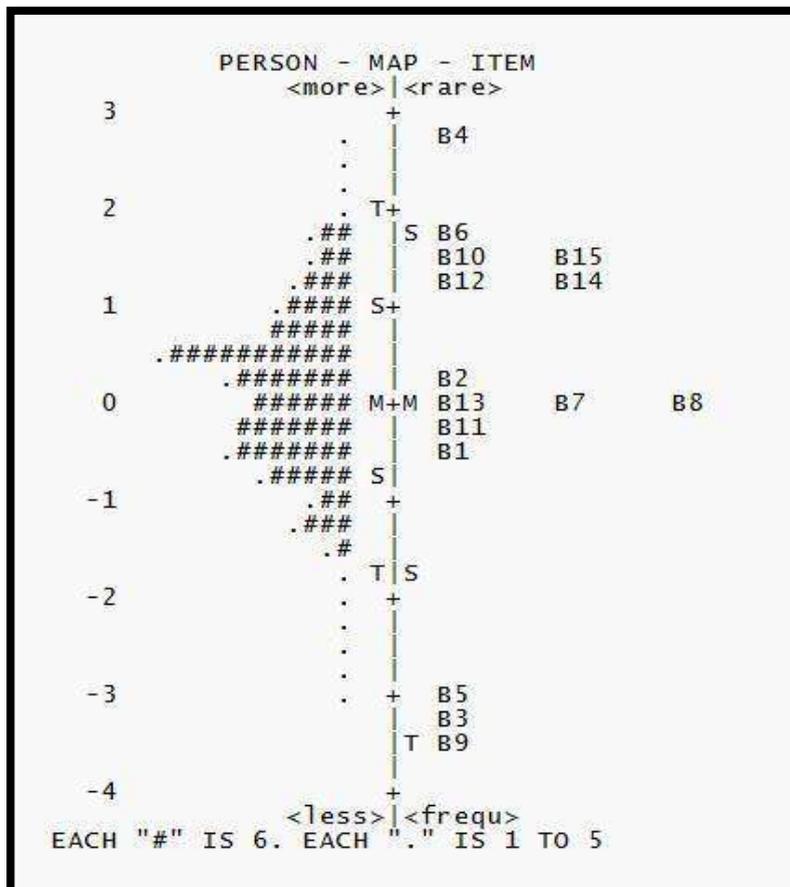
Picture 2. Item Maps of Academic burnout

Based on Figure 2, it can be seen that the average distribution of items can be answered by respondents well, items no. 5, 3 and 9 are the easiest to agree with. Statement number 5 is "Feeling worried about missing lecture material when unable to attend lectures", number 3 is "Completing assignments even though there are many tasks to be completed" from number 9 is "Trying to do coursework to the maximum". The statement is in the indicator of emotional exhaustion and depersonalization.
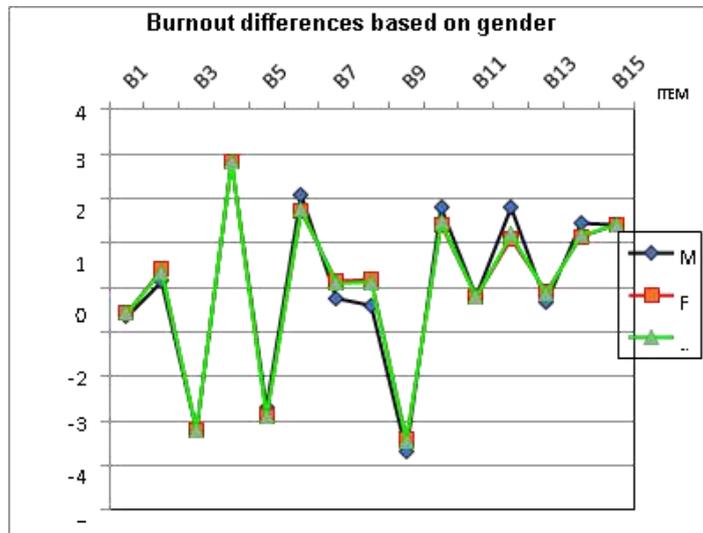
The figure above explains the burnout condition based on gender, in the figure it can be understood that the female graph line is closer to the item than the male, this can be interpreted that women feel more burnout than men. In addition, based on the semester level, it can be seen that the seventh semester experiences more burnout conditions, this can be seen in the following figure
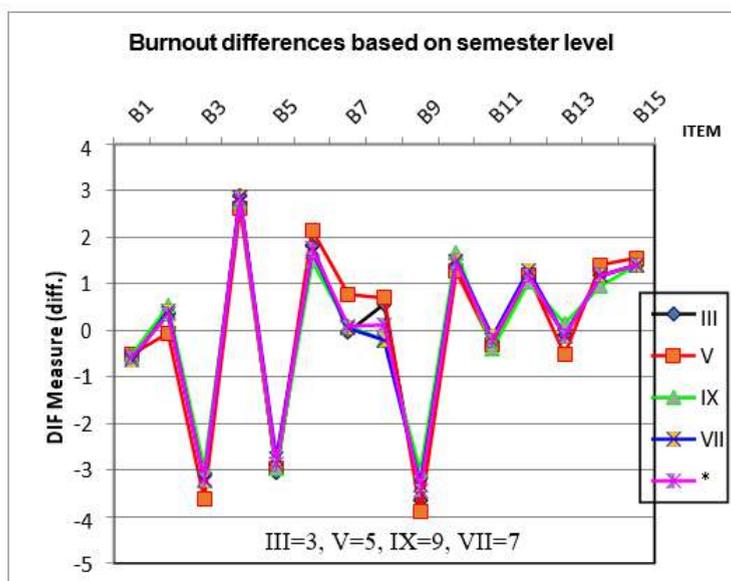
In semester 7, the burnout condition is felt because the assignments during semester seven tend to be more varied, this means that in semester seven the students carry out field practice which requires them to do internships in

predetermined schools, on the other hand the students also still have courses that must be followed on campus to deepen their material and understanding, and because of their condition there are also those who work, to make a living, for that the various responsibilities and demands that must be carried out in one certain time, namely during semester seven, make the students experience burnout.

In the graphical representation of gender and semester level, it can be seen that item number 4 is closest to each respondent, where the item states "When the assignments given are many, I ignore the assignments given by the lecturer". It can be seen that one of the closest conditions that makes student burnout is the task given too much. Burnout is understood as a state of physical, emotional and mental exhaustion caused by long- term involvement in emotionally demanding situations (Pines & Aronson, 1998; Maslach & Leiter, 2016). Emotional exhaustion is the beginning of the emergence of burnout then depersonalization, and finally shows a decrease in achievement / achievement (Maslach, 1993; Maslach & Leiter, 2016). Emotional exhaustion is fatigue in individuals related to personal feelings characterized by a sense of helplessness and depression, emotional exhaustion is always preceded by a common symptom, namely the onset of anxiety every time you want to start working, which then leads to a feeling of helplessness in facing the demands of work (Bianchi et al., 2018).

In line with this, the results obtained by students feel worried and the thought of having to complete assignments makes students feel emotional fatigue, this condition can also be accompanied by the demands of studying and working which make it difficult for students to manage or allocate time between the two, this condition can also make students easily neglect their responsibilities to study and complete assignments given by lecturers (Le et al., 2018). On the other hand, the condition of students who have to work full-time or part-time to fulfill their financial needs is also undeniable. This is further driven by the fact that many parents no longer support or bear the full financial costs of college education and scholarships are limited and very competitive (Lenaghan & Sengupta, 2007; Barrow et al., 2014; Broton et al., 2016; Herbaut & Geven, 2020). For this reason, pressure at work or workload is also a factor in the emergence of burnout (Pace et al., 2021). Burnout in college students can be the key to understanding their various behaviors as well as the quality of learning, student burnout can also affect their present and future relationships with colleges, friends, lecturers and others. (Neumann et al., 1990; Lin & Huang, 2014). Thus, handling academic burnout can be focused on overcoming the emotional exhaustion faced by working students through various approaches in guidance and counseling, one of which is cognitive behavior art therapy (CBAT) (Gad, et al: 2023; Catanzano et al, 2023; Welsh et al, 2025) or Solution Focus Brief Counseling (Khadijah, et al., 2023).

Conclusions

Through the results of data analysis of academic burnout with RASCH modeling and Ms. Excel, it is obtained that academic burnout of students who work is quite an important concern, this is because the results of academic burnout in the medium and high categories are seen. Based on item maps, the emotional exhaustion indicator is the most common condition felt by students. Of course, this is necessary for guidance and counseling to further provide the right treatment in reducing the academic burnout of working students, one of which is through cognitive behavior art therapy or Solution Focus Brief Counseling.

Acknowledgments

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Religiosity as a Remedy: Alleviating Academic Burnout Among Working Students

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Abstract: This study examines the phenomenon of prolonged fatigue among working students in the Islamic Education Study Program (PAI) at IAIN Kediri. Emotional and physical exhaustion arises from multitasking between studies, work, and organizational activities, leading to chronic stress and a loss of motivation. The research indicates that poor time management and intense social interactions in the workplace contribute to frustration and cynicism towards academic activities. Social support from friends or family can help prevent academic burnout, while religious practices have been shown to provide significant psychological support in coping with stress. Respondents exhibited variations in their levels of religiosity, with spiritual practices such as prayer and reading the Qur'an serving as coping mechanisms to enhance psychological well-being. These findings underscore the importance of understanding the role of religiosity in managing the academic workload of working students to mitigate the negative impacts of burnout.

Keywords: Religiosity; Academic Burnout; Working Students

Introduction

In the era of globalization and increasing competition, working students often face significant challenges in balancing academic demands and employment. One consequence of this pressure is a phenomenon known as academic burnout. Although many experts argue that most students maintain an active attitude toward learning, the phenomenon of study fatigue persists among some of them during the learning process (Chen & Chen, 2025). Academic burnout has been defined in various ways. Schaufeli et al. (2002) proposed academic burnout as a combination of emotional exhaustion, cynicism, and academic inefficacy caused by the ongoing failure to manage study-related stress effectively. Yang

(2004) defined academic burnout as a state of emotional exhaustion, depersonalization tendencies, and feelings of low personal accomplishment resulting from study pressure, academic workload, or other learning-related factors. Academic burnout can lead to decreased motivation, productivity, and mental health among students (Maslach & Leiter, 2016; Parker et al., 2022). Therefore, it is important to understand the factors that can help working students face and overcome this condition.

There are many factors that can influence burnout. Darto et al. (2015) suggested that one such factor is religiosity. Individuals with high levels of religiosity tend to exhibit positive attitudes such as responsibility and tolerance and show commitment to their work and organization.

According to Behere et al., (2013) religious teachings and values enhance an individual's ability to understand the meaning and importance of work. This, in turn, has a positive influence on burnout. Furthermore, individuals who are religiously committed tend to view their work positively, experience job satisfaction, and are more likely to be happier and more peaceful in their lives (Ghazzawi et al., 2016). Religion regulates human behavior through religious norms and values, while religiosity influences an employee's affective commitment (Barhem et al., 2009).

Religiosity can be defined as the degree of an individual's involvement in religious practices and spiritual beliefs. Previous research has shown that religiosity can serve as a source of emotional and psychological support for individuals experiencing stress. According to Pargament (1997), religiosity can provide meaning and purpose in life, which in turn helps individuals cope with challenges and difficulties they face.

In the context of working students, religiosity can play a significant role in mitigating the negative effects of academic burnout. An individual's level of religiosity is related to the degree of academic burnout they experience. According to Handika (2019), he higher the level of religiosity, the lower the level of academic burnout, and vice versa. Religiosity is also considered a factor that can release individuals from various feelings such as anxiety, tension, and even depression (Rizdanti & Akbar, 2022).

Students with high levels of religiosity tend to have better coping mechanisms when facing stress. A study by Koening (2015) showed that religious individuals are more capable of managing stress and exhibit lower levels of anxiety compared to those who are not religious. This indicates that religiosity can be an effective tool in managing academic pressure faced by working students.

Moreover, religiosity can influence how working students interact with their social environment. Social support obtained from religious communities can serve as a protective factor against burnout. According to Koenig (2012), "social support derived from religious communities can enhance resilience and provide coping resources". Thus, religiosity functions not only as a source of internal strength but also as a bridge for building important social support networks for working students.

Working students who participate in religious activities often have strong social networks that can provide emotional and practical support when facing academic challenges. According to Ellison & George (1994), social support

obtained from religious communities can help individuals feel more connected and reduce feelings of alienation, which are commonly experienced by working students.

In this context, religiosity functions not only as a source of spiritual strength but also as a coping mechanism to alleviate the negative impacts of academic pressure. In Indonesia, research on the relationship between religiosity and academic burnout remains limited. Therefore, it is important to conduct further studies to understand how religiosity can assist working students in the Islamic Education Study Program (PAI) at IAIN Kediri in overcoming academic burnout.

Considering the significance of religiosity in addressing academic burnout, this study aims to explore the role of religiosity in managing the challenges faced by working students. This research is expected to provide deeper insights into how religiosity contributes to the mental and academic well-being of working students, as well as offer recommendations for educational institutions in supporting their students.

Method

This study employs a qualitative approach with a phenomenological design. The phenomenological approach was chosen because it aims to understand individuals' subjective experiences related to a particular phenomenon—in this case, how religiosity influences working students' ability to cope with academic burnout. According to Cresswell (2012), phenomenological research focuses on the meanings individuals assign to their experiences and how those experiences shape their understanding.

The research was conducted at IAIN Kediri, a higher education institution with a population of students enrolled in the Islamic Education program. This site was selected due to the relevance of its population to the research topic and the accessibility it offered to the researcher (Creswell & Poth, 2017). The target participants in this study were students in the Islamic Education program who were also employed while pursuing their studies, specifically those in semesters 6 through 10. This group was considered to have sufficient academic and work experience to provide in-depth insights into the influence of religiosity on academic burnout. The list of respondents is presented in Table 1.

Table 1. Research respondents

No	Name	Gender	Semester	Job
1	BL	Female	10	Private Tutor
2	ZD	Female	10	islamic elementary school teacher (Madrasah Ibtidaiyah teacher)
3	NS	Female	6	Homemade Business
4	IM	Female	6	Homemade Business
5	LA	Female	8	Supermarket Employee
6	HK	Male	8	Storekeeper
7	MB	Male	10	Restaurant waiter

8	FQ	Male	6	Mousque administrator

The researcher enlisted the help of a key individual to provide insights into the subject's condition. This individual was chosen based on their approval by the subject and their close relationship with them. The primary data collection method employed in this study is semi-structured interviews, complemented by non-participant observation. An interview guide was prepared by the researcher to be used during discussions with each subject, allowing for further development as needed throughout the interviews. The researcher will engage in non-participant observation, meaning they will not directly participate in the daily lives of single mother teachers. Content analysis was utilized for this research; this technique involves analyzing words, meanings, images, symbols, or themes conveyed through text (Cresswell, 2012).

Credibility, reliability, and certainty/confirmability are used by researchers. The author employs a member check to gauge the degree of trustworthiness of this study. According to Helaluddin & Hengki Wijaya (2019), a qualitative researcher can use a member check to verify the accuracy of the data. This study employs triangulation techniques in addition to member checks. Triangulation is the process of verifying or re-verifying data using previously acquired data (Helaluddin & Hengki Wijaya, 2019). Triangulation strategies used in this study include source triangulation and triangulation method. The data analysis technique follows the steps outlined by Miles and Huberman, which consist of three stages: 1) data reduction; 2) data presentation; and 3) conclusion drawing and verification. (Murdiyanto, 2020).

Results

Academic burnout student's workers

The research findings indicate that the levels of academic burnout vary among students. Generally, they experience exhaustion, cynicism, and ineffectiveness as described by Maslach & Leiter (1997).

Exhaustion leads to prolonged stress, emotional instability, and difficulty in self-regulation. This condition was reported by several respondents.

"I used to enjoy studying. But now, I feel very down because circumstances require me to work to support myself. When my body is tired, it also affects my mind. It feels like my body refuses to cooperate. That is a heavy burden for me. On top of that, I am currently working on my thesis, so my thoughts are very divided. At this moment, I am truly exhausted in many ways; I even often postpone thesis guidance sessions." (BL, respondent 1)

"So, besides studying and working, I also participate in an organization. My work is online, but since it involves handmade crafts that take a long time to produce—not something that can be done in one or two days—and I do everything myself, from promotion, product making, packing, to shipping. Because of this, I sometimes get very confused about how to prioritize my time. For me, studying, working, and the organization are all equally important. I get very frustrated when the schedules for all three overlap or conflict." (NS, respondent 3).

"NS often asks for sick leave during lectures. Maybe she is tired because of her many activities. Besides that, as far as I know, her mother is also ill. So perhaps that's why she often requests permission not to attend classes." (IM, respondent 4)

"Lately I've been very anxious because I have to teach while facing my thesis deadline. Meanwhile, my supervisor has said from the beginning that intensive guidance is not possible because he is very busy. I feel anxious and worried that I might not be able to finish this semester and will have to repeat next semester." (MB, respondent 7)

In this study, the respondents experienced cynicism within themselves. The cynicism observed occurred when respondents underwent exhaustion (physical, mental, and emotional fatigue), which then triggered sensitive traits such as irritability and being easily offended.

"I realize that I am someone who gets angry easily. What angers me the most is when I have high expectations but then face realities that do not meet those expectations. The effect of my anger impacts both my studies and work. Usually, when this happens, I often skip classes." (FQ, respondent 8)

"My anger tends to surface after returning from campus. The class schedule is packed—from morning until evening—and then I have to go straight to work. I feel extremely exhausted. When I arrive at work, I'm expected to do tasks that are not part of my responsibilities or outside my job description." (HK, respondent 6)

FQ's statement indicates that the cynicism experienced is characterized by feelings of anger due to events not meeting their expectations. This condition has caused FQ to frequently skip classes. Similarly, HK becomes easily angered when required to perform tasks outside of their job description.

Like exhaustion and cynicism, working students perceive all assigned tasks as burdensome. When the workload or assignments are heavy, they tend to feel incapable of handling them.

"Sometimes I feel that multitasking is a very heavy burden. However, whether I like it or not, I have to carry out all of these responsibilities. I think it is better to be tired from working than to be exhausted because having no money at all." (BL, respondent 1)

"I feel that the tasks assigned to me are heavy, especially when facing deadlines. Often, the deadlines for academic assignments and work overlap. I also realize that sometimes I procrastinate, which makes everything feel overwhelming at the end. When this happens, I feel incapable of completing the tasks, resulting in my work taking a very long time to finish. Ultimately, I have to retake several courses." (ZD, respondent 2)

Although the respondents feel powerless, they can only accept the situation.

"Actually, all of this makes me very angry, but I can only remain silent and reflect on myself.." (HK, respondent 6)

Unlike HK, amidst pressure and feelings of powerlessness, BL is able to motivate herself to rise.

"I consider myself intelligent. This motivates me to carry out my activities. It is enough that others say negative things about me; what matters is that I do not." (BL, Respondent 1)

Respondents feel that every task seems difficult and unmanageable, which they believe negatively affects their self-confidence. However, some also feel that it does not have a significant impact.

The Role of Religiosity in Coping with Academic Burnout among Working Students

Working students in the Islamic Education Study Program (PAI) at IAIN exhibit diverse levels of religiosity, ranging from their beliefs, religious practices, knowledge of religion, religious experiences, to the consequences they face when embracing a religion. Each individual certainly holds firm belief in their faith, especially since they are enrolled in the Islamic Education study program.

> "I place my hope in Allah. I always believe that Allah is always with us. I also firmly hold on to Allah." (BL, respondent 1)

> "I always hope and firmly adhere to the teachings of Islam. I believe that the most painful hope is hoping in humans. Therefore, even if Allah does not answer the prayers I wish for, I still surrender and place my hope in Allah. I acknowledge the teachings of Islam and believe that everything we do is already outlined in the Qur'an." (ZD, respondent 2)

In practicing their religious duties, respondents admitted that some perform worship merely to fulfill obligations, while others carry out worship with the hope of gaining Allah's pleasure.

> "I am someone who, if asked whether I am devout, perhaps I am not very devout yet. Maybe it is more like as long as I pray and fulfill my obligatory acts of worship. Not necessarily performing them exactly on time every time. The important thing is that I perform the worship even if it is late." (ZD, respondent 2)

> "I am enthusiastic about worshiping Allah because I want to receive Allah's mercy and pleasure. Gaining Allah's pleasure is the greatest thing in this world." (FQ, respondent 8)

> "I am passionate about worshiping Allah because of the conviction in my heart. From the heart, I truly believe that as servants, we must carry out what has been commanded. And we must fulfill our obligations so that later we receive our rights." (MB, respondent 7)

A person's religiosity is also reflected in their religious knowledge.

> "Until now, I still attend Quranic study sessions near my home." (BL, respondent 1)

> "I live in a village, so religious studies are very frequently held around me, and I often participate in those sessions." (ZD, respondent 2)

Until adulthood, they continue to learn about the religion they adhere to. Studying in the Islamic Education Study Program does not guarantee that they will have a high level of religiosity. This is because religiosity is also seen from one's experiences and the consequences of those experiences, which vary from person to person.

"I once experienced boredom in performing worship, to the extent that I did not pray for one month. However, my thoughts became increasingly chaotic and disorganized. Eventually, I decided to resume praying. After that, I felt solutions gradually emerged and things improved." (MB, respondent 7)

"Several times I have felt sad, almost to the point of despair. However, it seemed as if circumstances provided guidance—there was always a sign reminding me not to give up, to always rise again, and to trust in Allah's help." (NS, respondent 3)

"My teacher said that a weak mentality is caused by weak faith, and this has proven true. When I maintain my faith, I feel at ease in living my daily life. However, when my faith begins to waver, my mental health also becomes disturbed." (BL, respondent 1).

"Indeed, religion plays an important role in maintaining my mental health. When I feel overwhelmed, I read the Qur'an and my heart becomes calm. Perhaps it is because there is nothing else on my mind except focusing on the verses I am reading." (HK, respondent 6)

"When I am overthinking, I pray to Allah and surrender everything to Him. This brings me peace in carrying out my activities." (FQ, respondent 8)

The research results indicate that religiosity can reduce respondents' stress through religious rituals such as prayer, supplication, and reading the Qur'an.

Discussion

Prolonged exhaustion is an increasingly common phenomenon among students who multitask between studying and working. Leiter & Maslach (2005) indicate that emotional exhaustion can arise when individuals feel unable to meet the demands from both academic and professional environments. In this context, the respondent experienced difficulties in managing the schedule for thesis supervision, which further worsened her emotional condition.

The majority of respondents in this study exhibited intense symptoms of exhaustion. This fatigue was not only physical but also encompassed emotional and mental exhaustion, especially when they had to divide their time between studying, working, and organizational activities. Symptoms such as prolonged stress, loss of motivation, and decreased self-management abilities were very evident in their narratives. Exhaustion in academic burnout is influenced by several factors, including prolonged stress, lack of social support, and imbalance between work and personal life (Alam, 2022).

The research findings indicate that intense interaction with many people in the workplace makes them feel drained. This aligns with the study by Schaufeli & Bakker (2004) which states that high levels of social interaction in the work environment can be a source of stress, particularly for individuals who also bear academic responsibilities. Kilic highlights that stress is a risk factor contributing to academic burnout. Social support from friends or family is perceived as a protective factor that can help students avoid experiencing academic burnout (Kilic et al., 2021).

Working students in the Islamic Education program at IAIN Kediri reported feelings of frustration when their class schedules, organizational commitments, and job responsibilities overlapped. This suggests that poor time management can contribute to emotional exhaustion. Britton & Tesser (1991) indicate that students involved in multiple activities

tend to experience higher levels of stress, especially when they struggle to set clear priorities. Academic exhaustion may also lead to problematic behaviors such as absenteeism and dropping out (Wang et al., 2019). This is consistent with the experiences of respondents who frequently missed classes due to fatigue.

Burnout is also characterized by the emergence of cynical attitudes or withdrawal from academic activities, as demonstrated by respondents who expressed anger, disappointment, and frustration when reality did not meet their expectations. Madigan & Curran (2021), found that students experiencing academic burnout tend to develop apathy toward their studies as a defense mechanism against the pressure they face.

Behaviors such as frequently skipping classes or postponing thesis supervision sessions are clear indicators of increasing cynicism. This not only affects academic engagement but also intensifies feelings of inefficacy, which represent the third dimension of burnout. According to Salmela-Aro et al. (2009) the inability to meet academic demands is a defining characteristic of academic burnout.

Respondents in this study also exhibited signs of feelings of helplessness in completing academic tasks as well as work responsibilities. In the context of burnout, this indicates that individuals begin to doubt their competence and capacity. This phenomenon is also known as diminished personal accomplishment. According to Schaufeli et al. (2002), this phenomenon arises when students feel that their efforts do not yield the expected results, thereby lowering their academic self-esteem.

Several respondents demonstrated efforts to persevere, such as BL, who tried to motivate themselves through positive affirmations. This indicates the presence of active coping strategies that play a crucial role in reducing the impact of burnout. Research by Alarcon (2011) shows that adaptive coping strategies, such as self-motivation and positive reframing, can decrease levels of burnout and enhance academic engagement.

In this context, it is important to explore the factors that can assist students in overcoming these challenges. One factor that emerges as a potential protective element is religiosity. Research has shown that religious practices and spiritual beliefs can provide significant psychological support for individuals in coping with stress, including academic burnout (Kholifah et al., 2016). Therefore, understanding the role of religiosity in this context is crucial for identifying effective solutions to help working students manage their academic load more effectively and prevent the negative impacts of burnout.

This study reveals that working students in the Islamic Education Department exhibit varying levels and forms of religiosity. This variation is reflected in aspects such as beliefs, religious practices, religious knowledge, spiritual experiences, and the consequences of religiosity in daily life. These findings align with the concept of the five dimensions of religiosity: ideological (belief), ritualistic (worship practices), intellectual (knowledge), experiential (personal spirituality), and consequential (impact on everyday behavior) (Hood et al., 2009).

Several respondents expressed a strong belief in the existence of Allah and the teachings of Islam. This belief provides direction and meaning in their lives, particularly in coping with the challenges of being both students and workers. A

study by Koenig (2012) emphasizes that strong religious beliefs can serve as a source of motivation, hope, and resilience in dealing with life's pressures.

In terms of religious practice, a distinction was found between worship performed merely to fulfill obligations and worship carried out with full spiritual awareness. This difference indicates that the level of internalization of religious values varies among individuals. Consistent with the study by Abdel-Khalek & Lester (2007), consciously and sincerely performed religious practices have a greater impact on enhancing psychological well-being and inner peace compared to ritual practices performed solely out of obligation.

Respondents also demonstrated efforts to continuously improve their religious knowledge, both through formal education in the Islamic Education Department and through religious activities within their local communities. This suggests that the development of religiosity is not solely shaped by the academic environment, but also by a supportive social context. This is supported by Gea (2011) who emphasizes the importance of social and cultural environments in shaping one's understanding and practice of religion.

Several personal religious experiences, such as a loss of motivation in worship and feelings of near despair, served as turning points for some respondents to return to a closer relationship with God. This reflects what James W. Fowler (1981) describes in his *Stages of Faith*, namely that an individual's faith development is not always linear, but often involves fluctuations that ultimately deepen the quality of one's belief.

This study also indicates that religiosity contributes to the respondents' mental health. Spiritual practices such as prayer (shalat), reciting the Qur'an, and supplication (du'a) function as coping mechanisms for dealing with stress and anxiety. This aligns with Pargament (2011), who found that religious coping can enhance psychological resilience, reduce depression, and provide a sense of peace for individuals facing life pressures.

Furthermore, Amalia & Nashori (2021), Sudrajat & Sufiyana, (2024) emphasize that students with high religious involvement tend to exhibit lower levels of academic stress. This provides evidence that religiosity is not merely a belief system but also plays a vital role in promoting students' psychological well-being.

Conclusion

This study highlights that prolonged exhaustion among working students, particularly those in the Islamic Education Department (PAI) at IAIN Kediri, has become a serious issue. Students experience both emotional and physical fatigue as a result of multitasking between academic responsibilities, employment, and organizational activities. Symptoms such as chronic stress and loss of motivation are clearly evident in their experiences.

The contributing factors to academic burnout include poor time management and intense social interactions in the workplace. These conditions lead to frustration when academic and work schedules conflict, and they further reinforce cynical attitudes toward academic activities. Respondents also expressed feelings of helplessness in completing their academic tasks.

However, religious practices emerge as a significant protective factor for students in coping with stress. Spiritual activities such as performing prayers (shalat) and reciting the Qur'an help them manage life pressures and enhance overall psychological well-being. Therefore, social support and religious practices can serve as effective solutions to prevent the negative impacts of burnout among working students.

Recommendations

Based on the findings of this study, several recommendations can be proposed. Educational institutions are encouraged to develop flexible academic policies that accommodate the needs of working students, such as adjustable class schedules, hybrid learning models, and access to mental health and spiritual support services. For working students, it is essential to cultivate effective time management skills, engage in regular religious practices as coping strategies, and seek social support from peers, family, and academic mentors. Future researchers are advised to conduct longitudinal studies to examine the dynamics of religiosity and academic burnout over time, as well as to explore other protective factors—such as personality traits or digital resources—that may contribute to students' psychological resilience in managing academic and occupational demands.

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Conflict of Interest

The authors has no conflicts of interest regarding the results of this study.

Data Availability Statement

The data of this research are available in this paper

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Barriers to Employment for Graduates of State Vocational High Schools in Indonesia: A Study in the Special Province of Yogyakarta Executive Summary

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Abstract: This study aims to reveal the inhibiting factors for graduates of SVHS Expertise Competency in Building Modeling and Information Design (BMID) to get their first job. This research is quantitative descriptive research. Data were obtained through questionnaire surveys and documents. The research population is SVHS organizing BMID Expertise Competency, SVHS graduates, and construction service companies in Yogyakarta Special Region Province. The research sample was determined purposively. Each district/city is represented by one State Vocational High School (SVHS). Data were collected through observation, questionnaires, and documents. Instrument validity uses questionnaire content validity based on expert judgment. Data analysis uses descriptive statistics and is presented in the form of graphs and data tables. The results showed that 52% of respondents chose to continue their education, 45% worked and 3% were entrepreneurs. As many as 44% of respondents who work get their first job without the help of other parties. 85% of respondents who work have an average duration of waiting period for work for < 6 months. A total of 46% of respondents agreed that the obstacle to getting a job was inappropriate skills or competencies. 50% of SVHS alumni applied to work at an internship site to get a job. Although SVHS provides training support and cooperation with industry, there is still a gap between the abilities of graduates and the needs of the world of work. Efforts to increase graduate employment require stronger synergy between SVHS, businesses, industries, and the government.

Keywords: Barriers, Employability, Career Choices.

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Introduction

The current era of technology has disrupted old jobs that are repetitive and less humane. It has also changed the job market's need for qualified, superior and productive human resources (HR). For a country, quality human resources will increase their valuation and influence their position of influence in the eyes of the world. A person can be said to be superior if they can implement both knowledge, competence, ethics and work behavior according to their field (Directorate General of Vocational Education 2020).

A qualified workforce will be able to optimally utilize natural resources, capital resources and technology to increase their country's growth and actively compete with other countries (Ghozali 2010; Perdana 2019). Quality human resources and competitiveness are created from educational institutions that always direct the control of the quality of graduates who are relevant to the needs of the world of work (Daryanto and Abdullah 2013).

As the Indonesian government's support for the creation of educational institutions that meet the needs of the World of Business and Industry (WBI), several policies related to the revitalization of vocational education were made through Presidential Instruction No. 9 of 2016 and Presidential Regulation No. 68 of 2022. This revitalization policy aims to encourage improvements in the competency achievements of graduates from VHS (Vocational High School), Polytechnics, Colleges, Academies, Community Academies, Institutes, and Vocational Schools at Universities.

The policy support encourages the government to provide a budget for updating school facilities and infrastructure, and training school management human resources (Alam 2023). Therefore, VHS graduates should be able to be absorbed easily, have a competitive character, entrepreneurial spirit, nationalism, and can compete in the local and global job market (Sofyan and Komariah 2016).

To support the speed of transition to the world of work, in VHS there is a Career Guidance section and a Special Job Exchange that guides students to be more prepared and mature in deciding their career choices towards the world of work (Widarto 2012). In addition, the implementation of alumni tracer studies also supports students to get an idea of what the world of work is like (Agustin, et al. 2017).

Although it has been supported by policies from the Indonesian government, in recent years there are still various obstacles in encouraging the absorption of VHS graduates into the world of work according to their competence. The obstacles faced such as WBI who only want to accept VHS children for internships, low work motivation of VHS graduates, low income of VHS graduates, long waiting periods for graduates to enter the world of work, reduced employment opportunities, extreme increase in the population of prospective workers, mismatch of expertise competencies with the needs of the world of work, lack of cooperation networks between VHS and WBI, and outdated

workshop practice equipment create an increase in the open unemployment rate of VHS graduates (Afandi and Wijanarka 2019; Johan, et al. 2019; Roseno and Wibowo 2019; Directorate General of Vocational Education 2020; Badan Pusat Statistik 2020).

In addition, through observation, it was found that many VHS graduates work outside the competencies acquired during school, and an increase in graduates who choose to continue their education when they do not find a job. According to VHS Career Guidance, this occurs because of the mismatch between the competencies of graduates and the needs of the world of work.

Currently, skilled, and competent personnel in the construction world are needed, due to the massive national construction development (Almira, et al. 2016; Adi and Adillah 2012; Fachreza 2017). Seeing this opportunity, VHS graduates in the field of construction expertise should be competent so that they can be absorbed by work and reduce the unemployment rate which causes economic crisis and sustainable social inequality (Sutarto and Jaedun 2018). There are various types of Learning Outcomes of VHS graduates in the field of construction related to the variety of construction company services such as planning, implementation and procurement of goods, and supervision of construction work (Oktaviastuti, et al. 2021). Before being able to build a construction, the planning stage is very necessary so that the implementation of the work can be on time, appropriate and cost-effective (Avani, et al. 2019). In planning work, it will require drafter or draftsman labor, which can be done by graduates of VHS Building Modeling and Information Design (BMID) (Armia 2020).

What affects the absorption of draftsmen in the construction industry today is the need for human resources that are able to adapt to the supporting technology of work planning, implementation and supervision of work (Riyanto, et al. 2020). This is inevitable because the disruption of digital technology has begun to integrate the use of cloud database systems for data storage, the availability of material and equipment stock information on the Internet, and smart construction technologies that are predicted to make work more efficient (Alfa 2018; Almira 2017; Ridwana 2019).

Another thing that also affects VHS BMID graduates to enter the world of work in the construction sector is that WBI wants graduates with relevant professional certification (Almira 2017; Perdana 2019). This certification supports WBI in the construction sector to participate in auctions or job procurement. To overcome this, VHS established a professional certification agency (PCA) to conduct a competency certification examination program according to the work areas of VHS graduates. It was also found that there are several WBIs that provide material and moral support for their workers to receive training and competency certification for skilled workers in the construction sector (Gunasti 2020; Kodri et al. 2018).

Method

This research uses a descriptive quantitative approach. The data collection method used was a survey using a questionnaire addressed to State Vocational High School (SVHS) in Yogyakarta Special Region (YSR) Province, Managers of construction service companies in YSR Province, and Graduates of SVHS with Building Modeling and Information Design (BMID) expertise in YSR Province. Descriptive research is used to interpret objects clearly,

systematically and sequentially using predetermined research questions (Sukardi 2019). This research aims to describe the phenomena and current conditions of the objects and subjects of research and is identified in a measurable manner to be able to capture the causes of obstacles to the absorption of graduates and efforts made to obtain employment.

The research was conducted at VHS that organize BMID expertise competencies in the Yogyakarta Special Region (YSR) province. The sampling technique used was purposive sampling technique. Sampling VHS used were state VHS with the assumption that the data were more complete than private VHS. Respondents of SVHS graduates selected are graduates in 2017-2020. While the construction companies selected as respondents are employers for graduates of SVHS BMID skill competencies. The sampling technique used to select companies uses convenient sampling where from each sample SVHS four construction companies are selected which are service users of the SVHS alumni.

The data collection technique used is the distribution of questionnaires to the management of SVHS, the management of construction companies as service users of graduates, and graduates of SVHS BMID competence itself. Supporting the questionnaire is a tracer study document to determine the level of absorption of SVHS graduates. The questionnaire used in this study is a semi-open questionnaire. Semi-open questionnaires are distributed in the form of options that have been provided and options that can be added so that they can be answered according to the original situation by the respondent. This semi-open questionnaire is applied to SVHS respondents, WBI construction service respondents and BMID Expertise Competency SVHS alumni respondents.

In this study, the validity test focused on content validity to capture data on respondents' answers and was assessed by experts. The moment product test is not needed because the respondents' answer choices do not use a Likert scale but answer options that have been provided and given the option of freedom to answer according to their original situation. There is mind map for this research.
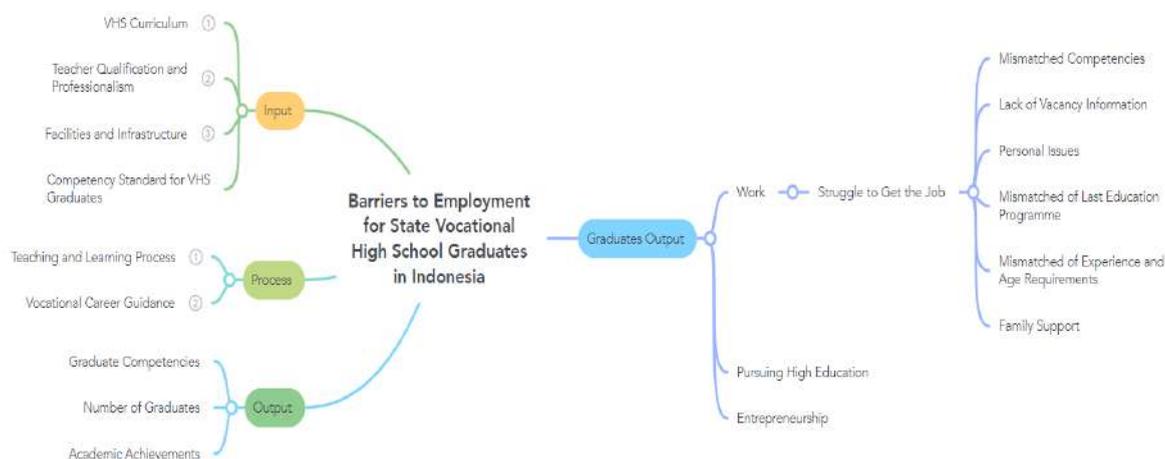
Figure 1. Mind Map of the Research

Results

Based on the data obtained, it is then presented in the form of descriptive statistics. In this study, the limitations of the research were found, namely, the respondent VHS were government VHS with superior quality conditions in the regencies/cities in the Yogyakarta Special Region Province. VHS tend not to be open with data because there are concerns about data leakage with other VHS, and the data provided on alumni are incomplete and not up to date. The respondents of this study consisted of alumni respondents from 5 vocational schools and 20 construction companies in Yogyakarta Special Region.

SVHS alumni respondents were first screened to see which ones were working, continuing education and entrepreneurship (BMW) in accordance with the Ministry of Education and Culture. The percentage of respondents can be seen in Figure 2.
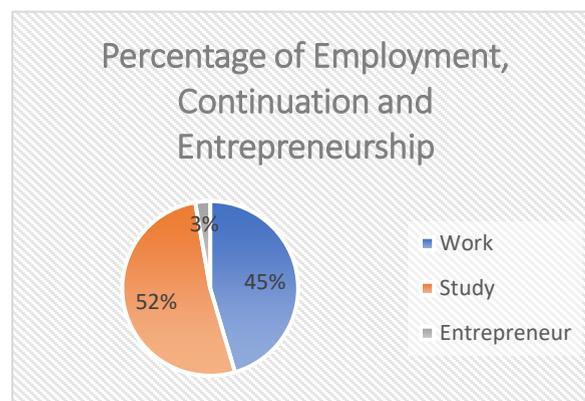
Figure 2. Percentage of Employment, Continuing Education and Entrepreneurship of SVHS Graduates with Expertise in Building Modeling and Information Design in Yogyakarta Special Region

It can be seen from Figure 2 that there has been a significant shift in SVHS alumni choosing to continue their education rather than work, and only a very few have decided to become entrepreneurs.

As this study will focus on graduates who are employed, the follow-up research questions were asked of employed graduates. To obtain their first job after graduation, working alumni were asked to provide answers regarding the assistance from which parties were involved in their job acceptance and can be seen in Table 1.

Table 1. Parties Helping To Get a Job

Assistance to Get a Job	Percentage(%)
Family Connections	30
Schools Relatives	20
Friends	6
Nothing	44
Total	100

From Table 1, there are a lot of graduates who are struggling on their own to get a job, so the next question is how long it takes them to get a job, and the data is presented in Figure 3 in the form of a percentage chart of the waiting

time for employment of SVHS Building Modeling and Information Design graduates.
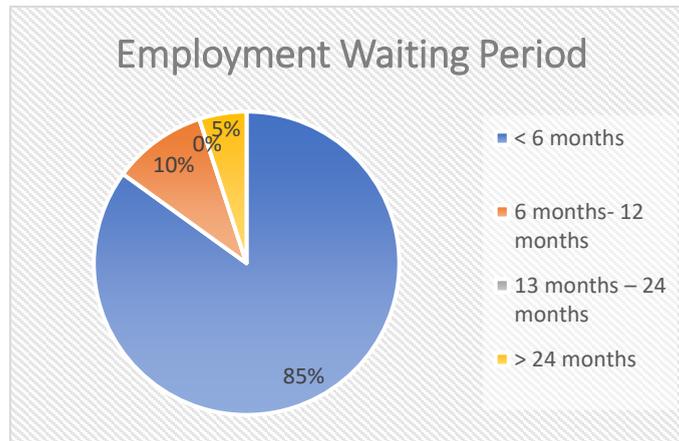
Figure 3. Waiting Period for Employment of Graduates of Vocational High Schools with Expertise in Building Modeling and Information Design in Yogyakarta Special Region

Figure 3 shows that there are still alumni who need more than 24 months (2 years) to get a job. Therefore, the researchers tried to find out what caused the alumni to be hindered in getting a job, which can be seen in Table 2.

Table 2. Factors That Prevent Graduates from Finding Jobs

Obstacles to Getting a Job	Percentage (%)
Mismatched Ability/Competency	46
Lack of Vacancy Information	30
Personal Issues	10
Mismatch Last Education Program	4
Mismatch of Age and Experience Requirements	6
Not getting family approval/support	4
Total	100

From Table 2 it is known that the most dominant obstacle faced by the graduates is the mismatch of their work competences with the company's demand. While the lack of parental support and the mismatch of the last educational certificate are minor obstacles.

To reduce these obstacles, SVHS, through the Career Guidance Section, tries to carry out activities as shown in Table 3.

Table 3. Debriefing by SVHS Career Guidance

Debriefing by SVHS Career Guidance
Leadership Workshop
Vocational Skills Training
Computer Application Training
Soft Skills Training for the World of Work
Industry Culture in Vocational Schools
Implementation of Employment Workshop
Construction Skills Certification

Despite the support provided by skills training and work culture, there is still a gap between the demands of the world of work and the skills of graduates. During this dilemma, the alumni respondents indicated what activities were carried out to get a job. This can be seen in Table 4.

Table 4. Job Search Activities

Job Search Activities	**Percentage (%)**
Construction Application Skill Course	16
Attending Soft Skills Training	4
Apply for a job at an internship site	50
Applying for a Job through a Job Vacancy Website	4
Applying for a Job via LinkedIn	4
Seeking Information from Specialized Vocational Job Exchange (BKK)	8
Participating in Jobfair	4
Contacting the Manpower Office for Job Information	2
Contacting Acquaintances/Relatives	6
Self-training in construction application skills	2
Total	100

From the data obtained, it can be seen that applying for a job at the place of apprenticeship is the dominant activity of graduates to get a job.

In this regard, the determination of the place of internship of students and teachers also affects the level of employment of VHS alumni (Purnamawati and Yahya 2019). This is because the cooperation between VHS and the business world and the industrial world will have an impact on the employment of VHS graduates. Therefore, a good partnership cooperation with WBI will increase the absorption of VHS graduates in addition to improving their technical skills, work skills, and adaptability (Wahjosumidjo 2011).

In addition, the researchers asked the alumni of SVHS BMID expertise competence and representatives of the business world and the industrial world to add input to improve the employment of VHS graduates in the field of construction, which can be seen in Table 5.

Table 5. Feedback from SVHS Alumni and Companies

Feedback from SVHS Alumni and Companies
Teamwork Ability
Communication Skills
Adaptability
Ability to Operate BIM Software
Innovative Capabilities
Improvisation Skills
Curriculum Adjustment
Modifying the learning design to make it relevant to the world of work

Discussion

Research conducted by Khurniawan and Erda (2019a) found that the average labor wage of VHS graduates is lower than the average national labor wage. It was also found that the difference in basic income between graduates of public vocational schools tends to be greater than that of graduates of private vocational schools (Newhouse and Suryadarma 2011).
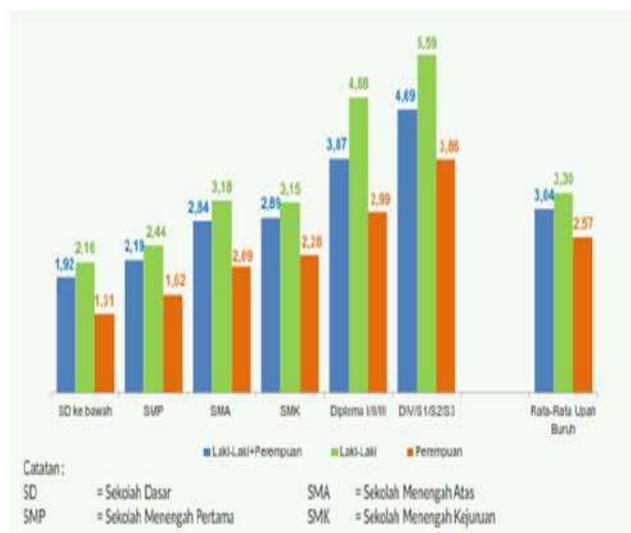
Figure 4. Average Labor Wages by Higher Education Completed between 2022-2024. (Badan Pusat Statistik 2024)

Data from the Central Bureau of Statistics (2024) supports the findings of previous researchers where the latest data shows the average labor wage of VHS graduates is IDR 2.89 million, which is clearly lower than the national average labor wage of IDR 3.04 million. Furthermore, D1/D2/D3 graduates earn an average wage of IDR 3.87 million, while D4/S1/S2/S3 graduates earn IDR 4.69 million (Figure 3). This significant difference is one of the reasons why many VHS alumni choose to pursue higher education before entering the workforce.

In addition to wage differences, the open unemployment rate also shows an interesting trend. Based on data on the Open Unemployment Rate for 2022-2024 (Badan Pusat Statistik 2024), VHS contributes the highest open unemployment rate at 8.62 percent. However, there is a decrease in the open unemployment rate of VHS graduates by 1.76 percent in that time span, which is the largest decrease compared to other education levels. On the other hand, graduates of D4 / S1 / S2 / S3 only experienced a decrease in the open unemployment rate of 0.54 percent (Figure 5). Choi (2021) found that vocational graduates who choose to work directly tend to have better employment status and wages than college graduates, if family influences and individual characteristics are ignored. This finding suggests that vocational education can provide significant economic benefits for graduates.

Figure 5. National Open Unemployment Rate by Last Education Level in the 2022-2024 Period. (Badan Pusat Statistik Indonesia, 2024)

Recently, there has been a decline in the employment rate of vocational high school (VHS) graduates in Indonesia. The decline in the employment rate of VHS graduates in this study is in line with the observations of Mutaqin, et al. (2015) and the study of Afandi and Wijanarka (2019). The causes of the low employment of VHS graduates in this study are also in line with the findings of other studies, which can be seen in Table 6.

Table 6. Factors Causing Low Job Absorption of Vocational School Graduates According to Other Researchers

Causal Factors	Explanation
The cooperation between vocational schools and business and industry is not optimal (Purnamawati, et al. 2019)	This cooperation is often just a formality and does not lead to concrete realization.
Failure of VHS graduates to meet the minimum requirements of the workforce by the Company (Sariwulan, et al. 2020)	Many VHS graduates do not have skills that match the needs of companies.

Causal Factors	Explanation
Failure of learners to display their strengths during the internship (Mulyadi 2018)	Learners are less able to take advantage of internship opportunities to demonstrate their excellence
Failure of productive teachers to capture knowledge during internships in the Company (Mulyadi 2018)	Teachers are not able to use the knowledge gained from practicing to teach.
Failure of vocational schools and companies to equalize the perception of the meaning of apprenticeship in industry (Akbar, et al. 2022)	Differences in views between VHS and companies on the purpose and benefits of apprenticeships.
Lack of compatibility of competencies of VHS graduates with the needs of the world of work (Akbar, et al.. 2022; Roseno and Wibowo 2019).	VHS curriculum that is not synchronized with the needs of business and industry.
Company recruitment patterns are not understood by VHS (Akbar, et al. 2022).	VHS do not understand the recruitment mechanism implemented by the company.
Teaching factory in vocational schools that have not met middle and high level skills (Sariwulan, et al. 2020).	In terms of developing students' skills, the Teaching Factory process is not optimal.
Industry reluctance to cooperate (Rojaki 2023).	Industries that are less interested or reluctant to work with VHS.
The lack of desire for graduates to work immediately (Santoso, et al. 2018).	Graduates who prefer to continue their education or other activities before working.
The performance of the Specialize Vocational Job Exchange (BKK) in managing graduates is not yet optimal (Santoso, et al. 2018).	Specialized Vocational Job Exchange (BKK) that is not maximized in helping graduates get jobs.
Lack of vocational school visits to industry (Ningsih 2016).	The lack of VHS visits to industry will also reduce industry recognition of the qualifications of prospective VHS graduates who can be employed in the industry.
Lack of job opportunities (Ningsih 2016)	The low job absorption of VHS graduates is also influenced by the number of labor needs in the field at the district/city, provincial, national, and regional levels.
Effects of Industrialization 4.0 (Khurniawan and Erda 2019b).	VHS graduates must face the effects of industrialization 4.0, especially in the fields of creative industries, industries with special skills, and IT support industries
VHS cannot guarantee that all graduates are absorbed (Santika, et al. 2023).	This is because the ability and skills possessed to work are the personal responsibility of graduates.
The demographic bonus increases competition for jobs (Rojaki 2023).	The demographic bonus could be a disaster if the number of workers absorbed does not increase immediately

Causal Factors	Explanation
Lack of work readiness of prospective graduates (Nugroho, et al. 2024).	Graduates who do not have enough mental readiness and skills to enter the workforce

Seeing the above problems, based on this research there are several solutions that can be an option to increase the absorption of VHS graduates, including:

1) **Improving and Ensuring Cooperation Realization**: Increasing the number of collaborations and ensuring that MoUs between vocational schools and business and industry are well realized in order to improve the quality of learning and increase the number of graduates absorbed in the world of work (Purnamawati, et al. 2019; Rojaki 2023). This cooperation can ensure that vocational education remains relevant to industry needs.

2) **Apprenticeship and Industrial Practice**: Extend the duration of apprenticeships and industrial practices to make graduates more job-ready. Yudha (2015) found that longer apprenticeship duration supports industry confidence to accept graduates. In addition, more effective apprenticeships for teachers and students will help improve the quality of learning and job absorption (Purnamawati, et al. 2019; Rojaki 2023).

3) **Curriculum Quality Improvement**: Aligning or synchronizing the curriculum with the competencies needed by the world of work (Akbar, et al. 2022). Andayani (2021) suggested a synergy between VHS, business, and industry through curriculum alignment.

4) **Improvement and Adjustment of Hardskill and Softskill Competencies**: Sudjimat (2017) and Roseno and Wibowo (2019) state that VHS graduates need to be equipped with hard and soft skills that are relevant to the current world of work. Training in basic skills such as communication, information management, and problem solving is essential.

5) **Improved Skills and Confidence**: Rijal (2018) found a correlation between increasing skills (work competence, social efficiency and social skills) with graduates' confidence when applying for jobs and increasing the chances of graduates getting jobs.

6) **Optimizing the Role of the Special Employment Exchange**: Improving the performance of the Special Work Exchange in marketing VHS graduates through mass media and social media. Santoso, et al. (2018) emphasized the important role of the Special Employment Exchange in graduate management. In addition, the Specialized Job Exchange can also add skill provision that is relevant to the needs of the world of work, job fair activities, and information on the latest job vacancies (Hana 2016).

7) **Leadership of Vocational High School Principal**: Principal leadership with high managerial skills can improve cooperation with industry and increase the absorption of graduates (Prihantoro 2010).

8) **Feedback from Companies that Employ Alumni**: Alam (2023) revealed that to get real input from the company, a feedback form is needed to determine the satisfaction of the company as a user of VHS graduates and provide criticism and suggestions so that graduates can be accepted in their environment.

9) **Professional Certification of Vocational School Graduates**: Alam (2023) stated that providing professional certification will make it easier for graduates to get a job.

10) **Marketing Vocational High School Graduates to Companies**: VHS must actively market their prospective graduates through various media. Dewi and Ulfatin (2014) suggest using social media, brochures, calendars, and souvenirs to showcase the quality of students.

11) **Government Support**: Jung and Go (2021) see that the success of the 2011 School to Work program in South Korea can effectively increase the absorption of graduates by 36 percent due to the encouragement of the South Korean government to massively absorb the workforce of VHS graduates.

12) **Non-Formal Training Course**: Mo Costabella (2017) supports the importance of vocational training courses after formal education in helping trainees find employment. This suggests that continuing education and training relevant to the world of work is essential to ensure graduates remain competitive in the job market.

Regarding the average duration of waiting time to get the first job of SVHS BMID graduates, 85 percent of respondents found jobs in a duration of <6 months. This is in line with the findings of Ningsih (2016) who revealed that the average duration of waiting time for SVHS graduates to get a job is in the range of 0-4 months.

Nilsson (2018) revealed that the field of vocational education pursued is not always related to the duration of waiting time to get the first job due to the limited vocational fields studied. This could be the basis for conducting further research to find the relationship between the field of vocational education and the time needed to get the first job.

Conclusion

This study analyzes the limitations and challenges faced by graduates of the State Vocational High School (SVHS) in the Building Modeling and Building Information Design (BMID) in Yogyakarta Special Region Province in securing their first job. Based on data obtained from alumni respondents and construction companies, here are some key points:

1) **Graduates Percentage**: The majority of SVHS Building Modeling and Information Design alumni choose to continue their education rather than work or become entrepreneurs. Only a few decide to pursue entrepreneurship.

2) **Help getting a job**: Most alumni (44percent) struggled on their own to get their first job, while 30 percent got help from family, 20 percent from school, and 6 percent from close friends.

3) **Waiting Period for Work**: Most alumni found employment in less than 6 months. However, some took more than 24 months.

4) **Barrier Factors**: The main factors that hinder alumni from getting a job are competency mismatch (46 percent) and difficulty getting job information (30 percent).

5) **Debriefing by SVHS**: SVHS through its Career Guidance department has provided various trainings, including job skills training, computer applications, soft skills, and construction skills certification.

6) **Activities to Get a Job**: Alumni predominantly apply for jobs at the internship site (50 percent) as the main strategy to get a job

7) **SVHS Collaboration with Business and Industry**: Good cooperation with business and industry plays an important role in increasing graduate employment. Determining the right internship place also has a big influence.

8) **Alumni and Industry Feedback**: To improve job absorption, alumni and representatives of business and industry suggested improving teamwork skills, communication, adaptation, innovation, improvisation, operation of BIM software, as well as adjusting the curriculum and relevant learning design.

9) **VHS Graduate Challenges**: Based on previous research and data from the Central Bureau of Statistics (2024), the average labor wage of VHS graduates is lower than that of other higher education graduates. The open unemployment rate for VHS graduates is also the highest, although there has been a decline in recent years.

10) **Solutions for Increasing Job Absorption**: Some of the solutions include increasing the realization of cooperation with industry, extending the duration of apprenticeships, adjusting the curriculum, improving hardskill and softskill competencies, optimizing the role of the Special Employment Exchange (BKK), improving the leadership of school principals, professional certification, marketing graduates through the media, government support, and non-formal training courses.

Overall, this study shows that despite the support from SVHS in the form of training and cooperation with industry, there is still a gap between the ability of graduates and the needs of the world of work. Efforts to increase graduate job absorption require stronger synergy between SVHS, the business world, the industrial world, and the government.

Acknowledgements

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People and Insects: Ethno-Entomology, Cultural Significance of Grasshoppers and Future Perspectives

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Abstract: Insects are invertebrates and the largest phylum Arthropoda class. Traditionally, insects are considered pests and disease carriers, although many benefit human welfare and constitute an important value of ecological services. They play a key role in many ecosystem services (ES) such as bee pollination, in the face of current global changes, especially for a sustainable future. Ethno-entomology is an interdisciplinary science that deals with interactions and interrelationships between people and insects, in different times and places worldwide. Perceptions and cultural practices of insects are crucial in understanding their values for cultural ecosystem services and conservation implications. In this article, we will outline the main theoretical perspectives of ethno-entomology; first, we will outline the main studies on insect uses in Albania; secondly, based on interviews with the local community living in Vlora, Albania, we analyze their perceptions and practices regarding insects with a special focus in the cultural significance of grasshoppers. Finally, we will discuss of the methodologies and perspectives of ethno-entomologist to develop the discipline of ethno-entomology in Albania.

Keywords: Insects, Grasshoppers, Ethno-entomology, Vlora, Albania

Introduction

During the evolution of life on Earth, insects were the first animals to evolve flight; they are defined as a class (Insecta) and considered invertebrates or animals that lack a vertebrate column (Eggleton, 2020). Insects comprise 75% to 80% of all known animal species but 80% remain undiscovered (Gebremariam, 2024). Their vast distribution in various niches and remarkable diversity are due to their complex adaptive features such as body construction, wing evolution, and holometaboly or complete metamorphosis (Gebremariam, 2024; Grimaldi et al., 2005).

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Additionally, the Insect's evolutionary path was a long road towards a dominant terrestrial group that rapidly adapted to changing conditions; all lineages of insects that are alive today, were in existence about 410 to 480 million years ago at least in the early Devonian with the first insects evolved in marine or coastal habitats and (Engel, 2015; Nature, 2014; Bradley et al., 2009). Furthermore, Insects account for a considerable proportion of all biodiversity on Earth, and as mentioned, their complex adaptations enable them to adapt and flourish in various habitats (Sollai et al., 2022). It is important to note that behavioral adaptations are much as important as feature adaptations. In this regard, the vast behavioral repertoire and activities of insects such as eusociality, parental care, antennal grooming and grooming behavior, learning and cognition, reproduction, dispersal, migration and flight capability and various environmental response through their sensory systems have been crucial in insect evolution and ecology and could explain their biodiversity and high fitness (Field, 2020; Wong et al., 2013; Zhukovskaya et al., 2014; Wada-Katsumata, 2019; Giurfa, 2015; Wheeler, 2009; Johnson, 1969; Roff et al., 2007).

Overall insects' importance is based on their role as indicators in monitoring pollutants in the environment and global change their influence on agriculture systems, public health and nutrition (Landman et al., 2023; Jankielsohn, 2018; Belluco et al., 2023; Aidoo et al., 2023). Additionally, they cycle nutrients, pollinate plants, disperse seeds, maintain soil structure and fertility, control populations of other organisms, and provide a major food source for different taxa (Scudder, 2017).

Although insects play a vital role in ecosystem services and human well-being, human-driven pressures and activities are becoming major threats to their diversity, abundance, and biomass such as agricultural intensification and climate change, and pollution that reduces pollination services, survival, and reproduction (Milicic et al., 2021; Raven et al., 2021; Ryalls et al., 2022; Wang et al., 2023; Duque et al., 2024). The most worrying fact is that insects receive little attention among scientists and their mostly negative public perceptions, attitudes, and low knowledge directly influence effective conservation strategies.

Insects' ecosystem services

Ecosystem services (ES) are a growing field of research, understanding exchanges or trade-offs between human beings and their natural environments and are referred to as all benefits that humans derive from the natural ecosystems in terms of human wellbeing as a central concern for various policies around the World (Mengist et al., 2020). Functioning and healthy ecosystems are important for human well-being, in terms of physical, social, and economic well-being, for providing tangible resources or goods obtained from ecosystems like food, clean water or water supply, biofuels, and other resources derived from terrestrial and aquatic systems (Encyclopedia of Biodiversity, 2013).

Ecosystem services are categorized into four major types: *provisioning services* (production of food, fiber, water, and other resources), *regulating services* (biological control and other feedback mechanisms), *supporting services* (primary production, pollination, decomposition and soil formation), and *cultural services* (non-material benefits such as recreation, spiritual and other aesthetic values) and insects provide the four major types of ecosystem services (Schowalter et al., 2017; Kumar et al., 2022). More specifically, insects contribute to provisioning services (e.g. honey

production, edible insects), regulating services (e.g. biological control), supporting services (e.g. pollination), and cultural services (e.g. tourism) (Morimoto, 2020).

In an interesting article, key insect cultural services were provided to demonstrate the value of insects across human cultures (Duffus et al., 2021). More specifically, the list included I) insects in traditional beliefs and mythology II) Insects in media, and III) insects in recreation and hobbies (Duffus et al., 2021). Regarding insects in traditional beliefs, mythology, and folklore, the authors focus on literature canon, and they give the example of the Greek poet Ovid Metamorphoses' narrative poem, where butterflies represent both beauty and the soul in Greek but also in Roman mythology (Duffus et al., 2021).

In 20th-century fiction, one well-known example is the Metamorphosis novella by the prominent Czech novelist and writer Franz Kafka. The opening line of the famous book: "As Gregor Samsa awoke one morning from troubled dreams, he found himself transformed in his bed into a gigantic insect" instead of beauty or soul, describes the alienation of the main character from the outside world.

Transformation constitutes a recurrent theme in Albanian folklore and is related to negative symbolism when associated with insects. For example, an old woman is described as an evil witch (Albanian: *shtrigë*) that sucks the blood of infants at night while they sleep and then transforms herself into a flying insect (Elsie, 2001). The transformation of the evil witch into an insect and blood is related to the fear of insects and the cultural experience of the relationship that exists between insects and diseases. Insects as transmitters of diseases, metaphorically described in the process of blood-sucking and transforming into insects are symbolic manifestations of the high risk of insects as disease transmitters, especially in children, which are prone to weak immunity and more susceptible. Therefore, negative symbolism is associated with the witch, and indirectly, with insects.

On the contrary, positive symbolism in Albanian folk culture is associated with the honeybee (*Apis mellifera* L.) (Albanian: *bletë);* the honeybee is highly esteemed among Albanians and is expressed with the use of the verb *die* which is a reference to human death or *vdiq* in Albanian language (Tirta, 2004). Additionally, a study on honeybee propolis uses and practices in Albanian folk medicine dates back to the 1960s and represents possibly the first ethnozoology study in Albania (Ndoja, 1967).

In this context, negative and positive perceptions of insects embedded in folk culture are crucial in understanding the manifestations and symbolic meaning in mythology and folklore. More importantly, these perceptions influence people's cultural practices mostly related to survival and could be considered cultural environmental adaptations; for centuries, these dynamic adaptations were transmitted orally and benefited people in giving meaning and reconstructing symbolically the environment to adapt to its various challenges, in order to survive.

Method

In this study, we used a mixed methods approach in which respondents' (N=25; Mean age 39.2) perceptions, attitudes, and knowledge (importance) regarding insects were assessed using a Likert scale (1 to 5). We conducted two

expeditions in July 2023 and June 2024 in the region of Vlora, Albania for a total of seven days. During expeditions we also conducted face-to-face interviews with respondents in the area, to further assess their perceptions and attitudes about grasshoppers and insect services and people's knowledge of insect role in ecosystems.

First, participants were asked to give their agreement or disagreement on statements about their perceptions, attitudes, and knowledge toward insects in general and grasshoppers specifically using a Likert scale. We asked respondents: How much do you agree with the fact that insects and grasshoppers are good for the environment and people's health? Then, the respondents were asked: How much do you agree with the fact that pesticides should be used on insects? Answers to the 5-point Likert scale were coded as 1 (Fully disagree) to 5 (Totally agree).

We were also interested in the knowledge and cultural practices regarding insects by the local community and grasshoppers specifically. Prior consent was received by all respondents, and they were informed that their responses would remain anonymous.

Results and Discussion

Using the Likert scale (1 to 5) we assessed respondents' perceptions regarding insects and specifically grasshoppers. The results were not strikingly surprising, considering their perceptions of insects in general and grasshoppers specifically; the values were 2.4 (July expedition) and 2.6 (June expedition).

Both values show disagreement on the fact that insects are good for both environment and health. It is worth mentioning that there is a slight improvement in respondents' perception from the June expedition. That is because, in June, most of the respondents were young (Mean age 30.5) compared to the respondents from the July expedition (Mean age 45). Younger people have possibly much more knowledge of insects and don't show aversion or negative feelings toward them.

The second statement, which assessed the attitudes of respondents regarding the use of pesticides on insects, including grasshoppers, was valued at 2.3 (July expedition) and 2.5 (June expedition). Both values show disagreement on the use of pesticides on insects. When talking to them, although they were concerned about the problems that insects bring to the environment or health for that matter, especially grasshoppers, they believed that the use of pesticides was risky and could impact people's health. In this regard, their attitudes were somehow insect-friendly, but only because of their fear of pesticides.

During face-to-face interviews to fully comprehend respondents' perceptions and attitudes about grasshoppers and insect services and their role in a healthy ecosystem, we were aware of their aversion to grasshoppers mostly when talking with older people, who had experience in the agricultural sector or have heard stories in the past. Most interestingly, when asked about other insects in the area they showed great concern about bees and fireflies' disappearance and gave various opinions on the causes, mostly related to the high level of pollution in the area and possibly, the use of pesticides. When asked about the uses of insects, such as food or for other purposes, none was recorded, and disgust or aversion followed consequentially.

Conclusion

Insects provide important ecosystem services and are crucial in the maintenance of healthy ecosystems around the world. Assessing people's perceptions and attitudes regarding insects can help tailor management policies and conservation plans in a certain local context. This study, the first of its kind in Albania is a beginning toward other studies that could focus on greater areas, especially protected areas in Albania, with more respondents or several interviewers, and can create a set of other structured statements that can help us analyze and understand better the intricate relationships between people and insects in an Albanian context. The results are indicative of expected values considering the level of knowledge on insect ecosystem services and their valuable contributions to healthy ecosystems in the country.

Additionally, the discipline of ethno-entomology in Albania is underdeveloped, and fragmented data mostly from folklore and mythology was provided in this article because of the lack of studies. In the future, studies should be conducted to assess people's knowledge and use of insects and identify and document folk traditions about insects in more vast areas and in older generations.

Acknowledgments

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Bibliometric Analysis of Adolescent Hatred on Social-Media: Trends and Insights From 2013 To 2025

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Abstract: This study conducts a bibliometric analysis of adolescent hate on social media, focusing on trends and insights from 2013 to 2025. By collecting data from the Scopus database, this research aims to identify publication patterns, leading authors, and emerging themes within the related literature. The results of the analysis indicate a significant growth in the number of publications, with a total of 267 documents published and an annual growth rate of 14.35%. The peak of publications occurred in 2023, reflecting the increasing relevance of this issue among researchers. However, despite the rise in publication numbers, there has been a notable decline in the number of citations after 2017, suggesting the need for a critical evaluation of the quality and relevance of existing research. This study also highlights the importance of a balanced approach in understanding the impact of social media, considering both its negative and positive aspects. The implications of these findings are highly significant for the direction of future research, as well as for formulating policies that are more responsive to the needs of adolescents. Thus, this research not only serves as a source of information but also acts as a catalyst for more proactive measures in addressing the issue of hate on social media and creating a safe online environment for adolescents

Keyword: Bibliometric Analysis, Online Hate, Social Media, Adolescent Hatred, Online Behavior

Introduction

In the contemporary digital landscape, social media has become an integral part of adolescents' lives, shaping their interactions, identities, and expressions. However, alongside its benefits, social media platforms also facilitate the emergence of negative phenomena, such as adolescent hate. Hate is one of the destructive negative emotions among other negative emotions such as dislike, anger, and disgust (Martínez et al., 2022). An individual who harbors hate becomes emotionally stimulated, feels personally threatened, and tends to engage in attack-oriented behaviors. The phenomenon of hate is often associated with aggressive behaviors such as bullying, discrimination, and violence, which can undermine social harmony (Cabeldue et al., 2018). With the increasing access to information and interaction on social-media, adolescent hate has become easier to spread, leading to serious issues (Mondal et al., 2017). The psychological impacts resulting from adolescent hate, whether perpetrated directly or through online media, include disorders such as loneliness and decreased life satisfaction (Stahel & Baier, 2023), post-traumatic stress disorder (PTSD), depression, and psychological distress (Matsumoto et al., 2024). This underscores the need for a deeper understanding of how adolescent hate manifests and evolves, particularly in the context of online hate on social media.

Understanding the dynamics of online hate among adolescents is crucial for addressing its implications and fostering a healthier online environment. The decade from 2013 to 2025 has witnessed a remarkable transformation in the way adolescents interact with social media. According to recent statistics, approximately 58% of adolescents aged 15 to 17 are share experiences or negative impacts of using social media, with Instagram, TikTok, and Twitter being the most popular (Alluhidan et al., 2024; Woodward et al., 2025). With this significant presence, young users are constantly exposed to a variety of perspectives and social influences (Kirkbride et al., 2024). This continuous connectivity fosters a sense of community among their peers, enabling them to share experiences and ideas (Zamiri & Esmaeili, 2024). However, while this exposure can promote inclusivity and understanding, it can also lead to the reinforcement of negative sentiments and divisive rhetoric (Demasi et al., 2024). This bibliometric analysis aims to explore trends and insights related to adolescent hate on social media during this critical period, providing a comprehensive overview of the existing literature.

Despite the increasing attention to this issue, there remains a significant gap in the current research. Several studies have explored the manifestations and consequences of adolescent hate, highlighting its detrimental effects on mental health, including increased anxiety, depression, and feelings of isolation among affected individuals (Keighley, 2022; Wachs et al., 2022). However, there is a lack of systematic bibliometric analyses that synthesize these findings. Such analyses are crucial for understanding the full scope of research conducted in this field, as well as for identifying key themes, methodologies, and the evolution of scientific discourse (Mishra et al., 2024). This study aims to fill this gap by providing a structured review of the literature on adolescent hate on social media, contributing to a more nuanced understanding of the topic and its implications for future research.

Furthermore, this bibliometric analysis will highlight the contributions of various authors and institutions in this field, illuminating the collaborative efforts and interdisciplinary approaches that have emerged in response to this issue (Rahimi et al., 2024). By mapping the intellectual landscape of research on adolescent hate, this study aims to foster

a deeper understanding of the factors influencing this phenomenon, including cultural, social, and technological dimensions (Rejeb et al., 2025). Additionally, this study will identify gaps in the existing literature that require further exploration. The insights gained from this analysis will be instrumental in guiding academics, educators, and policymakers in their efforts to combat hate among adolescents in the digital world, ultimately contributing to the development of effective strategies and interventions that promote a safer and more inclusive online environment.

The expectation of these findings is to map the evolution of research, identify gaps in the literature, and address existing deficiencies, while also presenting unique opportunities to contribute to the theory and practice of a discipline (Öztürk et al., 2024). By bridging the existing gaps in the literature, this study aspires to contribute to the development of effective interventions and policies aimed at reducing hate among adolescents, ultimately fostering a more inclusive and supportive online community.

Method and Material

Bibliometric analysis

The rapid growth in the number of scientific publications has created challenges in quickly and accurately finding relevant research. Bibliometric analysis has emerged as a widely used method for reviewing literature, revealing the structure of knowledge and development trends within specific fields (Donthu et al., 2021). The rise in publications featuring bibliometrics is primarily due to two factors. Firstly, the substantial growth in available data enables thorough and detailed exploration across numerous academic fields. Additionally, the availability of diverse software tools improves the analytical process, making it more accessible and efficient (Hoxhalli et al., 2024). Bibliometric software such as VOSviewer and Gephi, as well as the availability of scientific databases like Web of Science (WoS), Scopus, PubMed, and others (Benhander, 2024; Passas, 2024). This method has become an essential part of research evaluation, enabling researchers to analyze unstructured data using measurable and reliable statistics

Bibliometric analysis provides the capability to quickly identify annual document production, the most relevant authors and sources, as well as trending topics and conceptual networks within a specific research field (Wei & Jiang, 2023). Various disciplines have utilized this analysis to generate accurate and objective information for researchers and stakeholders (Pessin et al., 2022)

In this study, we present the results of a bibliometric analysis focused on adolescent hate on social media, with the hope of providing insights into the current state and emerging trends, as well as serving as a valuable reference for stakeholders in understanding this phenomenon.

Data Collection

The steps involved in collecting scientific publication data for this bibliometric analysis are presented in the table 1 (Donthu et al., 2021). Initially, we assessed the research questions to determine the appropriate dataset to be utilized. The selection of keywords was based on these questions, allowing for a more focused and rigorous analysis of the

keywords. All necessary data for analyzing the development of adolescent hate on social media was obtained from the Scopus database, which is well-known as a comprehensive source for scientific literature.

Table.1 Data Collection Design

Steps	Description
1. Define the research objectives	1. What is the current status (e.g., annual scientific production, most cited journal articles, sources of citations, authors, institutions, countries) and research trends related to adolescent hate on social media? 2. What future directions can be predicted in the research on adolescent hate on social media through this bibliometric analysis?
2.Database selection	Scopus
3.Research criteria adjustment	1. Keywords: "adolescent hatred", "adolescent hate", "online hate", "cyberhate", "social media" 2. Time period: from begining 2013 to 2025 3. Scopus categories: computer science, social science, arts and humanities, psychology 4. Source type: article, conference proceeding 5. Language: english 6. Publication stage: final
4.Tool of analysis	Bibliometric-R package, VOS Viewer, scopus analyze
5.Examination of information	Analysis and discussion of results

Subsequently, to ensure the relevance of the literature, specific indicators were applied, as outlined in Table 1, to refine the dataset. A process of reviewing titles and abstracts was conducted to exclude publications that did not align with the research focus. Only publications in English were included to facilitate comprehension. In total, 267 documents were successfully retrieved from the database. The files were then exported for analysis.

Data Analysis

A total of 267 documents were analyzed using the Biblioshiny tool to explore the current status of research on adolescent hate on social media and its future directions (Arora & Mehta, 2023). We utilized RStudio software with the bibliometric package v.4.3.1 to analyze the extracted data based on bibliometric indicators (Zhexenova et al., 2024). Specifically, the bibliometric analysis commenced in the RStudio by executing the commands: "install.packages", "library (bibliometrix)", and "biblioshiny", which opened the Biblioshiny web interface.

Results

Main Information

The descriptive characteristics of the literature concerning adolescent hate on social media from 2013 to 2025 are presented, encompassing a total of 267 sources, which include journal articles and conference papers. Overall, there is an annual growth rate of 14.35%. The average age of the documents is 3.39 years, and the average number of citations per document is 28.02. Additionally, a total of 12,263 references has been included in the articles, indicating a growing interest in the study of hate among adolescents.

The document content analysis reveals that the total number of keywords reached 1.041, while the number of author keywords was 686. This indicates that the theme of adolescent hate encompasses a wide range of research topics. Notably, 743 researchers have contributed to the study of adolescent hate, with 35 authors producing documents as sole authors and 38 documents authored by individual writers. The average number of authors per document is 3.43, and the international collaboration rate stands at 25.84%. This reflects the growing interest in this area of research.

Table.2 Main Information

Main information about the data	
Timespan	2013-2025
Sources (journal, procceding)	195
Documents	267
Annual growth rate % Document	14.35
average age Average citations per	3.39
doc	28.02
References	12263
Document contents	
Keywords plus (ID)	1041
Author's keywords (DE)	686
Authors	
Authors	743
Authors of single-authored docs	35
Authors collaboration	
Single-authored docs	38
Co-authors per doc	3.43
International co-authorships %	25.84
Document types	
Article	160
Conference paper	107

Annual Scientific Production

The state of publication can serve as a direct indicator of research quality and trending topics within a specific field (Pranckutė, 2021). In the context of adolescents hate speech on social media, Fig. 1 illustrates the annual number of publications related to this topic. Our data encompasses the period from 2013 to 2025, with the first article published in 2013 titled "Hate speech on the rise: Phenomenons, reflections, and social media-driven concepts against cyber hate." This initial publication marks the beginning of a continuously expanding body of work in this area. The growth trajectory can be divided into two phases: the initial phase (2013– 2019) and the rapid development phase (2020– 2024), while 2025 is ongoing. During the first phase, relatively few researchers focused on this issue, resulting in low productivity. However, the second phase has demonstrated a significant increase in the number of published articles, particularly peaking in 2023, followed by a slight decline in 2024, with 59 and 54 articles published, respectively.

The observed upward trend indicates a growing interest among researchers in the phenomenon of adolescent hate speech on social media, consistent with global academic shifts noted by (Rawat et al., 2024a). Fluctuations in the number of publications reflect alternating periods of growth and decline, signifying an increasing awareness of this topic among academics (Joseph et al., 2024). Contributing factors to this trend may include the pervasive influence of social media in the lives of adolescents, which has brought issues of hate and cyberbullying to the forefront (Ghosh et al., 2025). As social media platforms become increasingly significant in communication, many countries are beginning to recognize the necessity of addressing these challenges. For instance, educational institutions are increasingly incorporating discussions on digital citizenship and online behavior into their curricula, a trend documented by Prasetiyo et al., (2021). Consequently, the assessment of adolescent behavior in digital spaces has become critically important, underscoring the need for further research in this vital area.
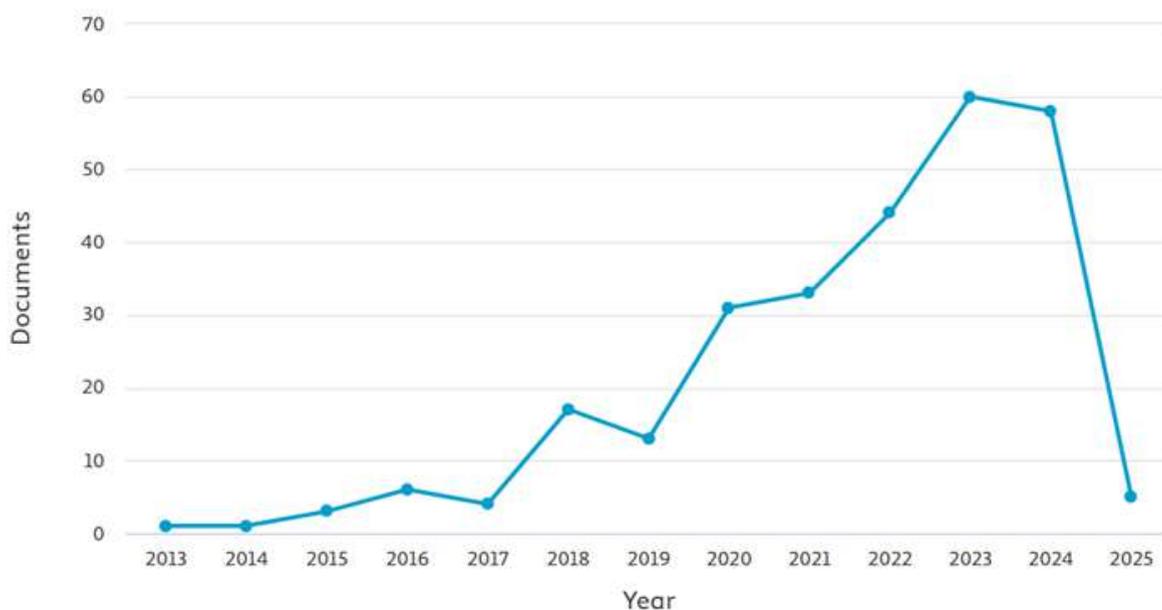
Fig.1 Annual Scientific Production

Average Citations Per Year

Figure 2 illustrates the average citation trend per year from 2013 to 2025. A significant spike is observed in 2017, reaching nearly 40 citations, which is subsequently followed by a drastic decline in the following years. After 2017, the number of citations tends to decrease gradually, with minor fluctuations occurring between 2018 and 2020. From 2020 to 2025, a consistent downward trend is evident, indicating an overall decline in citations. This trend suggests that the impact or relevance of the topic, as measured by citations, has diminished over time.
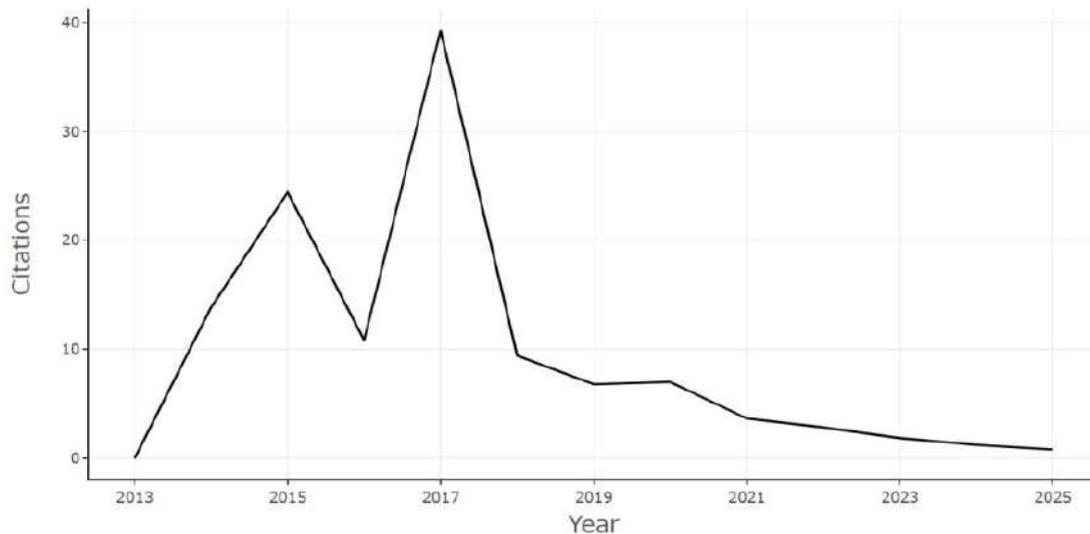
Fig.2 Avarage Citations Per Year

Based on the consistent decline in citations from 2020 to 2025, it can be concluded that the topic measured by these citations faces challenges in maintaining its relevance and impact in the future. Therefore, efforts are needed to update or revitalize this topic to regain attention and citations in the forthcoming years.

Source Analysis

Most Relevant Sources

The visualization of the number of documents based on their publication sources is presented in Figure 3 below, arranged in descending order from the highest to the lowest. The top three sources, namely CEUR Workshop Proceedings, IEEE Access, and Social Media and Society, each contain six documents, indicated by equally sized blue circles representing quantity. This is followed by the ACM International Conference Proceeding Series, IEEE Transactions on Computational Social Systems, and Social Network Analysis and Mining, each with five documents. Additionally, four other sources, including the 12th International AAAI Conference on Web and Society, Computers in Human Behavior, Expert Systems with Applications, and New Media and Society, each have four documents. The chart employs a horizontal bar format with circles as markers for the number of documents, facilitating visual comparison among publication sources. This information is crucial for understanding the distribution of research publications across various platforms and can assist researchers in selecting relevant sources for their work.
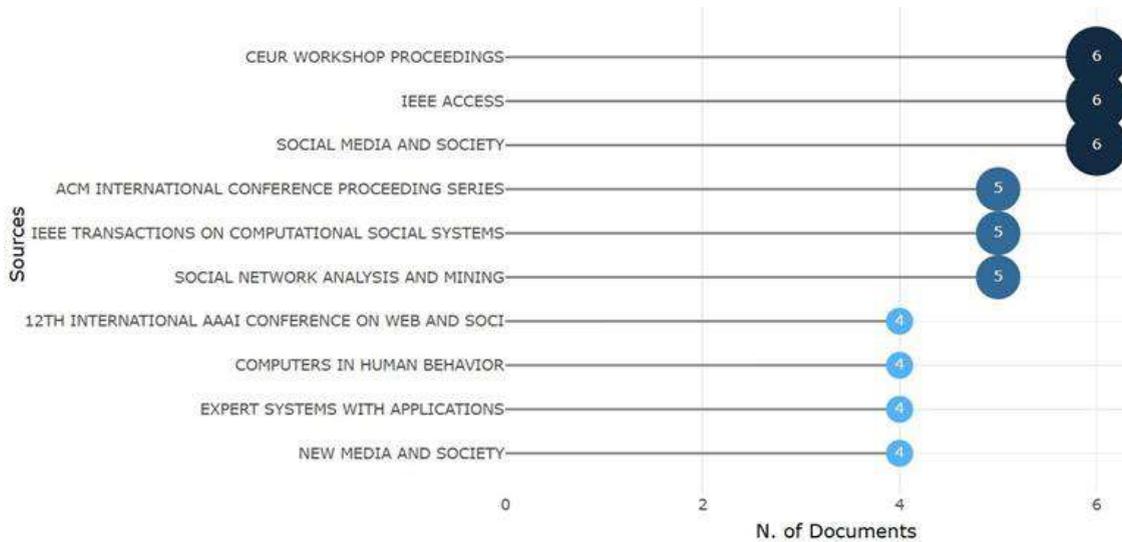
Fig.3 Most Relevant Sources

Most Local Cited Sources

In addition to the most relevant sources, it is also essential to examine the most frequently cited authors within these publications (Secinaro et al., 2021). Davidson T ranks at the top with 78 citations, followed closely by Waseem Z with 73 citations, both significantly higher than other authors. Burnap P occupies the third position with 58 citations, indicating a substantial contribution to the field. Other authors, such as Fortuna P, Mathew B, and Badjatiya P, have citations in the range of 40, while Devlin J, Awan I, Gagliardone I, and Hawdon J have citations in the 30s. Relating this to the previous discussion on the most relevant sources, these highly cited authors are likely to have contributed to publications in these sources or their works are frequently cited within these publications (Kwiek, 2021). Thus, these citations reinforce the relevance and influence of these authors in the context of the ongoing research discourse.
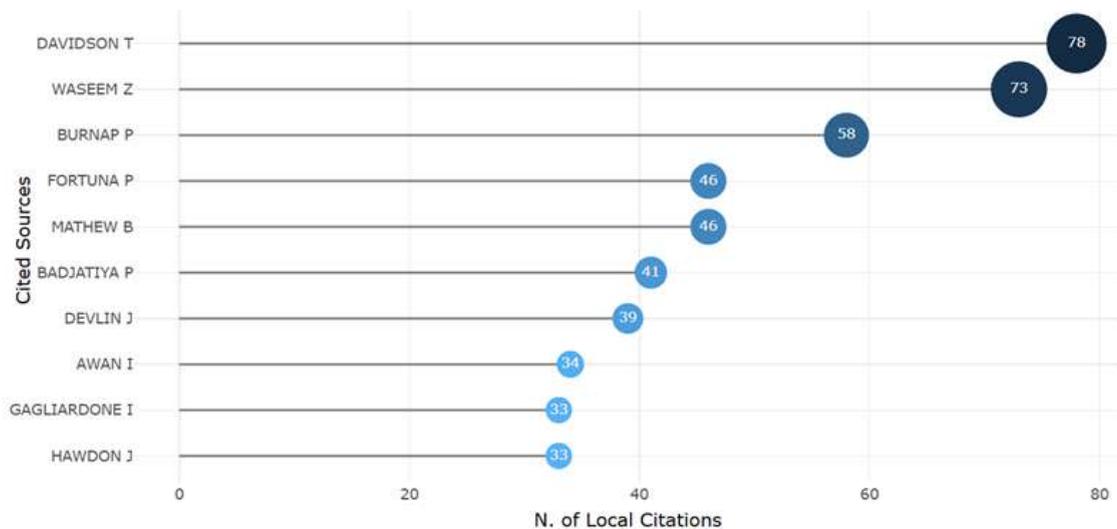
Fig.4 Most Local Cited Sources

The high citation counts of authors such as Davidson T and Waseem Z underscore their crucial roles in this research area, indicating that their works have a significant influence and serve as primary references within the discussed topic. This prominence not only highlights their contributions to the field but also reflects the broader academic community's recognition of their research as foundational in understanding adolescent hate speech on social media.

Sources' Production over Time

Shifting from the analysis of citation trends, we will now examine the distribution of documents based on their publication sources. This examination will assist in identifying the primary sources that contribute to the existing literature on the subject.
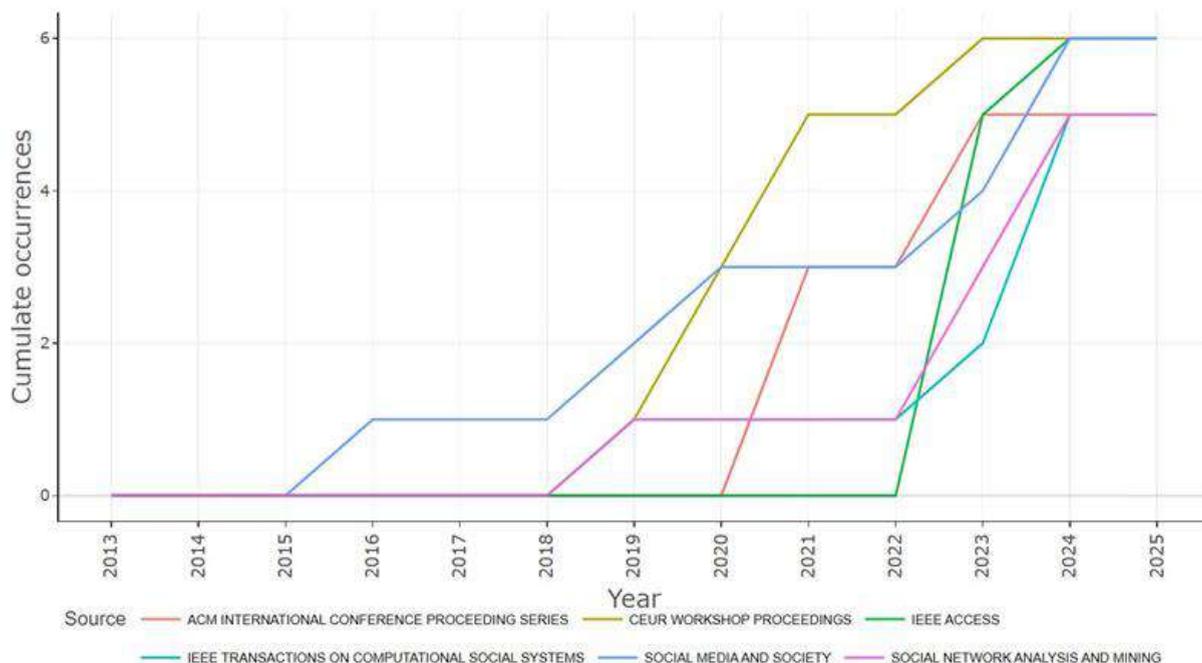
Fig.5 Sources' Production over Time

Figure 4 illustrates the cumulative occurrence of documents from various publication sources over time, spanning from 2013 to 2025. Notably, the publication trends of each source exhibit distinct developmental patterns. For instance, CEUR Workshop Proceedings and IEEE

Access demonstrates a steady and significant increase, reaching a total of six documents by 2024, which aligns with previous data indicating that these two sources are among the most productive. Conversely, sources such as the ACM International Conference Proceeding Series and IEEE Transactions on Computational Social Systems exhibit a slower growth trajectory, achieving five documents by 2023. This suggests that while these sources remain relevant, they may not be experiencing publication growth at the same pace as others. The graph also highlights the initial emergence of documents from each source; for example, documents from social media and Society began to appear in 2020, indicating a relatively recent interest in this topic. In contrast, other sources like CEUR Workshop Proceedings have been active since 2018. By comparing this graph with the previous one, it becomes evident that the most productive

	International Conference on	
ICRES	**Research in Education and Science**	**iSTeS**
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sources in terms of document quantity also exhibit stable and sustained growth over time (Wang et al., 2022). This observation confirms the significance of these sources within the analyzed research publication landscape. The consistent output from these sources not only highlights their relevance but also suggests that they are pivotal in shaping the discourse surrounding adolescent hate speech on social media. Such insights are crucial for researchers seeking to identify key platforms for disseminating their work and for understanding the

evolving dynamics of this field.

Author Analysis

Most Relevant Authors and Local Impact

Most relevant authors describe the authors who have made significant contributions within a specific context, focusing on how their works influence or are recognized within the local environment (Verma et al., 2021). This implies a study of the relevance of these authors in relation to their impact on the local academic or research community.

To provide an objective measure of authors' contributions to the research on adolescent hate speech on social media from 2013 to 2025, we present the h-index, g-index, m-index, total citations (TC), and number of publications (NP). Table 3 lists the top 10 authors based on the number of publications (NP), with Oksanen A ranking first with 8 publications, followed by Hawdon J with 6 publications, and Burnap P, Jansen Bj, Jung S-G, Salminen J, and Williams MI each having 5 publications. This table also displays relevant citation metrics. For instance, Oksanen A has values of 7, 8, and 0.636 for these indices, indicating the productivity and impact of their work. However, these indices have been criticized for not accounting for highly cited papers and the authors' career span (Koltun & Hafner, 2021). To address these limitations, we also reference variant indices that provide additional credit for highly cited papers and indices that adjust for career length, making them useful for comparing researchers with varying career spans.

Table 3. Most Relevant Authors' Information

Authors	Articles	h-index	g-index	m-index	TC	NP	Affiliation
Oksanen A	8	7	8	0.636	228	8	Tampere University
Hawdon J	6	6	6	0.545	335	8	Virginia Polytechnic Institute and State University
Burnap P	5	5	5	0.455	859	5	Cardiff University
Jansen Bj	5	4	5	0.500	383	5	Qatar Computing Research Institute
Jung S-G	5	4	5	0.500	383	5	Qatar Computing Research Institute
Salminen J	5	4	5	0.500	383	5	Vaasan Yliopisto
Williams Ml	5	5	5	0.455	859	5	College of Arts, Humanities and Social Sciences, Cardiff
Almerekhi H	4	4	4	0.500	381	4	Qatar Computing Research Institute
Awan I	4	4	4	0.333	483	4	Birmingham City University
Batista F	4	3	4	0.750	22	4	Iscte – Instituto Universitário de Lisboa

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Overall, the authors listed in the table represent the top 10 contributors in terms of productivity and the impact of their published works on adolescent hate speech on social media. Notably, Oksanen A, Burnap P, and Hawdon J demonstrate significant contributions based on citation metrics and the number of publications. Their prominence in this field underscores the importance of their research in advancing the understanding of this critical issue.

Most Local Cited Authors

Most local cited authors refer to the number of references or citations attributed to a writer's work by other authors within a specific context or environment, such as publications produced by a particular institution, community, or region (Agbo et al., 2021). This metric reflects the influence and contribution of the author within the local sphere and indicates how frequently their work is referenced by peers in the same area.

Figure 6 illustrates the ranking of authors based on the number of local citations they have received. Benevenuto F leads with 5 citations, represented by the largest blue circle at the far right of the figure. Following Benevenuto F is a group of authors with 4 citations each: Almerekhi H, Jansen BJ, Jung S-G, Salminen J, and Veronesi F. Finally, the group of authors with 3 citations comprises Correa D, Hawdon J, Mondal M, and Salim Cer. The size of the blue circles visually corresponds to the number of citations, facilitating a straightforward comparison of author contributions within the context of local citations. This graphical representation provides a clear and concise overview of author productivity based on citation metrics.
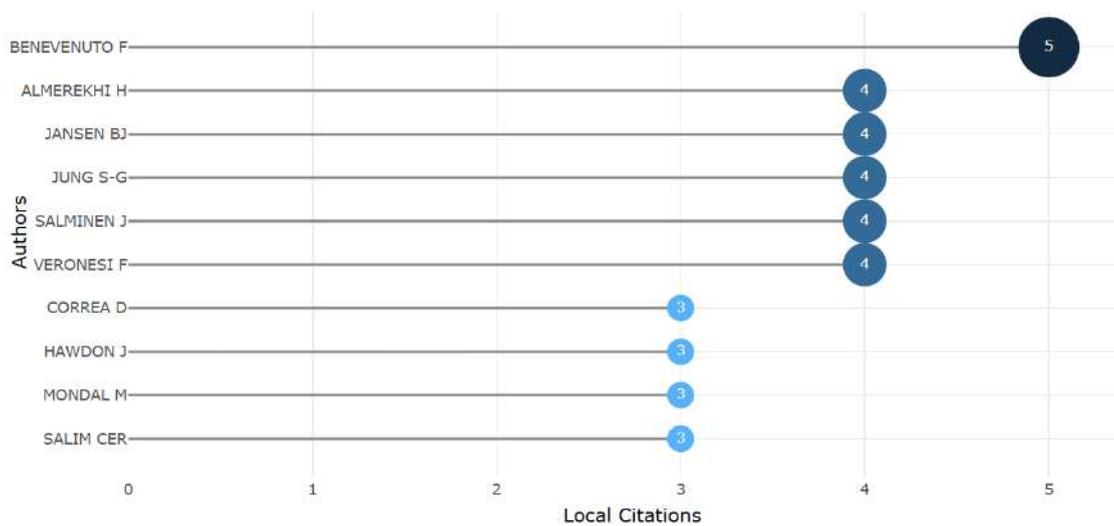
Fig.6 Most Local Cited Authors

Most Relevant Affiliations and Countries

This graph displays the top 10 university affiliations based on the number of published articles. Tampere University ranks first with 15 articles, followed by Cardiff University with 14 articles, indicating a significant contribution from both institutions to the research on this topic. The University of Antwerp and the University of California each have 9 and 8 articles, respectively, demonstrating a strong interest in this research in Europe and the United States. Other

universities, such as the University of Turku, Arkansas State University, the Indian Institute of Technology Patna, and Princess Nourah Bint Abdulrahman University, each have 7 articles. Delhi Technological University and Dublin City University round out the list with 6 articles each. This visualization employs a horizontal bar chart with circles indicating the number of articles, facilitating the comparison of contributions among affiliations. This data is crucial for understanding the geographical and institutional distribution of research on adolescent hate in social media, as well as highlighting key research centers in this field.
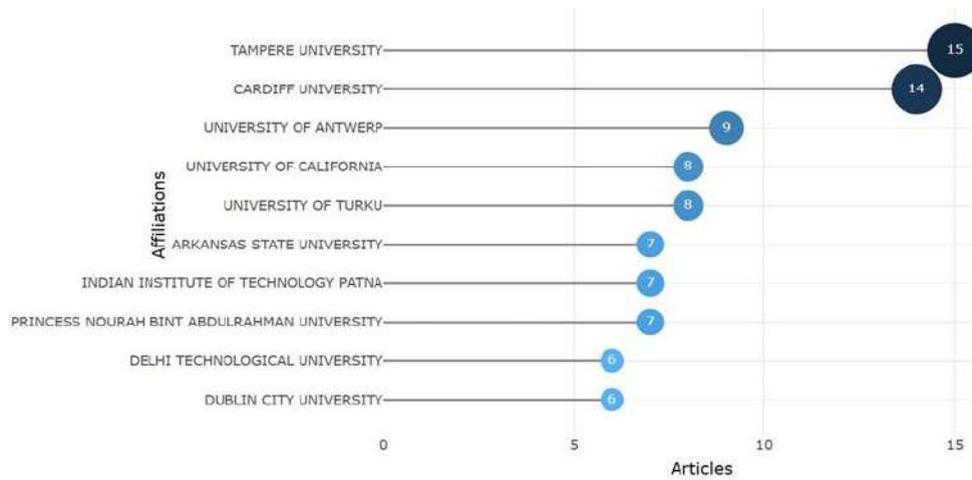
Fig.7 Most relevant affiliations

The data related to documents by country or territory will be described in Fig. 8. This bar chart illustrates the number of documents produced by the top 10 countries. The United States ranks first with the highest number of documents, followed by India in second place.

The United Kingdom is in third position, followed by Germany, Spain, Finland, Italy, Canada, Australia, and France in the last position. Overall, this chart provides an overview of the research productivity or document publication from various countries, with the United States and India as the primary contributors.
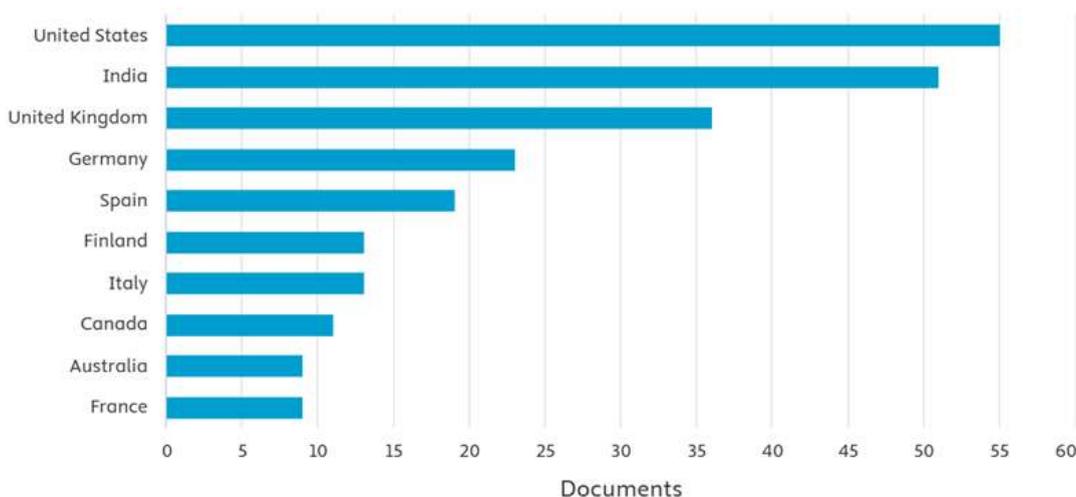
Fig.8 Document by Country or Territory

Furthermore, we turn our attention to the global citation landscape, revealing the countries that are most influential in this research area. Figure 7 presents the top 10 countries based on the number of citations in related studies. It is evident that the United Kingdom dominates with 1,095 citations, significantly surpassing other countries. This indicates a substantial impact of research conducted in the UK within this field. The United States occupies the second position with 410 citations, followed by Saudi Arabia with 274 citations, reflecting the growing interest and contributions from countries in the Middle East. European nations such as Italy, Finland, and Germany also demonstrate significant contributions, with 240, 223, and 114 citations, respectively. China and Australia, with 209 and 145 citations, respectively, show strong contributions from the Asia-Pacific region. Qatar and Spain complete the list with 191 and 82 citations, respectively. This chart employs a horizontal bar diagram with circles indicating the number of citations, facilitating comparisons among countries and highlighting those with the highest research impact.
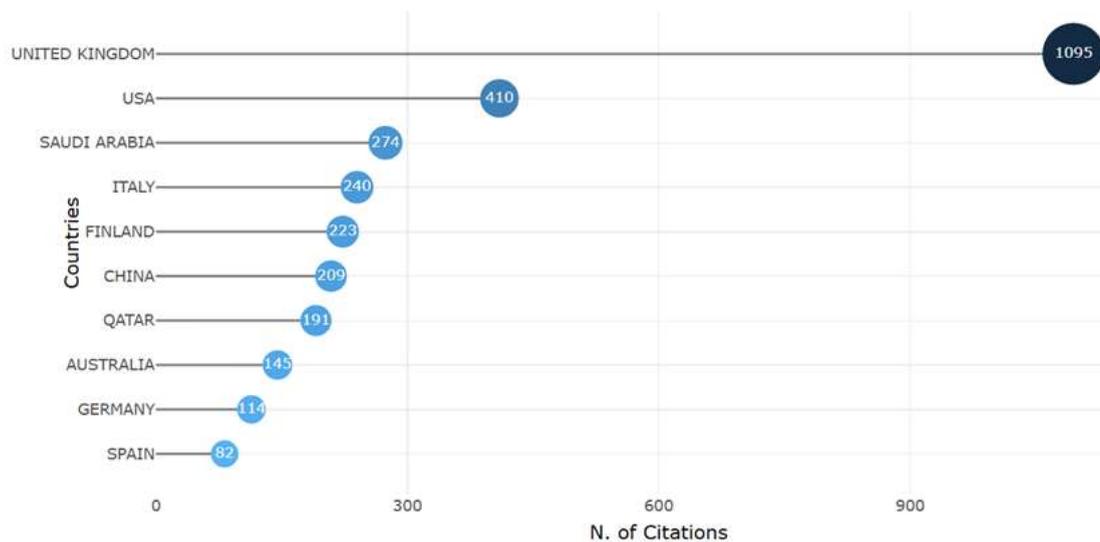
Fig. 9 Most Cited Countries

The data and findings indicate that in research on adolescent hate in social media, in addition to traditionally influential developed countries such as the United Kingdom and the United States, other nations are also becoming increasingly prominent. This is evident from the global citation distribution, where the United Kingdom dominates with 1,095 citations, followed by the United States with 410 citations. However, significant contributions also come from countries such as Saudi Arabia, Italy, and Finland, reflecting a growing interest and research activity beyond traditional research hubs. This aligns with the data on university affiliations, where institutions from countries such as Finland (Tampere University, University of Turku), Belgium (University of Antwerp), and Saudi Arabia (Princess Nourah Bint Abdulrahman University) demonstrate significant contributions. The increase in geographical diversity reflects a global development in research on adolescent hate in social media, where researchers from various countries and institutions contribute to a more comprehensive understanding of this topic.

Co-citation Analysis

Co-citation analysis examines the frequency with which two documents are cited together in other publications, revealing intellectual relationships and interconnected themes within a specific research field (Annarelli et al., 2021).

This analysis is based on the assumption that the more frequently two works are co-cited, the stronger the relationship between their content. In the visualization, the size of the nodes reflects the number of citations for a particular paper, while the thickness of the connecting lines between nodes indicates the frequency of co-citation.

Co-citation network of papers

Co-citation network of papers illustrates the relationships among documents based on the frequency with which they are cited together by other papers, revealing thematic similarities and intellectual influence (Kleminski et al., 2022).
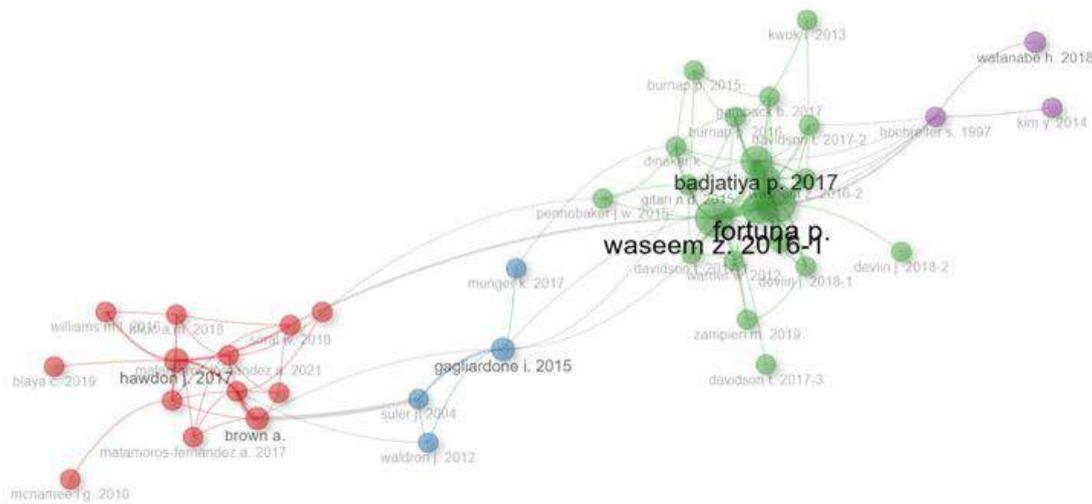
Fig. 10 Co-Citation Network

The pattern illustrates the network of author collaboration within a specific research field. Each node represents an author, with the size of the node indicating the number of their publications. The lines between nodes signify co-authorship, while the color of the nodes groups authors based on their collaborations. The largest cluster, represented in green, focuses on sentiment analysis and natural language processing, featuring key authors such as Waseem Z, Fortuna P, and Badjatiya P. The red cluster, with Hawdon J and Brown A as the primary authors, centers on cybercrime. The blue cluster, led by Gagliardone I, investigates internet governance, while the smaller purple cluster, including Watanabe H and Kim Y, has a more specialized focus. This graphic provides a visual representation of how these authors are connected and collaborate within their research domain.

Co-occurrence network

Figure 10 visualizes the co-occurrence network, illustrating the relationships among entities based on their frequency of co-occurrence (Zhou et al., 2022). Each node represents an entity, with the size of the node indicating its frequency of occurrence. The lines between nodes signify co-occurrence, while the color of the nodes groups entities into clusters. The blue cluster focuses on technology and data analysis, featuring keywords such as "speech recognition" and "social networking (online)." The green cluster, which includes terms like "social media," "speech," and "behavioral research," emphasizes studies related to behavior. The red cluster centers on human studies and

demographics, with keywords such as "human," "male," "female," and "adolescent." This network provides a visual representation of the relationships among entities and the key themes that emerge from the data it represents.
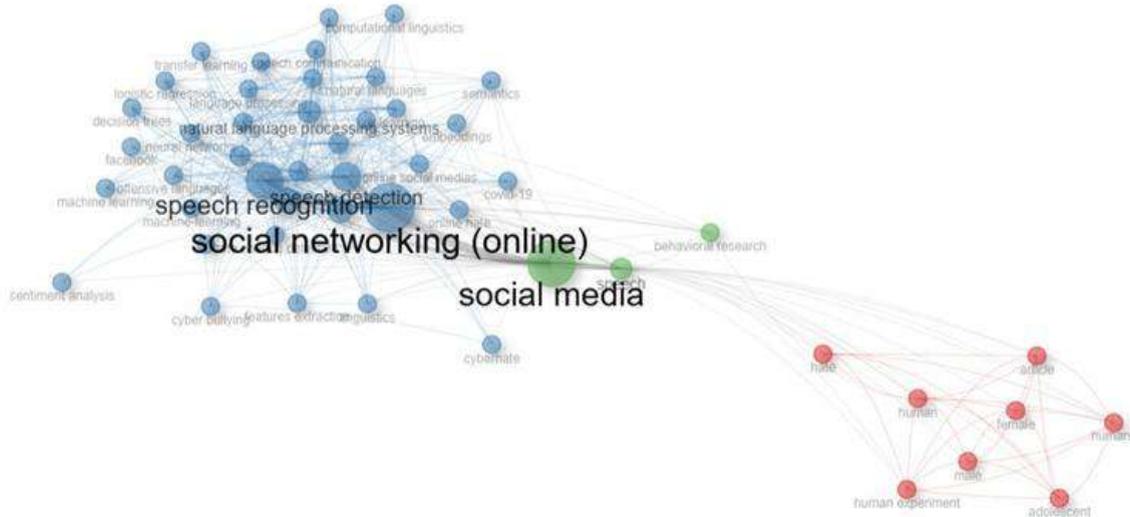
Fig. 11 Co-Occurrence Network

With this visualization, we can quickly identify dominant thematic clusters and understand the relationships among entities within the represented research field. This allows us to see how various concepts are interconnected and influence one another, as well as to identify emerging or overlooked research trends. Consequently, this facilitates more informed decision-making and the development of more effective research strategies.

Thematic Map of Adolescent Hatred on Social-Media

This figure maps research themes based on their relevance and development, providing a visual representation of the landscape of topics currently under investigation (Alkhammash, 2023). Research themes are categorized along two main dimensions: Relevance (Centrality) and Development (Density). The horizontal axis (Relevance) indicates how central or relevant a theme is within the research field, while the vertical axis (Development) reflects how developed or dense that theme is in the literature. The size of the circles represents the number of publications associated with each theme, allowing for a clear understanding of the prominence and focus of various research areas. This visualization aids in identifying key themes, emerging trends, and potential gaps in the existing body of research.

The "Iche Themes" quadrant in the upper left contains specific themes that are developing but are less central. The "Emerging or Declining Themes" quadrant in the lower left indicates themes with low development and relevance, which may either be newly emerging or experiencing a decline in popularity. The "Basic Themes" quadrant in the lower right includes foundational themes that are highly relevant but underdeveloped. Finally, the "Motor Themes" quadrant in the upper right showcases themes that are both highly relevant and rapidly developing, serving as driving forces in discussions or research.
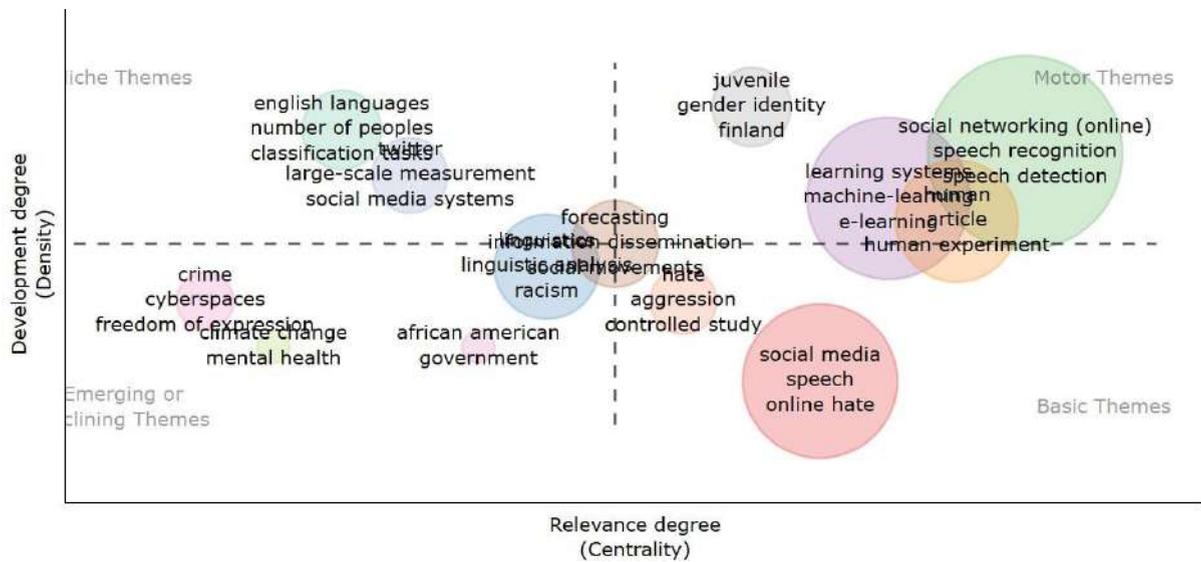
Fig. 12 Thematic Map

Overall, this visualization provides a comprehensive overview of the research theme landscape, enabling researchers to identify trends, potential collaborations, and areas that require further attention.

Keywords and Trend Topics

Word Cloud

The keywords serve as a concise representation of the core of a document or research, enabling the rapid identification of the main themes and facilitating efficient information retrieval (Li et al., 2025). Figure 12 displays the most frequently occurring words within a specific text corpus, with the size of the words reflecting their frequency of occurrence. Terms such as "social media," "speech recognition," and "speech detection" dominate the display, indicating a strong research focus on technology and data analysis. These terms reflect trends in natural language processing, machine learning, and digital interaction analysis. Furthermore, words such as "hate speech" and "cyberbullying" underscore concerns regarding the social impacts of technology, while terms like "human" and "adolescent" emphasize the importance of understanding the implications of technology on individuals.

The diversity of words within this word cloud also illustrates the presence of dialogue and collaboration among various disciplines. Terms such as "computational linguistics," "behavioral research," and "machine learning" indicate how researchers from diverse backgrounds collaborate to comprehend complex phenomena. This word cloud serves not only as a representation of the past and present but also as a reflection for the future, encapsulating the evolving trends in research and societal priorities. By understanding this word cloud, we can reflect on the direction of our research and ensure that our inquiries remain relevant to the needs and challenges faced by humanity.

Fig. 13 Word Cloud

Furthermore, Figure 13 illustrates the cumulative trends in the emergence of ten specific terms from the year 2013 to 2025 (projected), thereby providing insight into the evolving focus of research and discussions over time. Generally, there is a noticeable increase in the occurrence of all terms, particularly from the year 2018 onwards, indicating a growing interest in these topics. Terms such as "social media," "speech recognition," "social networking (online)," "natural language processing systems," and "deep learning" exhibit the most significant increases, reflecting the rapid advancements in technology and digital interaction. The rise in the term "hate speech" signifies an increasing concern regarding issues related to online hate speech. This graph serves to identify research trends and emerging areas, offering valuable insights for researchers, technology developers, and policymakers.
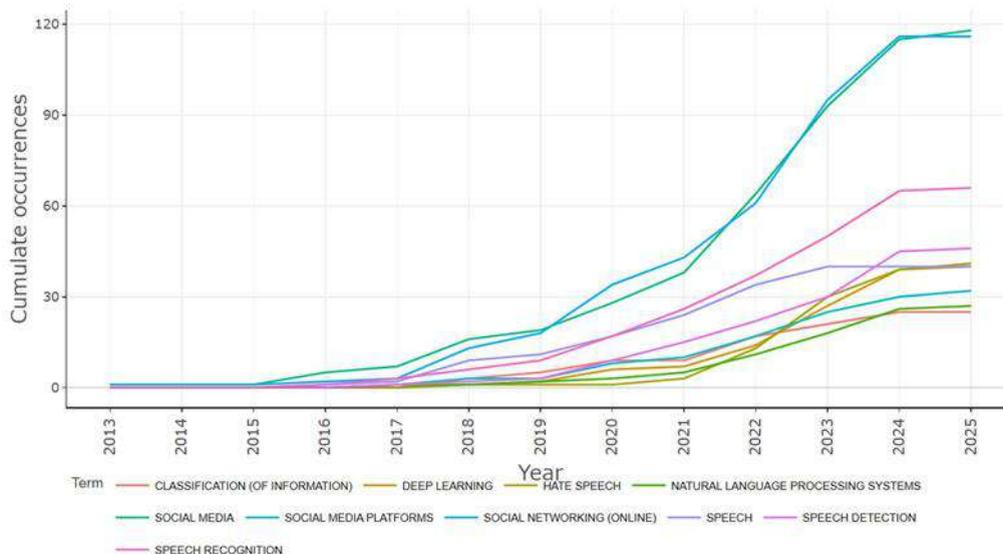
Fig. 14 Word Growth

Trending Topics

Figure 14 illustrates the research topic trends from the year 2016 to 2024, highlighting the development and popularity of various terms within the fields related to technology and data analysis. The horizontal axis represents the years,

while the vertical axis lists the analyzed terms. The horizontal lines corresponding to each term indicate the duration of their emergence, and the size of the circles reflects the relative frequency of each term during specific years. This visualization provides a comprehensive overview of how certain topics have gained traction over time, allowing researchers and practitioners to identify shifts in focus and emerging areas of interest within the technological landscape. By analyzing these trends, stakeholders can better align their research efforts and strategies with the evolving demands of the field.
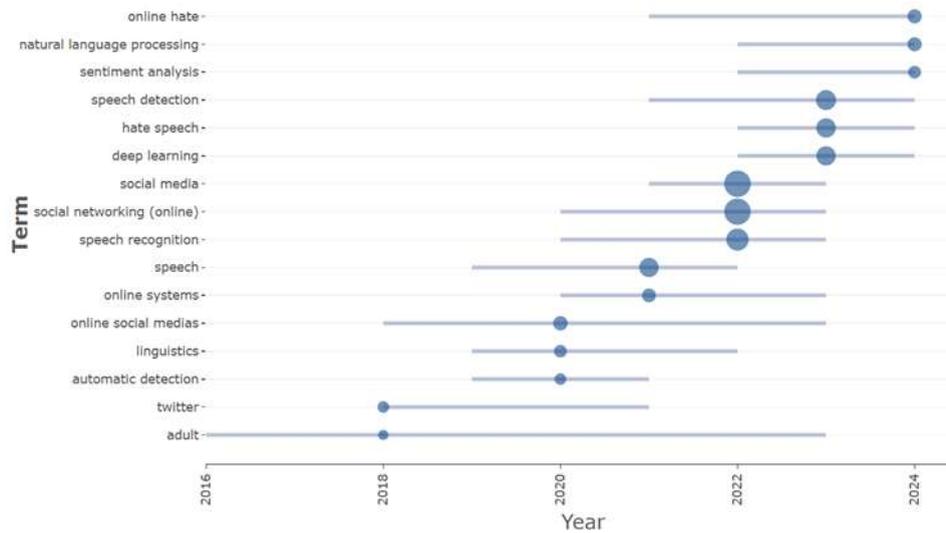
Fig. 15. Trend Topics

Several terms exhibit strong trends, such as "online social media," "speech recognition," and "social networking (online)," which consistently appear and demonstrate an increasing frequency over time. These terms reflect a sustained focus on social media analysis and voice recognition technology. Additionally, "deep learning" shows significant growth, indicating a rising interest in advanced machine learning methods. Terms such as "hate speech" and "online hate" emerge later, highlighting a developing concern regarding issues of hate speech on online platforms. Conversely, terms like "linguistics" and "Twitter" display more sporadic appearances, suggesting less consistent trends or a more specialized research focus. Overall, this graph provides an overview of the evolution of research topics, emphasizing digital technology, data analysis, and related social issues.

VOS Viewer Analysis

This figure illustrates a keyword co-occurrence network, visualized using VOSviewer, to depict the relationships among keywords within a specific research domain (Bukar et al., 2023). Each node represents a keyword, with the size of the node reflecting the frequency of that keyword's occurrence within the analyzed document corpus. The links between nodes indicate co-occurrence relationships, demonstrating how often two keywords appear together in the same publication. The color of the nodes groups keywords into clusters based on their co-occurrence relationships, thereby reflecting interconnected research themes. This visualization serves as a valuable tool for understanding the landscape of research topics and identifying areas of collaboration and focus within the field.

The cluster analysis reveals several dominant research themes. The red cluster, characterized by keywords such as "social media," "social networking (online)," "online hate," and "hate speech," indicates a strong research focus on social media analysis and issues related to online hate speech. The blue cluster centers on "speech detection," "speech recognition," "hate speech detection," and "deep learning," reflecting an interest in voice recognition technology and advanced machine learning techniques. The green cluster encompasses keywords like "natural language processing," "text classification," "computational linguistics," and "social media platform," highlighting a focus on natural language processing techniques and machine learning for text analysis. Lastly, the yellow cluster includes "Facebook," "YouTube," and "online hate speech," indicating a specific focus within computational linguistics on the analysis of hate speech across popular social media platforms.
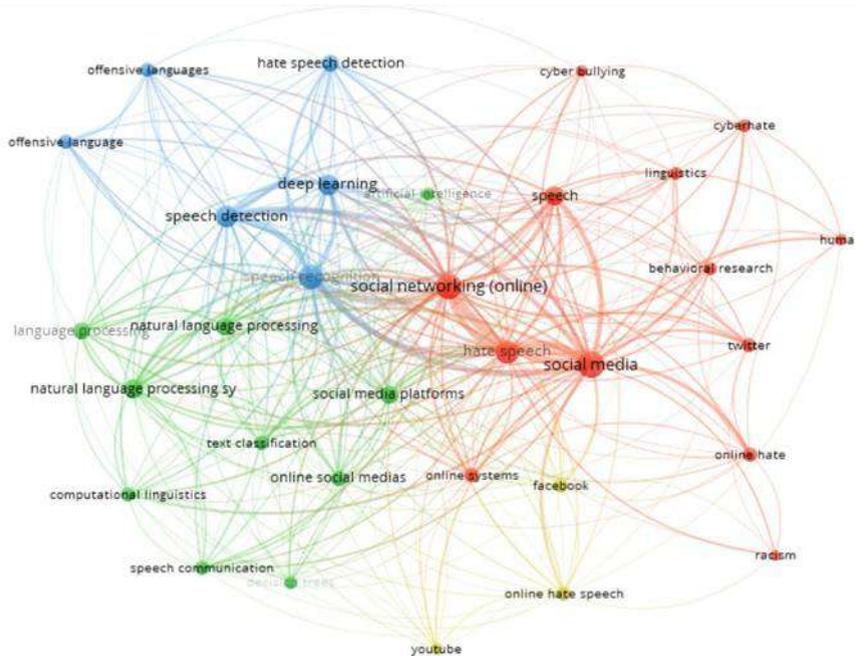
Fig. 16 Vos Viewer Analysis

Overall, this network visualization provides a comprehensive overview of the research landscape and the challenges associated with the detection of hate speech and offensive language in the digital age. It underscores the complexity of these issues, the necessity for multidisciplinary approaches, and the critical role that technology and social media platforms play in addressing these challenges. By visualizing the relationships among terms, this representation enables researchers and practitioners to identify key areas of focus, comprehend the interconnections among concepts, and develop more effective strategies to combat online hate, particularly among adolescents on social media platforms.

Discussion

This study aimed to analyze trends, productivity, and dynamics in research on adolescent hatred on social media from 2013 to 2025 using a bibliometric approach. This method was selected for its ability to systematically uncover publication patterns, collaboration networks, and thematic evolution by analyzing large-scale data. The results revealed exponential growth in published volume, with an annual growth rate of 14.35%, peaking in 2023 (59 articles).

This surge aligns with findings by Dahish & Miah, (2023), who noted that globalization and technological penetration drive research interest in social media-related topics. However, citation trends consistently after 2017, suggest that increased publication quantity does not necessarily correlate with academic impact. This phenomenon mirrors observations by Wu, (2022) in second language acquisition (SLA) research, where publication booms are often followed by citation declines due to topic saturation or methodological stagnation.

The relatively low number of publications on youth online hate on social media from 2013 to 2025 can be attributed to several interrelated factors. Initially, the topic may not have attracted significant academic interest, as researchers often focus on more immediate or visible issues, such as cyberbullying or mental health, which can obscure the specific nuances of online hate (Harriman et al., 2020). Additionally, the complexity of the subject, encompassing psychological, social, and technological dimensions, can hinder researchers due to challenges in establishing clear methodologies and frameworks for research (Alkomah & Ma, 2022). The rapid evolution of social media platforms further complicates research efforts, as trends and user behaviors change swiftly, making it difficult to maintain a consistent research focus (Benhander, 2024). Furthermore, the potential for methodological stagnation, where existing research fails to innovate or adapt to new contexts, may limit exploration of this critical area (Rawat et al., 2024b). Recent studies, such as "Combating Hate Speech on Social Media: Applying Targeted Regulation, Developing Civil-Communicative Skills and Utilising Local Evidence-Based Anti-Hate Speech Interventions" (Pukallus & Arthur, 2024) and "Issues Among Adolescents: Exploring Factors, Impacts, and Alternative Strategies" (Septiana et al., 2024), highlight the need for more focused research, indicating that while the issue is recognized, it has not been thoroughly explored in the academic literature.

Furtermore, the dominance of platforms such as CEUR Workshop Proceedings and IEEE Access as primary publication venues reinforces findings by Arif et al., (2024) and Che Ghazali et al., (2024) who emphasized the role of conference proceedings and multidisciplinary journals in social technology research. However, this contrasts with critiques by (Hladchenko & Moed, 2021), who warned that overreliance on specific platforms risks marginalizing contributions from niche or local journals. In terms of authorship, the productivity of Oksanen A and Hawdon J reflects patterns identified by Aviv-Reuven & Rosenfeld (2021), where internationally collaborative authors tend to dominate citations. However, the critique by Faraldo-Cabana, (2018) regarding the potential bias in citation indexes that may favor authors from English-speaking institutions needs to be taken into consideration, particularly as the United Kingdom dominates total citations (1,095), while contributions from non-Western countries like Saudi Arabia (274 citations) remain limited.

Geographical distribution confirms the traditional dominance of the U.S. and Europe, consistent with Mironescu et al., (2023) in multilingualism research. However, the emergence of Saudi Arabia and Finland as significant contributors supports arguments by Bata (2023) for geographical diversification in global issue studies. Conversely, minimal contributions from Africa and Latin America reflect gaps criticized by Loewenson et al., (2021), who advocates for greater inclusion of Global South perspectives in academic discourse.

Thematic analysis identified three primary clusters: technology, online behavior, and sociodemographic implications. The dominance of technological themes like deep learning and speech detection aligns with trends observed by

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Khera et al. (2025) in AI-driven language assessment. However, critiques by Dreißigacker et al. (2024) are pertinent; they caution that technical approaches often overlook social complexities, such as the psychological motivations behind hate speech. The socio-demographic cluster, particularly mental health impacts, reinforces findings by Mohd Fadhli et al. (2022) linking cyberbullying to adolescent depression. Yet, counterarguments by Mosanya et al., (2024) suggest that social media's harm may be overstated, contingent on moderating factors such as familial support.

The post-2017 citation decline poses a critical challenge for researchers and academics. This decline mirrors patterns observed in language assessment research by Patterson et al. (2020), suggesting a broader trend within the academic community. Additionally, it may reflect critiques by Windisch et al., (2022), who argue that hate speech studies often recycle methodologies without introducing innovative approaches, potentially leading to stagnation in the field. On the other hand, Lendvai (2025) and Davis et al. (2025) propose that shifting interests toward related topics, such as cancel culture or algorithmic bias, could explain this trend, indicating a possible reallocation of scholarly attention. This hypothesis warrants further exploration, as understanding the underlying factors contributing to the citation decline is essential for revitalizing research in hate speech and ensuring that it remains relevant and impactful in contemporary discourse.

The limitations of this study are notable, particularly the reliance on indexed documents, which may exclude valuable contributions from local journals and smaller conferences, a concern raised by Storm et al. (2023) regarding database bias. This bias can result in an incomplete understanding of the research landscape, as it overlooks region-specific studies and innovative ideas that may not yet be recognized by larger academic platforms. Furthermore, the projections made towards 2025 are inherently predictive and vulnerable to dynamic shifts in research trends, as cautioned by (Ofer et al., 2024). These shifts can stem from various factors, including societal changes, technological advancements, and evolving funding priorities, all of which can significantly alter the focus and direction of research (Grinin et al., 2021). Consequently, while the study aims to provide insights into future trends, it is crucial to interpret these projections with caution, recognizing the potential for substantial changes in the academic landscape.

Overall, these findings enrich academic discourse by mapping the research landscape on adolescent hatred in social media while highlighting the need for revitalizing the field through multidisciplinary approaches. Recommendations for future research include integrating qualitative methods (e.g., digital ethnography) to explore micro-contexts, expanding collaborations with researchers in underrepresented regions, and examining emerging social media platforms (e.g., BeReal, Twitch). Thus, this study not only reflects past developments but also establishes a foundation for more inclusive and relevant innovations in future research and policy.

Conclusion

This research makes a significant contribution to understanding the complex dynamics of hatred among adolescents on social media. By mapping the development of research, identifying key trends, and highlighting implications for the future, this study aids in our comprehension and addressing of this critical issue. The findings indicate that online hatred among adolescents has experienced substantial growth since 2013, with a total of 267 published documents and an annual growth rate of 14.35%. However, despite the increase in the number of publications, a notable decline

in citation counts after 2017 underscores the necessity for amore critical evaluation of the content and methodologies employed. The controversies arising from definitions, methodologies, and the application of research findings suggest that caution is warranted when drawing conclusions and formulating policies. It is anticipated that the results of this study will encourage the development of more effective strategies and interventions to create a safer and more supportive online environment for adolescents, as well as provide a foundation for further research in this field. Thus, this research serves not only as a source of information but also as a catalyst for more proactive measures in addressing the issue of hatred on social media.

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Tag The Perspective of a New Teaching Method

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Abstract: We live in a digital age and social networks are an inseparably integral part of the lives of youth nowadays. Therefore, we hold that it would be valuable to support and encourage the learning process through the use of techniques and structure methods that respond to the students' interest and hold on to their everyday experiences with technology. The attempt to include methods that develop critical thinking and promote student-centered teaching is one of the challenges of teachers today. Not only do teachers have to be professional in the field of knowledge, but they should also have the methodological skills to convert the achievements and developments in the classroom into learning situations, motivating teaching activities, through teaching methods that shape critical thinking and mobilize students to actively participate in the process of knowledge construction. This study investigates an innovative pedagogical approach in the field of teaching methods that promote active and critical thinking, as a necessary path to increase the analytical and practical skills of students in the field of natural sciences. In this paper, we will elaborate on a teaching method, which we have named "TAG", (label attached to someone or something for the purpose of identification or to give other information. "Tell by Reasoning who the tag belongs to". This new method supports learning by helping students to actively engage in the process through critical thinking and analysis of their previous experiences by associating these everyday experiences in groups with those of their peers, making "TAG "elements of the main concepts to be covered during the lesson by grouping them in clusters of terms or events by reasoning.

Keywords: Learner-Centered Teaching, Innovation in Teaching, Critical Thinking, Teaching Models

Introduction

Active learning promotes the involvement of students in the learning process and this is achieved through the use of interactive teaching methods, which in contrast to conventional passive learning approaches, promote the involvement of students by focusing the learning process on their interests. Active participation of students in knowledge construction is positively related to improved quality of learning, promotes understanding of the subject and develops critical thinking. (Bonwell, 1991; Franco et al., 2017).

Using teaching methods that promote critical learning involves cultivating the competencies to analyze information, concepts, and solve problems critically and functionally. The use of methods that develop critical thinking encourages students to critically analyze their knowledge, theories and views on society and development. This process enables students at the individual and group level to engage in improving independent thinking, learn to evaluate different points of view, and formulate conclusions based on reasoning and facts. (Mazzucelli, 2009, Baroncelli, 2013). Teaching methods aimed at building analytical skills facilitate the process of evaluating ideas, information and help build arguments with a comprehensive perspective. This teaching approach enables students to overcome the low levels of superficial knowledge by directing them towards the level of evaluation, building beliefs, attitudes and identifying values, also accepting different perspectives. This process fosters the development of intellectual skills and provides the necessary tools to deal with complex issues and effectively solve problems in various fields (Tynjälä, 1999; Tynjälä, 2003; Sullivan, 2007).

Teaching methods that encourage the development of critical thinking develop also the ability to break down complex problems into smaller, more manageable components, discern root causes, and evaluate multiple possible solutions. This enables the achievement of a general formation that helps students make decisions based on facts and preliminary analysis (Michel, 2011; Milter, 1995). In the field of teaching natural sciences, there are always challenges on how to plan and build the methodology of the lesson. One of the main challenges faced by the teachers of these subjects is the planning of the teaching process based on student-centered teaching methods, which influence directly the academic results of the students and support innovation in the classroom. Among these methodologies, the "TAG" method that we are proposing is a very attractive method, which affects the change of the teaching paradigm and the dynamics of classroom organization and student engagement. Using the TAG method, teachers can foster student motivation by promoting learning through exploration and inquiry within the natural sciences.This method orchestrates an environment conducive to collaboration, creating an enthusiastic classroom atmosphere for knowledge acquisition and problem solving. Additionally, the TAG method serves as a catalysator for increased interpersonal interactions, fostering a culture of cooperation and mutual support among peers.

The main beneficiaries of this innovative approach are the students themselves, whose academic journey is enriched manifold through its implementation. One of the best benefits of this method is the cultivation of critical thinking skills, as students are encouraged to break down complex scientific phenomena, analyze data and formulate well-reasoned conclusions. Through hands-on experiences facilitated by the TAG method, students transcend the limits of rote memorization, embarking on a transformative journey toward a deeper understanding of biological concepts and principles. Furthermore, this method fosters the development of autonomous learning skills, empowering students to

take control of their learning trajectory and develop knowledge independently. Furthermore, essential to the effectiveness of the TAG method is its emphasis on improving essential skills such as attentive listening and professional observation, which is coupled with the ability to notice or perceive and assimilate biological information from primary sources. By actively participating in cooperative learning activities, students improve their ability to absorb information effectively by attuning their senses to the complexities of the natural world. In addition, the interactive nature of learning within the TAG method cultivates students' communication skills, by involving them in discussions, debates and presentations where they must articulate their ideas in a coherent and convincing manner. This multifaceted educational approach not only equips students with the necessary tools for academic success, but also nurtures their capacity to contribute to an increasingly interconnected global society.

Methodology

The methodology applied in this study includes a rigorous and principled approach to research, characterized by a synthesis of qualitative research methods and ethical considerations. Utilizing the power of literature review and scenario building, this research has attempted to uncover the multifaceted dynamics of the TAG teaching method and its implications for application in biology classroom teaching (Prichard, 2001). Through a rather fine point of view through scientific elements, this method not only advances scientific knowledge, but also supports the importance of applying these methods in the subject of biology. The methodology used in this study relies on the qualitative approach, planned by a rigorous process designed to gather knowledge on the efficiency and impact of innovative teaching methods, especially focusing on the use of the "TAG" method within the context of biological education.The study procedure has started with an exhaustive review of the relevant literature, meticulously searching for scientific sources to identify methodologies that resonate with students' perspectives as part of teaching that promotes the development of critical thinking and that have as their main focus the improvement of student results (Garben, 2011). This literature review serves as a cornerstone, laying a solid foundation upon which the subsequent stages of research unfold. Based on the knowledge gathered from the literature, during the scientific research process, several pedagogical scenarios have been built that illustrate the implementation of the "TAG" teaching method within the dynamic landscape of science education, with special emphasis on biology. These scenarios are carefully designed to encapsulate different classroom dynamics, catering to a spectrum of learning preferences and cognitive styles. Through scenarios, the research attempts to elucidate the nuanced interplay between instructional strategies and student engagement, providing valuable insights into the transformative potential of the TAG method in fostering a deep and lasting understanding of biological concepts.

Description of the Procedure for Building a Teaching Method

Based on the description of Richard & Rodgers (2001) the elements and sub-elements that make up a teaching method are: **Method**, is the level at which theory is put into practice, a process during which choices are made regarding the specific skills needed to be learnt, the content to be taught and the order in which the content will be presented, while **Technique** is the level at which the procedures for implementing the method in the classroom are described, and **Approach** is the level at which the assumptions and beliefs about the concepts are specified in a specified field of

knowledge (Figure 1) (Richard, & Rodgers, 2001; Paparisto, 2013; Marzano, 2017; Orlich & Harder, 2012; Contant & Bass, 2017).

There are three steps to building a teaching method: Approach, Design or Construction, Procedure (Figure 1) (Richard, & Rodgers, 2001). Let's take a closer look at each of these elements and the sub-elements that make them up, before exploring all three of these elements for the TAG method.

Approach is associated with:

      a. Theory on the nature of natural science knowledge

      b. Nature theory of natural science teaching

To better understand the theory on the nature of knowledge in the natural sciences (McGraw-Hill, 2023) we see that there are three views on the **Approach**, as a theory on the nature of knowledge:

1. **The structural perspective** which sees knowledge in the field of natural sciences (the totality of concepts, skills and habits) as a system of structural and logical elements connected to each other.

2. **Functional perspective** which considers scientific terms as a means to express the functional meaning of knowledge in the field of natural sciences.

3. **The interactive perspective** which sees knowledge in the field of natural sciences as a tool for realizing interpersonal relationships and social interaction between individuals for the development of human Asociety.
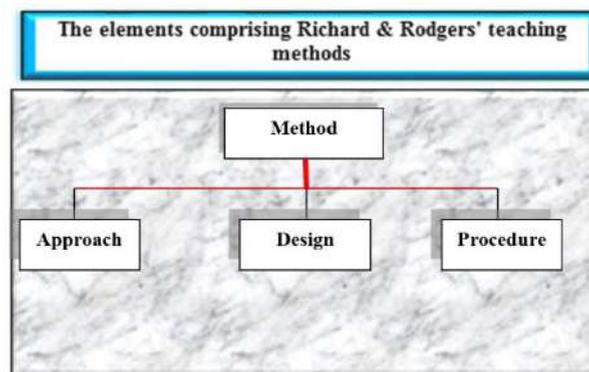
Figure 1. Elements Of Teaching Method (Richard & Rodgers, 2001)

Design or construction is an important part of the conception of a teaching method, which clarifies and provides information on learning outcomes; indicates the model on which the content of the method is developed; determines the types of learning activities; identifies the roles of the students and the teacher during the implementation of the method as well as shows the types of teaching materials needed for the practical development of the method and the role of each of them in achieving the teaching goal for which the method is used.

The procedure is an important part in the compilation of a new teaching method, which shows the techniques, practices and behaviors in the classroom during the practical use of the method; the resources in terms of time, space and equipment used by the teacher for the successful implementation of teaching while using the method; the

interactive models observed during class teaching, which can be applied in accordance with the concepts and the field where the teaching method is applied; as well as the tactics/strategies that should be applied by teachers and students when the method is being used.

Ethical considerations

Ethical considerations underline the commitment to uphold the highest standards of academic integrity and respect for participants have been an integral part of the entire research process. Throughout the research journey, ethical imperatives are meticulously woven into the content of every decision and action.

Results

The construction and application of "TAG" - teaching method in the subject of Biology

The aim: Reinforcement of knowledge, concepts and key terms in the subject of biology through guided reasoning.

Content

TAG: this method is built on 2 levels:

Level 1: The teacher presents on the blackboard or interactive screen a list of randomly ordered concepts that coincide with phenomena, processes, systems, events or procedures. All these elements can also be presented in the form of a scheme, diagram or poster. On the other side of the table, names that coincide with roles, functions, characteristics, uses, ingredients, elements, phases, scenes etc., depending on the concept or situation that is selected to be addressed are lined up randomly. The labels listed in the interactive table can be moved by transporting them virtually, while in the case of a usual table, these elements can be written on paper labels, which can be attached and moved easily.

Level 2: The teacher asks the students to choose each one at random from a sticky label or to choose a label at random on their screen. Tags, as explained above, contain elements that students must attach (TAG) to the phenomenon or process they are analyzing. Students are asked to explain why they have made a "TAG" on a particular part of a cycle or process, event or phenomenon.

Activities

The teacher places in advance on the board and in clusters all the concepts related to the process they will analyze with which they are familiar. The teacher explains the procedure and provides the necessary data. Each of the students is randomly choosing its labels. In each label there is written, based on what has to be analysed, the role, the function or the use of the parts belonging to the object, phenomenon, process, or elements that take part in the construction of a system, apparatus, organism, practical application, etc. under investigation. The opposite can also happen (Larsen-Freeman, 2000). The teacher calls the students to come to the front of the class one by one based on their will. They have to read aloud what is written on their labels and "TAG" it, in the scheme, diagram or process presented on the board, where they think this element belongs after telling why. During this time, the teacher and other students can help complete the procedure by completing each other. By the end after the whole class gets actively engaged, the teacher analyzes the results of this activity. He/She can use this teaching activity for assessment or to keep personal notes about the state of the class and the progress of each of the students.

The role of students

Students are active participants in the construction of learning processes. They must be attentive, ready to cooperate, reason and support each other. Students apply logic and use memory to complete the task. They are able to make the logical connection of the acquired knowledge with practical, substantive and comprehensive situations.

The role of the teacher

Level 1: The teacher in this process plays the role of facilitator and manager. The teacher explains the procedure to the students. He/she monitors the situation, gives them the necessary orientations to help them through the questions he addresses in case of need, which lead to finding the right answers.

Level 2: The teacher can deal with more than one general concept such as process, phenomenon or event at the same time. In this cooperation, the teacher encourages in-depth reasoning and the establishment of logical connections between knowledge and concepts. The teacher stays in cooperation with the students throughout the implementation of this method. He/She clearly handles the procedure, gives orientations and guides the students regarding the realization of the method.

The procedure for the implementation of the TAG teaching method

Resources: Textbook, various science encyclopedias, interactive tables, sticky notes, diagrams, posters, various photos, models, etc.

Completion time: 20- 30 minutes

Space: The implementation of the TAG method can take place in a normal classroom or in any other environment where the teacher can use the space to develop the concept(s). The environment should provide students with the necessary infrastructure and space to develop all educational activities related to the development of the TAG method.

Implementation of the method

During the implementation of this method, several situations may be encountered as follows: The teaching topics have different loads of knowledge and concepts that must be explained and assimilated by the students, so the time for the application of this method can vary from 10-20 min.The teacher should plan the time he/she needs depending on the topic, its load and the level of the class as many times as he/she will implement the TAG method. Instead of the teacher giving the cards to the students at random, the teacher can put all the cards in a box in front of the class and ask the students to go and pick a card at random. There may be cases where students may not know where their "TAG" card is, so in these cases to avoid anxiety, students can choose another card or ask other students for help in small groups, which the teacher have created in advance. It should be kept in mind that during the application of the method, the classroom may not be managed properly and noise may be created. To eliminate the noise in classes with a large number of students, the teacher can facilitate the random distribution of cards by going from table to table.

Even in the second phase of implementation when the students have to "TAG" the concept, term, element or part written on their card on the bord, the teacher can choose to ask the students in turn where they want to TAG their card.The teacher or a student can complete the group on the board with the information that the student will "TAG". In the case where there is an interactive whiteboard in the classroom, each student from the desk can "TAG" the interactive whiteboard from his device using the computer network in the classroom Hannan & Silver, 2000).

Application of the TAG teaching method in a teaching context in the subject of biology

Scenario No. 1

In the last 10-20 minutes of the lesson, after the teacher has finished the lesson about hormones and the human endocrine system, he/she presents in a schematic table the glands and organs that produce the main hormones in the human body.

Each of the students is randomly distributed cards of different colors with glue, on which the names of different hormones are written in advance, such as: insulin, glucagon, adrenaline, etc., that are produced in the body.

Then, each student is asked to go to the board to read the name of the hormone on the card and TAG it in the scheme presented on the board (Herbst, 2004). During this process, the student labels, identifies, shows the organ, the gland that produces this hormone and argues the reason why he made this choice. The teacher can choose instead of using schemes, to have short case studies which describe situations where these hormones do not have normal values. Students should match the case study with the type of hormone responsible. After choosing, students make their TAG card and argue the reason why they made this choice.

Scenario No. 2

The teacher can use the same procedure, this time writing in groups on the board different hormones that are produced in the human body, based on their chemical structure (four types: peptides, steroid hormones, amino acid derivatives and fatty acids derivatives). Then the teacher randomly distributes cards to the students on which the roles of hormones in the body are written.

The teacher asks each of the students to read in turn the role that their hormone has in the body. Students identify which this hormone could be; determine where it is produced in the body. They show based on the chemical structure to which group it belongs and on the last step they "TAG" their card on the board below the group to which this hormone belongs (Corbett, 2005).

Scenario No. 3

This method can also be used during a practical work class or field observation. Using this method in these teaching situations makes the lesson more fun.

An example in this case could be an excursion where the educational goal is to teach about the leaf as an important organ of the plant.

The teacher's first step is to lead the students on their observation about the different types of leaves. The second step is the description of leaf morphology and how leaves' shape and morphology are adapted in relation to the type of plant and the way of life.

In this framework, the teacher leads the lesson in nature. He/she gives the students a preliminary explanation about the construction of the leaf, their types and shapes. After that, the teacher explains the procedure to be followed. Students are divided into groups. Cards are distributed to each group on which different characteristics of the leaf are

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written in advance, such as in relation to the morphological structure, or the types of leaves based on their shape or the way the veins are placed, etc. Each of the groups places its own card in the center of the poster, which the teacher has distributed in advance, and scatters in the natural environment to collect as many leaves of different types and types as possible (Keeling, 2006). When the students return to the educational base in nature with the collected leaves, where the posters according to the groups are put on the ground, the teacher directs them to "TAG", the biological material they have collected with the poster of their group or of other groups. In this way, the students classify the leaves they have collected according to certain characteristics, which are identified on the cards distributed by the teacher at the beginning of the lesson and placed in the center of each of the posters. Students complete the posters with the already sorted leaves.

In cases where a group makes a mistake in identification, they can correct their decision on the poster where they have positioned the collected leaf and change it. In this way, group work, analytical observation and critical thinking of students are encouraged. Another teaching strategy that the teacher can follow in this case is to ask the groups to collect leaves that correspond only to the characteristic that is written on the card that their group has placed in the center of the poster at the beginning of the lesson. The work product in both cases is the same, but the strategic approach is different. In both cases, students are encouraged to identify the features of plants in nature and classify them. The same approach can be followed for the classification in terms of features for fruits, seeds, flowers, etc., depending on the interest of the class and the period of the year in which the lesson takes place. Then, students in a large group describe their experience and difficulties they may have encountered in identifying features of biological material in the field. The teacher may choose to tell about the work of biologists in defining species based on their morphological features. The teacher asks which of the students would like to have this profession (Kilimci, 2009). Students should show why it is important to define the species of the living world; what is its contribution to the recognition and protection of biodiversity on the planet, etc. At the end of the lesson, the teacher explains once again the characteristics of the leaf, showing concrete examples based on the material collected by the students themselves. All the leaf clusters built on the posters placed on the ground are photographed by the students. Next day in the classroom students can "TAG" the photos taken in the field, to the paragraphs of the textbook that talk about the leaf.

Discussion

The "TAG" method, which is based on the principle "show using reasoning who/what belongs to" represents an innovative and interactive approach that teachers can use to facilitate learning activities involving a variety of concepts and definitions. The integrated study of concepts, definitions and examples, used during the application of this teching method, not only helps students to develop what they know and understand, but also supports the process of personal development by establishing logical connections between what we know and what we learn. The logical connection of concepts between each other increases the chances for better processing and using of knowledge. This process paves the way for the construction of behaviors, beliefs and attitudes, as well as for the creative development of what we know into what we can do.

Using the power of guided reasoning, the TAG method serves as a highly efficient tool for consolidating knowledge and reinforcing key concepts and terms. This methodical approach directly affects the improvement of teaching

quality. One of the main advantages of the TAG method lies in its ability to encourage active student participation and inclusiveness within the classroom environment. By encouraging students to engage in comprehensive processes that require concentration, analytical and synthesizing skills, using this method helps deepen the understanding of the learning material while nurturing essential reasoning and critical thinking skills.The TAG method helps students build meaningful connections between acquired knowledge and its application. It develops the space for the use of both visual and spatial intelligence. Through this method, students improve their cognitive scheme by identifying practical ways of connecting concepts between them and with practical situations.The TAG method serves not only as a pedagogical tool, but also as a catalyst for fostering an atmosphere of intellectual exploration and discovery. By challenging students in a curious yet intellectually stimulating way, this method fosters curiosity and encourages active engagement with the subject. Using this method helps students create the foundations for lifelong learning and their intellectual growth. For teachers, using the TAG method represents an excellent opportunity to cultivate in their students critical thinking and analytical skills as well as to build an inclusive and supportive learning environment (Mottier, 2005).

However, it is essential to recognize that implementing the TAG method is not a process without challenges. The implementation of this method requires managerial skills, considerable investment in time and resources, meticulous planning and good support in didactic tools and technological infrastructure. Effective time and space management skills are also essential to ensure the smooth integration of TAG activities within the wider learning framework. Teachers must be prepared to guide the teaching process even in cases of possible interruptions by managing the classroom dynamics effectively. While using this method, feelings of confusion or stress can be unintentionally caused in students, who are faced with time constraints and pressure to identify the correct combinations within a limited time.

Furthermore, while the TAG method offers a number of benefits in terms of student engagement, critical thinking development, and knowledge reinforcement, its successful implementation depends on careful consideration of the challenges described in this article and implementation of mitigation strategies. By harnessing the transformative potential of the TAG method while addressing its limitations, teachers are able to foster a dynamic and enriching learning environment conducive to the holistic development of students' cognitive skills and intellectual curiosity.

Conclusions

This paper has shown the construct, approach and content of a new teaching method. TAG is based on active and critical learning through the promotion of analytical competences and logical skills.The integration of the TAG method in teaching represents a very important moment, which is based on a dynamic and student-centered approach. Through its holistic emphasis on motivation, collaboration, and skill development, this innovative teaching method catalyzes a profound transformation in the learning experience. Using TAG empowers students to become active in the learning process.

The use of active and critical learning methodologies makes an essential contribution to the growth of analytical skills and practical competencies in solving practical problems not only in biology, but also in the entire spectrum of STEM

education. Through the implementation of effective pedagogical techniques, students are equipped with the necessary competencies to identify problems and skillfully design functional solutions in all STEM areas of education. Teaching methods for developing critical thinking in the classroom are not only important for student achievement, but also for their development by equipping them with the necessary competencies as active citizens of the future.

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Gender Effects and Practical-Oriented Entrepreneurship Education in Tunisia: Assessing Skill Development and Intentions in Crisis Context

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Abstract: This paper examines the development of entrepreneurial skills and intentions in students who have taken a practical-oriented entrepreneurship course. It specifically investigates the gender effect and the impact of learning through practice and observation in the context of a crisis. The study includes a sample of 163 students from the Faculty of Economics and Management in Tunis. The research explores attitudes, skills, and intentions to gain insights into the characteristics of university entrepreneurs. The findings, obtained through two-sample independent t-tests, indicate that there is no significant difference between men and women in terms of developing entrepreneurial self-efficacy, resilience, entrepreneurial intention, and its antecedents. However, women show a higher level of empathy development compared to men. The study also reveals that participation in extracurricular activities and having an entrepreneur role model positively influence the entrepreneurial intentions of university students. These results contribute to the existing theories on entrepreneurship education and intentions within the context of higher education during a crisis. The authors discuss the implications of these findings for universities and policymakers.

Keywords: Entrepreneurial Self-Efficacy, Resilience, Empathy, Entrepreneurial Intention, Gender Effect.

Introduction

In recent years, there has been a revitalization of entrepreneurship, highlighting the significance of this phenomenon in the development of economies and societies. In Tunisia, efforts in the field of entrepreneurship began with the widespread implementation of entrepreneurship education in all university institutions, aiming to foster an entrepreneurial culture. This initiative has been in place since the 2000s.

Gradually, with the support of governmental and non-governmental organizations, a complete entrepreneurial ecosystem has emerged. Consequently, a practical approach of entrepreneurship education within university institutions is starting to be implemented alongside theoretical education. The objective is to foster the development of entrepreneurial skills (Chaker & Jarraya, 2021), which in turn leads to the development of entrepreneurial intention

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(Chaker & Dellagi, 2022) as it is considered as one of the key characteristics of individuals who are potential entrepreneurs (Karimi et al., 2016).

Furthermore, in a context characterized by multiple crises, where economic, health, political, and social crises intersect, the act of entrepreneurship takes on paramount importance. In fact, economic crises are widely acknowledged to be significant catalysts (Amit & Muller, 1995), exerting external pressures that drive individuals towards entrepreneurship because of limited alternative options available to them. Economic crises and periods of high unemployment are often recognized as influential triggers, propelling individuals towards self-employment due to the absence of viable alternative prospects (Dawson & Henley, 2012; Devece, Peris-Ortiz, & Rueda-Armengot, 2016).

In the Tunisian context, and according to the GEM (Global Entrepreneurship Monitor) report (2022), entrepreneurial intention has increased to 50.7% in 2022, compared to 22% in 2012. The report highlights a high level of entrepreneurial willingness (inclination, intentions, perception of skills) in Tunisia, and national experts recommend the implementation of more targeted support programs that encourage entrepreneurial activities and sustain them into more mature stages (promoting the resilience of emerging entrepreneurial ventures). According to this report, ninety percent of the respondents affirm that they have embarked on entrepreneurial activities to make a living due to limited job opportunities. We are faced with a significant number of young individuals who see entrepreneurship as an important path to pursue. However, having entrepreneurial intentions solely out of fear of unemployment is not sufficient. Indeed, according to the literature, unemployment is not the sole factor to be considered when talking about entrepreneurship. Other factors such as the desire for autonomy and challenges in finding employment based on educational background, race, class, or gender should also be considered (Gonzalez-Gonzalez et al., 2011; Devece, Peris-Ortiz, & Rueda-Armengot, 2016). As a result, developing an entrepreneurial culture by promoting entrepreneurial specific values and developing specific entrepreneurial skills that enable individuals to face crises can assist young people in perceiving them as opportunities they will seek to seize, aiming to create diverse forms of value (Margharitha et al. 2016).

In this regard, on the one hand, the literature presents entrepreneurial resilience as a value and a skill that enables individuals to confront and bounce back from crises and failures. In fact, resilience is closely linked to a business's ability to effectively absorb shocks (Walker et al., 2004). It also facilitates the analysis of cognitive and behavioural mechanisms involved in adapting to new situations (Biggs et al., 2010). Moreover, empathy plays a key role in sensing and interpreting problems, as well as assisting in transforming the crisis into an opportunity to be seized (Packard & Burnham, 2020). And finally, entrepreneurial self-efficacy is a crucial prerequisite for new venture intentions, as it encompasses a complex network of interconnected perceptions regarding an individual's ability to achieve entrepreneurial goals (Lee et al., 2011). On the other hand, literature suggests that intentions reflect motivational factors that have an impact on behaviour (Ajzen, 1991). These factors, which are rooted in the desire and feasibility of acting, consist of three elements: personal attitude, subjective norms, and perceived behavioural control. Entrepreneurship education with practice plays an increasingly significant role in the development of these entrepreneurial values and skills.

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Research investigating the impact of practical-oriented entrepreneurship courses on the development of entrepreneurial skills in the crisis context has included an examination of the gender effect, yielding mixed findings with certain studies indicating a bias favouring men over women (Giotopoulos, Kontolaimou, & Tsakanikas, 2016; Pines et al., 2010). However, there is a notable gap in understanding the influence of these courses on the development of entrepreneurial skills and intentions when an experiential learning process incorporating practice and observation is involved (Ferreras-Garcia, Hernández-Lara & Serradell-López, 2020). Addressing this gap in knowledge is of great importance.

In this study, we align with the literature that recognizes the potential positive impact of entrepreneurship education on the development of entrepreneurial outcomes and skills. However, given that this education has been implemented in Tunisian university institutions for over twenty years and practical-oriented programs have been adopted for more than six years, it is crucial to assess the extent of these entrepreneurial skills development among Tunisian students. Factors such as gender, participation in extracurricular activities, and the presence of an entrepreneurial role model are considered as potential influences on this development. The assessment is particularly relevant in the context of a crisis, where students, some of whom may be inclined towards self-employment, are exposed to concepts like those in entrepreneurship programs. The study holds significant policy implications, particularly for universities with a weak employment rate, as it helps determine the value of designing and implementing specialized entrepreneurship education programs to foster entrepreneurship among university graduates. In practical terms, the aim of this study is to address the question of whether universities should develop and implement specialized entrepreneurship programs that consider factors such as gender or prioritize factors like entrepreneurship learning through practice and observation. By comparing students who have participated in a practical-oriented entrepreneurship course while considering gender, extracurricular activities, and the presence of an entrepreneurial role model, this study provides new evidence, specifically in the case of Tunisia, regarding the significance of entrepreneurship education in fostering entrepreneurial intentions in times of crisis.

This paper is structured as follows. The next section presents the conceptual framework utilized to evaluate the effectiveness of practical-oriented entrepreneurship education in developing specific entrepreneurial skills and values, considering the gender effect and the factors influencing students' entrepreneurial intention. Within this framework, the research hypotheses are outlined. The subsequent section outlines the research methodology, encompassing the population and sample design, questionnaire development, and methods of analysis employed. Following the methodology description, the research findings are presented and analysed. Finally, the paper concludes with our conclusions, research limitations, and suggestions for future studies.

Theory and Research Hypothesis

Entrepreneurship education and learning, along with practical experiences in entrepreneurship foster the development of students' entrepreneurial attitude and intention (Lyu et al., 2023) and the motivational factors that influence behavior (Arranz et al., 2018). Students can acquire entrepreneurial knowledge and skills through a combination of educational and extracurricular programs as well as through observation of entrepreneurs (Chaker & Dellagi, 2022). Universities are providing support to students in the process of creating a business through various channels. These

include the development of curricular activities, such as specific training programs focused on entrepreneurship, besides extracurricular activities that facilitate students' access to market information or financing options (Arranz et al., 2018). By engaging in educational practical learning programs, students can enhance their resilience (Wong & Chiu 2019), empathy (George 2000), and entrepreneurial self-efficacy (Fearon et al., 2019). And through extracurricular programs (Nguyen at al., 2021) and observing entrepreneurs (Yeadon-Lee, 2018), they can develop their entrepreneurial intention. However, the effect of these initiatives is not the same for all students, as it depends on their gender and their level of engagement and experience in the entrepreneurship field.

Entrepreneurship and Crisis

Entrepreneurship, which is strongly influenced by the prevailing economic conditions, is anticipated to undergo substantial impacts during times of crises (Klapper & Love, 2011). Crisis can manifest as punctuated moments within an organization's lifespan or endure over extended periods (Pattinson & Cunningham, 2022). These crises can be initiated by internal organizational factors, external factors, or a combination of both throughout the stages of entrepreneurship (Xu et al., 2021).

Crisis can exert both positive and negative influences on entrepreneurs and their businesses. One positive aspect of a crisis is its potential to reveal new opportunities that entrepreneurs can effectively seize (Pattinson & Cunningham, 2022). When confronted with a crisis, entrepreneurs are compelled to foster innovation through product, service, network, or process innovation (Xu et al., 2021). A significant adverse consequence of a crisis in the realm of entrepreneurship is the challenging decision faced by certain entrepreneurs to cease their ventures, leading them to encounter the associated stigma of business failure (Walsh, 2017). Out of such business failures, some entrepreneurs may contemplate embarking on a fresh venture through regenerative entrepreneurship (Walsh and Cunningham, 2017), while others may opt not to pursue future entrepreneurial endeavors. This potential loss of entrepreneurial activity represents a further setback for both the economy and society (Pattinson & Cunningham, 2022).

Adopting an entrepreneurship-as-practice perspective in the development of nascent entrepreneurs and support for established entrepreneurs throughout their entrepreneurial journey necessitates an increased awareness of the nature of crises, their impact on individuals and organizations, and effective leadership and management strategies (Thompson et al., 2020). In the realm of entrepreneurship education, there is a growing imperative to enhance the readiness and preparedness of entrepreneurs to effectively navigate crises that are inherent in the various stages of entrepreneurship, regardless of the contextual factors (Audretsch et al., 2021). In their comprehensive literature review on entrepreneurship and crisis, Xu et al. (2021) emphasize the significance of equipping individuals with the necessary values and skills to effectively navigate diverse crises. They stress the importance of addressing this issue across all stages of entrepreneurship within university-based entrepreneurship programs and extracurricular activities. This viewpoint is reinforced by Bacq et al. (2020), Cunningham et al. (2021), and Liguori & Winkler (2020), who also highlight the importance of addressing this matter within the context of entrepreneurship education and activities.

Examining the Gender Effect on the Development of Entrepreneurial Skills through Practice-Based Entrepreneurship Education

There are numerous studies that examine the development of entrepreneurial intention and skills, considering a gender-based approach. Their frameworks have been outlined with concepts such as 'gender, stereotypes, prejudice, discrimination, cultural or social problems/obstacles' and have been implemented in various regions around the world (Türko, 2016). These studies support the assertion made by social psychologists that gender stereotypes are present worldwide, with both similarities and differences arising from cultural influences (Dökmen, 2009). Gupta et al. (2005) conducted a comparative field survey that explored gender role stereotypes and entrepreneurial intentions. The study revealed a consistent pattern of gender role typing in entrepreneurship among students from the USA, India, and Turkey. Despite the cultural, geographical, religious, and historical differences between these countries, the phenomenon of associating entrepreneurship with masculinity was observed in the sample. The findings suggest that while entrepreneurial thinking may have universal elements, gender role stereotyping could be a universal dimension within entrepreneurial thinking (Türko, 2016). To address this issue, we propose that practice-based entrepreneurship education can play a role in reducing stereotypes against women in entrepreneurship.

Practice-Based Entrepreneurship Education and Entrepreneurial Self-Efficacy

Entrepreneurial self-efficacy is defined as 'the strength of an individual's belief that he or she is capable of successfully performing the roles and tasks of an entrepreneur' (Chen et al., 1998, p.301). Studies examining the relationship between entrepreneurial self-efficacy and entrepreneurial education have shown evidence of a reciprocal relationship. Indeed, entrepreneurial self-efficacy has been found to influence individuals' inclination to become entrepreneurs (Izquierdo & Buelens, 2008; Zhao et al., 2005) and enroll in entrepreneurial education programs. In turn, entrepreneurial education with practice can enhance entrepreneurial self-efficacy by providing individuals with the skills and experiences necessary to succeed in entrepreneurship (Bergman et al., 2012).

While most studies conducted on entrepreneurial self-efficacy suggest a higher level of self-efficacy among men (Dempsey & Jennings, 2014; Bergman et al., 2012; Wilson et al., 2009), a study conducted by Wilson et al. (2009) revealed that the positive effects of entrepreneurship education on ESE are stronger for women than men. Furthermore, the significant presence of women in Tunisian universities and their active participation in entrepreneurial activities and competitions, particularly within the framework of entrepreneurship courses, have significantly enhanced their perceptions of entrepreneurship and boosted their confidence in their ability to excel in an entrepreneurial career. This is evidenced by the fact that in the academic year 2019-2020, out of the total regular number of students in Tunisia, which was 234,029, approximately 66% were females (MESRS, 2021). Moreover, women are increasingly engaging in informal projects on social media and leveraging their entrepreneurial experiences to enhance their capabilities (Chaker & Zouaoui, 2022).

We propose that entrepreneurship education based on practice can play an important role in enhancing participants' level of self-efficacy, regardless of their gender. Based on this proposition, we hypothesize the following:

Hypothesis 1: The impact of entrepreneurship education with practice on students' entrepreneurial self-efficacy (ESE) does not differ significantly between male and female students.

Practice-Based Entrepreneurship Education and Resilience

The concept of resilience was first studied in the field of mental health, specifically within the Western and industrialized context. Its origins can be traced back to studies conducted in the 20th century, which focused on youth who had faced significant adversity but demonstrated positive outcomes (Khanlou & Wray, 2014).

Despite the increasing popularity and usage of the term 'resilience', particularly in the context of crisis, there remains a lack of consensus and clarity regarding its exact meaning and implications. Despite the lack of consensus, many definitions of resilience acknowledge the significance of adaptation and coping when confronted with risks, adversities, and challenges (Barankin & Khanlou, 2007; Khanlou & Wray, 2014Masten et al., 2008).

The impact of gender on resilience has been examined in numerous studies, but no consensus has been reached. Önder & Gülay (2008) found that female students displayed higher resilience, while Bahadır (2006), Sürücü & Bacanlı (2010), and Erdogan et al. (2015) reported higher resilience among male students. Conversely, other studies such as Aktay (2010), Özcan (2005), and Sezgin (2005) did not observe a significant relationship between gender and resilience.

While resilience is commonly understood as a personal trait in some studies, there is an alternative perspective that considers it as a quality that can be cultivated, and a process influenced by environmental factors. The prevailing viewpoint suggests that resilience is not solely an inherent individual characteristic, but rather a dynamic process that emerges through the interaction of various factors in the face of challenging experiences (Erdogan et al., 2015). In a study conducted by Gürgan (2006), the impact of psychological guidance, specifically a group guidance resilience training program, on the resilience of university students was assessed. The findings of this study demonstrated that resilience can be developed and sustained through targeted interventions.

In our study, we consider that practicing entrepreneurship within the course framework enhances students' resilience, regardless of their gender. This is particularly evident for individuals who have encountered a context marked by the occurrence of multiple concurrent crises, such as the Tunisian context. This leads us to formulate the following hypothesis:

Hypothesis 2: The impact of entrepreneurship education with practical experience on students' entrepreneurial resilience does not differ significantly between male and female students.

Practice-Based Entrepreneurship Education and Entrepreneurial Intention

The theory of planned behaviour (TPB) advances that planned behaviors, such as starting and creating a business, are intentional and best predicted by the intentions toward the behavior (Ajzen 1991). Hence, the entrepreneurial activity

of starting a business is considered an intentionally planned behavior, with intention understood as a cognitive state (Ngek Neneh, 2020).

Prior research suggest that men have a higher level of entrepreneurial intention compared to women (Chowdhury and Endres, 2005; Wilson et al., 2007). To address this issue, Wilson et al. (2007) propose that entrepreneurship education may mitigate these gender differences for women who have entrepreneurial aspirations. In doing so, entrepreneurship education can be positioned as an equalizer, potentially diminishing the constraining effects of low entrepreneurial intention, and ultimately enhancing the likelihood of successful venture creation by women. In his study, Rauth Bhardwaj (2014) found that receiving appropriate entrepreneurial education, such as through professional training and skills development programs, motivates women to pursue entrepreneurship as a career and supports them in initiating their own ventures. By doing so, these women enhance their entrepreneurial intentions.

And since in our case, the students have gained real-life experience in business creation by interacting with actual clients and stakeholders in the socio-economic environment, we argue for the absence of gender-based differences in the development of entrepreneurial intention. Based on this, we propose the following hypothesis:

Hypothesis 3: The impact of entrepreneurship education with practical experience on students' entrepreneurial intention does not differ significantly between male and female students.

Practice-Based Entrepreneurship Education and the Antecedents of Entrepreneurial Intention

Krueger et al. (2000) were the pioneering scholars to apply the theory of planned behavior (TPB) in the field of entrepreneurship education. Their research revealed that entrepreneurship education significantly influences the factors preceding entrepreneurial intentions as identified by TPB, including personal attitude, social norms, and perceived behavioral control.

The concept of personal attitude towards entrepreneurship refers to an individual's level of positivity or negativity towards becoming an entrepreneur (Ajzen, 1991, 2002; Kolvereid, 1996). It encompasses the perception of entrepreneurship's desirability, which has been identified as a crucial predictor of entrepreneurial intention. A favourable attitude towards entrepreneurship is expected to result in a positive EI. Specifically, a strong or highly positive attitude towards pursuing entrepreneurship is believed to indicate a greater inclination towards starting one's own business rather than opting for employment within an organization (Kolvereid, 1996).

Subjective norm in the context of entrepreneurship pertains to the impact exerted by significant reference groups on an individual's decision to pursue entrepreneurship. It encompasses the perceived social pressure emanating from supervisors, colleagues, relatives, and friends, which can influence one's behavioral intentions (Ajzen, 1991).

Perceived behavioral control (PBC) refers to an individual's perception of the ease or difficulty associated with performing a specific behavior, such as starting a business (Ajzen, 1991; Kolvereid, 1996). It shares similarities with the concept of perceived feasibility in the entrepreneurial event model and Bandura's self-efficacy theory (Bandura,

1977, 1982). Among the three antecedents of intention, PBC holds particular significance as it reflects an individual's capacity for self-regulation and self-management when faced with the choice of engaging in a behavior or not (Ajzen, 2002). In the context of new venture creation, PBC signifies how positively an individual evaluates their own capabilities and ability to assume control over entrepreneurial activities, utilizing incentives and overcoming encountered barriers throughout the process (Ahmed & Klobas, 2017).

Kolvereid (1996), in his application of the TPB to predict employment status choice, concluded that gender influences self-employment intentions indirectly through its effect on attitude, subjective norm, and perceived behavioral control. Research studies conducted by Oosterbeek et al. (2010), Peterman & Kennedy (2003), and Souitaris et al. (2007) have demonstrated that entrepreneurship education has a significant impact on the antecedents of entrepreneurship, namely personal attitude, subjective norms, and perceived behavioral control (PBC). Specifically, students who participate in Entrepreneurship Education Programs tend to exhibit a higher level of entrepreneurial spirit in terms of their personal attitude towards entrepreneurship, the influence of subjective norms, and their perceived behavioural control. These findings underscore the positive impact of practice-based entrepreneurship education in shaping and nurturing an entrepreneurial mindset among students, regardless of their gender, through the development of entrepreneurship antecedents.

Based on these results, we propose the following hypothesis:

Hypothesis 4: The impact of entrepreneurship education with practical experience on students' personal attitude, subjective norms, and perceived behavioural control does not differ significantly between male and female students.

Practice-Based Entrepreneurship Education and Empathy

Given that entrepreneurship involves creating new businesses for a specific community, having a strong understanding and appreciation of the needs and desires of community members through empathy is a crucial skill (Snipes, 2020). The intersection of empathy and entrepreneurship education is a subject of increasing interest in entrepreneurship literature (Korte, 2018). Entrepreneurship education commonly aims to encourage and cultivate an entrepreneurial mindset among students. Moreover, a crucial aspect of an entrepreneurial mindset is the capacity to empathize with others (Snipes, 2020). Some entrepreneurship educators have embraced the concept of empathy, from directly teaching it to entrepreneurs (Neck & Greene, 2011) to indirectly incorporating it through newer methods such as design thinking (Daniel, 2016). Empathy is defined as a cognitive and affective process that involves the ability to understand and empathize with the feelings and experiences of others (Snipes, 2020). The study conducted by Snipes (2020) revealed that, among others, the study and practice of entrepreneurship led to enhanced empathy outcomes for students.

Several studies support the notion that women tend to be more skilled than men at accurately perceiving the emotions experienced by others (Strauss, 2004; Toussaint & Webb, 2005). Furthermore, several studies confirm that women excel in encoding and decoding both verbal and nonverbal messages (Charvoz, 2008; Noller, 1981), which could explain their natural inclination towards empathy. By delving deeper into studies that observe differences in

perception favouring women, several explanations are put forward to account for this gender gap. Firstly, during childhood, the socialization of young girls differs from that of young boys, as parents emphasize emotional expression with girls (Strauss, 2004). Thus, a strong socialization of emotions in girls may be the underlying factor for a more natural inclination to be sensitive to the emotions of others (Lennon & Eisenberg, 1987). Additionally, several neuropsychological studies demonstrate that the female brain tends to process the emotional aspect of information (e.g., words and images) in a more integrated manner than males (Recer, 2002; Strauss, 2004). In fact, the theory proposed by psychologist Baron-Cohen & Wheelwright (2003) suggests that, based on genetic and biological factors, women may have a brain structure that is more inclined towards empathy compared to men. However, Strauss (2004) emphasizes that this ability is not innate but rather stems from adaptive responses. Specifically, in the past, women were responsible for caring for preverbal children (i.e., from 0 to 3 years old), allowing them to adeptly decode the needs of children through the reading of their emotional expressions. Neural plasticity facilitated this brain differentiation, accounting for women's superiority in detecting and responding to the emotions of others (Strauss, 2004).

Based on the above-mentioned, we formulate our fifth hypothesis as follows:

Hypothesis 5: The effect of practice-based entrepreneurship education on students' empathy differs significantly, favouring female students over male students.

Enhancing Students' Entrepreneurial Intention through Practice-Based Entrepreneurship Education: The Influence of Extracurricular Activities and Role Models

As numerous studies delve into the effect of gender on the development of entrepreneurial intention, it becomes evident that this factor may lose its relevance when entrepreneurship education incorporates practical experience. Instead, it is prudent to shift our focus towards the learning process, which holds greater significance. Entrepreneurial learning can take place through experiential learning within the course curriculum, complemented by participation in extracurricular entrepreneurial competitions, or through the observation of successful entrepreneurs who can serve as role models. By exploring these avenues, students can enhance their entrepreneurial intentions and cultivate a mindset conducive to entrepreneurial endeavors.

Participating to Extracurricular Activities and Entrepreneurial Intention

Given the diverse array of educational initiatives and support systems within the entrepreneurial ecosystem of universities, extracurricular activities emerge as a crucial component (Doan & Sung, 2018).
Entrepreneurship extracurricular activities encompass a range of actions, experiences, and innovative endeavors that extend beyond the formal curriculum of higher education institutions, both within and outside university settings (Souitaris et al., 2007). Entrepreneurship extracurricular activities serve as valuable supplements to the formal curricular requirements in university education (Nguyen et al., 2021). These activities are specifically designed to foster entrepreneurial initiatives and provide tailored support to students' entrepreneurial interests and intentions in starting new ventures (Arranz et al., 2017). They encompass a diverse range of forms, such as entrepreneurship games,

business plan competitions, exchanges, business mentoring, clubs and societies, pre-incubators, workshop programs, entrepreneurship support programs, new product development and innovation competitions, idea development, and business incubators (Pittaway et al., 2011).

Angulo (2019) defines engagement in extracurricular activities as a type of experiential learning. This approach promotes learning through active participation and practical application (Hoppe, 2016). It facilitates the construction of new knowledge and perspectives through collective experiences (Nguyen et al., 2021). Thus, participation in extracurricular activities provides a supportive environment for students to engage in business and entrepreneurial endeavors, fostering increased awareness and a positive attitude towards entrepreneurship (Pittaway et al., 2011). Through these activities, students acquire knowledge and social capital, which in turn enhances their entrepreneurial intention (Peterman & Kennedy, 2003). Research conducted by Doan and Sung (2018) as well as Pittaway et al. (2011) and Nguyen et al. (2021) has demonstrated that involvement in activities such as business plan development, competitions, and entrepreneurship-focused student organizations, such as clubs, positively influences an individual's intention to pursue entrepreneurship. This leads us to our sixth hypothesis, which is as follows:

Hypothesis 6: Students who actively participate in entrepreneurship-related extracurricular activities will exhibit higher levels of entrepreneurial intention compared to those who do not engage in such activities.

Vicarious Learning through Role Models and Entrepreneurial Intention

The concept of vicarious learning, rooted in Bandura's social learning theory (1977), refers to the process by which individuals can change their behavior by observing the behavior of others without directly experiencing the consequences themselves (Voit & Drury, 2006). It can also involve observing or 'listening in' on experts or peers as they engage in discussions about a new topic (Cox et al., 1999), or learning through the experiences of others (Fox, 2003).

This concept presents an alternative approach to learning that does not rely on direct participation, reflection, and action, but rather on observing the behavior of others. It provides learners with the opportunity to benefit from the experiences of their peers and learn through their examples (Roberts, 2010). Role models play a pivotal role in vicarious learning and career decision-making. Through the process of vicarious learning, individuals form cognitive evaluations of specific careers based on the reinforcement received by role models and the behaviors associated with such reinforcement (Scherer et al., 1989). Observational learning in this context can either serve as a motivating factor or deter individuals from pursuing careers like those they have observed (Betz & Hackett, 1981; Mitchell & Jones, 1976).

Yeadon-Lee (2018) suggests that when employed thoughtfully within an action learning context, vicarious learning can enhance the effectiveness of learning. Citing the research conducted by Baum et al. (2000) and Henisz & Delios (2001), the authors argue that vicarious learning is particularly valuable in entrepreneurial action learning, where participants often face new experiences with high uncertainty and engage in group-based learning. In fact, the authors specifically highlight that effective vicarious learning enables individuals to acquire general rules and strategies for

navigating new situations.

Based on these arguments, we propose the following hypothesis:

Hypothesis 7: Students who have a role model will develop better their entrepreneurial intention when participating in entrepreneurship education with practical experience compared to those who do not have a role model.

Method

Description of the Study Context

We conducted an empirical study on students and graduates from the Faculty of Economics and Management of Tunis (FEMT). This faculty has a strong tradition in teaching entrepreneurship and conducting extracurricular entrepreneurial activities. As part of the University of Tunis El Manar, students from this faculty have been exposed to a dynamic entrepreneurial training and competition environment, both at the local and international levels, through various local and international projects.

At the faculty level, the teaching of entrepreneurship started in the 2000s with a course on business creation. Entrepreneurial culture courses were later added to raise awareness among students about the importance of entrepreneurship. Moving to a more advanced level, entrepreneurship, business plan, and Business Model Canvas (BMC) courses were introduced, along with personal development, design thinking, and soft skills courses. The objective of this introduction was to develop entrepreneurial skills.

During the academic year 2018-2019, the entrepreneurship course was taught by combining theoretical and experiential approaches for the first time in a pilot experiment, and the first entrepreneurial competition was organized. The positive effects of this experiment on students' entrepreneurial skills development and on the development of their entrepreneurial intention (Chaker & Dellagi, 2022; Chaker & Jarraya, 2021) encouraged other lecturers to adopt these two approaches. Since then, an entrepreneurial competition has been organized for students every year. These competitions are preceded by a 3-day bootcamp that trains students on the tools and steps for launching a project.

At the university level, the same dynamism in favor of entrepreneurship has been observed. Four major international projects, leading to the organization of bootcamps and entrepreneurial competitions, have been launched. The first project, an Erasmus Plus project, created a competition between students from the university and students from Morocco and Algeria. The second project, in partnership with the United States Embassy, organized a competition between students from the university of Tunis El Manar and students from other Tunisian universities. The third project, in partnership with the University of Kassel in Germany, and the fourth project, funded by the World Bank, fostered competition among students from different institutions within the university. These projects involved multidisciplinary team collaboration. Additionally, the Tunisian entrepreneurial ecosystem is highly dynamic, and several entrepreneurial competitions and hackathons are organized to support young entrepreneurs.

Respondents

The statistical population of this research includes all students and graduates of the faculty who have taken an entrepreneurship course with practice during their academic studies. To collect our data, an online questionnaire was administered during the second semester of the academic year 2022-2023, specifically from February 2023 to April 2023. The sample consisted of 163 students from FEMT.

The respondents are undergraduate students (11% in the first year of undergraduate studies (L1), 17.8% in the second year (L2), and 14.1% in the third year (L3)), graduates (16%), master's students (17.2% in the first year of master's studies (M1) and 22.1% in the second year (M2)), and doctoral students (1.8%).

As for their ages, respondents range from 19 to 47 years old, with 84% of respondents being between the ages of 19 and 26. They have all received entrepreneurship courses with practice during their academic studies.

Among the respondents, 62.6% were female and 37.4% were male. 62% of the participants have engaged in social work through involvement in associative activities, while 38% did not. 62.6% of the participants have previous work experience, while 37.4% % do not.

Regarding the participants, 66.9% confirmed having an entrepreneurial role model to emulate, while 33.1% did not. Among the respondents who have an entrepreneurial role model to emulate, 22.01% affirm having a familial relationship with that model, while 77.98% have no familial relationships. Furthermore, 73.39% affirm that the role model they emulate is of the same gender as them, while 26.60% follow role models of the opposite gender.

Measures

The measures utilized in the study largely aligned with previous research. Entrepreneurial intentions were assessed using questions adapted from Liñán and Chen (2009), whose study demonstrated the high reliability of this construct (with a Cronbach's alpha of .943). Following the approach of Liñán and Chen (2009), students were requested to indicate their level of agreement with six statements that measure entrepreneurial intention on a seven-point Likert scale. We also incorporated the measurement scales proposed by these authors to assess the antecedents of entrepreneurial intention, namely perceived behavioural control, attitude, and subjective norms. Indeed, these variables were assessed using the entrepreneurial intention questionnaire developed and validated by Liñán and Chen (2009). The constructs were measured using a 7-point Likert scale. The perceived behavioural control was measured using six items, the attitude was measured using five items, and the subjective norms were measured using three items.

Entrepreneurial Self-Efficacy (ESE) was assessed based on the scale introduced by Zhao et al. (2005) where students were asked to express their agreement level with four statements related to ESE using a five-point Likert scale.

Regarding the measurement of resilience, we adopted the scale proposed by Sinclair and Wallston (2004), where respondents were asked to indicate their agreement levels with four items measuring this variable on a five-point Likert scale.

For empathy measurement, we utilized the Multidimensional Emotional Empathy Scale (MDEES) developed by Caruso and Mayer (1998, p. 262). The MDEES specifically emphasizes the affective aspect of empathy and is designed for application among adolescents and adults. This variable consists of seven items evaluated on a five-point Likert scale.

The following table (see table 1) presents the different scales used as well as their reliability measured through Cronbach's alpha.

Table 1. Variables' Scale Items and Reliability

Variables	Number of items	Cronbach's alpha
EI	6 items	0.939
Empathy	7 items	0.716
Resilience	4 items	0.837
ESE	4 items	0.895
PA	5 items	0.951
SN	3 items	0.737
PBC	6 items	0.893

Method and Results

Since we aim to examine the impact of gender, role models, and extracurricular activities on the development of students' entrepreneurial intention, its antecedents, and three specific entrepreneurial skills, namely empathy, resilience, and ESE, we conducted two-sample independent t-tests on groups that were divided based on these criteria. In these tests, our objective was to determine if there were significant differences in the mean values between respondents in the different groups. The two-sample independent t-test is a widely used statistical test for comparing means of two groups. In our study, the data met the necessary requirements for conducting this test. In fact:

- The dependent variables in our study are continuous, whereas the independent variables are categorical in nature.
- Each time we conduct the test, all cases in our study have values for both the dependent and independent variables.
- The two groups in our study are independent, indicating that there is no relationship between the subjects in each sample. In our case, when we change the independent variable (gender, role models, and extracurricular activities), the following conditions hold: (a) the subjects in the first group are distinct from the subjects in the second group; (b) subjects in one group do not influence subjects in the other group; and (c) the groups do not have any influence on each other.
- The data sample was selected randomly from the population.
- Due to the moderate size of each sample, it is not necessary for the dependent variable in each group to follow a normal distribution. In fact, even if normality is violated in moderate or large samples, accurate p-values can still be obtained.

- The final requirement is to test the assumption of homogeneity of variances, which means that the variances are approximately equal across the groups.

Based on the following table (see table 2), the assumption of homogeneity of variances is not violated for any of the variables with respect to gender.

Table 2. Test of Homogeneity of Variance for Gender

Variables	Levene statistics	df1	df2	Sig.
EI	1.327	1	161	0.251
Empathy	1.662	1	161	0.199
Resilience	0.045	1	161	0.832
ESE	0.109	1	161	0.742
PA	1.559	1	161	0.214
SN	0.836	1	161	0.362
PBC	0.799	1	161	0.373

According to results (see table 3), the assumption of homogeneity of variances is not violated for the variable of 'entrepreneurial intention' when considering the role model.

Table 3. Test of Homogeneity of Variance for Gender

Variables	Levene statistics	df1	df2	Sig.
EI	0.684	1	161	0.410

However, considering the results (see table 4), the assumption of homogeneity of variances is violated for the variable of 'entrepreneurial intention' with respect to extracurricular activities.

Table 4. Test of Homogeneity of Variance for Extracurricular Activities

Variables	Levene statistics	df1	df2	Sig.
EI	9.921	1	161	0.002

After testing the homogeneity of variances, we will present in the following table (see table 5) the means test corresponding to the gender effect:

Results (see Table 5) reveal that, among the seven variables, there is no significant differences in means between women and men for six of them. For these six variables, the means of the first sample fall within the 95% confidence interval of the means of the second sample. These variables include 'entrepreneurial intention', 'resilience', 'entrepreneurial self-efficacy', 'personal attitude', 'subjective norms', and 'perceived behavioural control'. However,

specifically, the means of the first sample for the variable 'empathy' do not fall within the 95% confidence interval of the means of the second sample, indicating a significant difference between them. In this case, the sign of the mean differences, represented by the t-value, is positive, suggesting that the means for women are significantly higher than those for men. In fact, the results indicate that women show a significantly better effect for this skill, with a mean of 3.8039 compared to men's mean which is in the range of 3.4848. Thus, we can conclude that teaching entrepreneurship with practice has a similar effect on both gender groups, except for the variable of 'empathy'. Thus, hypotheses H1, H2, H3, H4 and H5 are all confirmed.

Table 5. Survey Results for Gender Effect

Variable	Female Students mean (1st sample: n=102)	95% CI	Male Students mean (2nd sample: n=61)	95% CI	Δ Mean	TΔmean	Variable
ESE	4.1765	[4.00-4.34]	4.0861	[3.84-4.32]	0.0904	NS	**H1 Supported**
Resilience	4.0931	[3.92-4.25]	4.0574	[3.82-4.28]	0.0357	NS	**H2 Supported**
EI	5.2304	[4.93-5.52]	5.2596	[4.79-5.72]	-0.0291	NS	**H3 Supported**
PA	5.6373	[5.35-5.92]	5.4426	[5.01-5.86]	0.1946	NS	**H4 Supported**
SN	4.9412	[4.64-5.24]	5.1475	[4.77-5.51]	-0.2064	NS	
PBC	4.6373	[4.38-4.89]	4.7814	[4.40-5.15]	-0.1441	NS	
Empathy	**3.8039**	**[3.66-3.93]**	**3.4848**	**[3.28-3.68]**	**0.3191**	**2.750****	**H5 Supported**

Note: NS = not significant (p-value > 0.05), **p-value < 0.01.

The results corresponding to the extracurricular activities are presented in the following table (see Table 6).

Table 6. Survey Results for Extracurricular Activities Effect

Variable	Students participating in extracurricular activities mean (1st sample: n=82)	95% CI	Students not participating in extracurricular activities mean (2nd sample: n=81)	95% CI	Δ Mean	TΔmean	Variable
EI	5.5041	[5.18-5.82]	4.9753	[4.58-5.36]	0.5287	2.100*	**H6 Supported**

Note: *p-value < 0.05.

Results (see Table 6) reveal a significant difference in means between students who participated in extracurricular activities and those who did not. This finding suggests that the means for the variable 'entrepreneurial intention' differ significantly between both samples. Furthermore, the sign of the mean differences for this variable is positive,

indicating that the mean for students who participated in extracurricular activities (5.5041) is significantly greater than that of students who did not (4.9753). Hypothesis H6 is also confirmed.

As for the results corresponding to the effects of role models, they are presented in the following tables (Table 7).

Table 7. Survey Results for Role Model Effect

Variable	Students with role model (1st sample: n=109)	95% CI	Students with no role model (2nd sample: n=54)	95% CI	Δ Mean	TΔmean	Variable
EI	5.4587	[5.15-5.75]	4.8025	[4.35-5.24]	-0.0291	2.469*	**H7 Supported**

Note: *p-value < 0.05.

The results indicate that students who have a role model demonstrate greater development of their entrepreneurial intention when participating in a practical-oriented entrepreneurship course, compared to those who do not have a role model. Specifically, the means of this variable shows significant differences between the two samples. Therefore, the results suggest that students with a role model exhibit a significantly better effect for this skill, with a mean of 5.4587 and hypothesis H7 is confirmed.

Discussion

The objective of this research was to assess the influence of practical-oriented entrepreneurship education on the development of students' entrepreneurial skills within the crisis context. The study aimed to examine the variations among students based on factors such as gender, participation in extracurricular activities, and the presence of an entrepreneurial role model. The findings shed light on the differential skill development resulting from the practical approach among Tunisian students amidst a crisis.

Research on entrepreneurship education has garnered significant attention, particularly regarding the development of entrepreneurial skills and intentions. However, most studies have primarily focused on the gender effect, often revealing a favourable impact for men compared to women. The main objective of this study is to demonstrate that, during a crisis period, teaching entrepreneurship through practical methods can enhance students' entrepreneurial skills and intentions, regardless of gender. In this context, instead of solely considering the gender effect on entrepreneurial intention, it is more pertinent to examine the influence of participating in extracurricular activities and having a role model for observation and learning purposes.

The importance of ESE lies in the fact that individuals with high entrepreneurial self-efficacy perceive the same entrepreneurial environment as offering new opportunities, while those with low ESE perceive it as filled with costs and risks (Bergmen et al. 2011). There is controversy in the results of studies that have examined the effect of entrepreneurship education on the development of students' ESE, considering gender. Indeed, while the study

conducted by Bergman et al. (2011) found that men benefited from the program more than women, with their ESE growing stronger while that of the women diminished, the study conducted by Nowinsky et al. (2017) found that ESE was higher among females than males. They concluded that entrepreneurship education is significantly more efficient in increasing marshalling and planning ESEs among females compared to males. Our study, however, did not observe any significant differences between genders. The results provide hence evidence of the effectiveness of the practical-oriented entrepreneurship course in reducing the gender gap in terms of ESE development.

Some studies indicate that resilience can significantly influence an individual's ability to navigate challenging situations (Ayala and Manzano, 2014; Pyrkosz-Pacyna, Nawojczyk and Synowiec-Jaje, 2021). Resilience refers to the capacity to adapt, bounce back, and maintain well-being in the face of adversity. It encompasses psychological, emotional, and cognitive processes that enable individuals to effectively cope with difficulties and setbacks. Therefore, considering the role of resilience in how individuals handle difficult situations is crucial in understanding their entrepreneurial behaviour and response during a crisis period (Nawojczyk and Synowiec-Jaje, 2021). In our study, we did not find any gender difference in the development of resilience among students who took a practical-oriented entrepreneurship course. Although this result goes against most studies that have highlighted a positive effect in Favor of men, they recommend implementing training programs that contribute to the development of resilience levels in universities (Ceglédi et al., 2022; Erdogan et al., 2015). Hence, once again, our study presents compelling evidence of how the practical-oriented entrepreneurship course effectively reduces the gender gap in terms of resilience development. Indeed, both groups have developed a very good level of resilience, as the means show excellent values for both women and men (respectively 4.0931 and 4.0574).

We can say the same for entrepreneurial intentions. In fact, previous studies have consistently demonstrated that women exhibit lower entrepreneurial intentions compared to men (Nowinsky et al., 2017; Santos, Roomi, and Liñán, 2016). But when considering the effect of entrepreneurial education, research provides an ambiguous picture regarding the impact of gender on the link with entrepreneurial intention. Some studies show a more positive (or less negative) effect for men than for women (Oosterbeek, van Praag, and Ijsselstein, 2010; Westhead and Solesvik, 2016), while other studies do not report any significant difference between the two groups (Bae et al., 2014). Our current study aligns with the latter group as we did not observe any significant difference related to gender. In fact, both groups exhibited similar levels, with a mean of approximately 5.2304 for women and 5.2596 for men. The gender-specific effect observed could be attributed to students' learning experiences through practical-oriented courses, which bridge the gap between men and women. This finding reinforces the notion that the practical-oriented entrepreneurship course effectively diminishes the gender gap in terms of entrepreneurial intention development in the Tunisian context.

Regarding the antecedents of entrepreneurial intention, it has been suggested that entrepreneurship education enhances the perceived attractiveness and feasibility of venture creation (Fayolle et al., 2006; Souitaris et al., 2007). In other words, students who have taken entrepreneurship courses are expected to exhibit a stronger entrepreneurial spirit in terms of attitude, subjective norms, and perceived behavioural control (Ahmed & Kolbas, 2017), regardless of their gender. Our study aligns with the findings of Oosterbeek et al. (2010), Peterman & Kennedy (2003), and Souitaris et al. (2007), which have demonstrated the significant impact of entrepreneurship education on the antecedents of

entrepreneurship.

The only factor where gender made a difference is resilience, which is more developed in women. Our research aligns with studies that support that women tend to be more skilled than men at accurately perceiving the emotions experienced by others (Strauss, 2004; Toussaint & Webb, 2005) and present them to be more empathic than men. A study conducted by Chaker & Zouaoui (2022) in the Tunisian context has shown that this skill has been of great utility for women working in the digital field, as they are closer to their clients compared to conventional commerce.

Another important finding of this research consisted of revealing that what makes the difference in the development of entrepreneurial intention is not gender but rather the learning and practice that is further enhanced through participation in extracurricular activities or the observation of an entrepreneur role model. In fact, entrepreneurship extracurricular activities, which encompass various actions, experiences, and innovative endeavours beyond the formal curriculum of higher education institutions, both within and outside university settings (Souitaris et al., 2007), play a valuable role as supplements to the formal curricular requirements in university education (Nguyen et al., 2021). These activities are specifically designed to encourage entrepreneurial initiatives and offer customized support to students' entrepreneurial interests and intentions in launching new ventures (Arranz et al., 2017). Similarly, role models play a crucial role in vicarious learning and career decision-making. Through the process of vicarious learning, individuals form cognitive evaluations of specific careers based on the reinforcement received from role models and the behaviours associated with such reinforcement (Scherer et al., 1989). Observational learning can serve as a motivating factor for individuals to pursue careers like those they have observed (Betz & Hackett, 1981; Mitchell & Jones, 1976).

Conclusion

This study provides valuable insights into the impact of entrepreneurship education on the development of entrepreneurial skills and values, particularly in the context of a crisis period in Tunisia. The findings reveal that practical-oriented entrepreneurship courses have a positive influence on the development of students' entrepreneurial skills and intentions, regardless of gender. Entrepreneurship education with a focus on practical application enhances the antecedents of entrepreneurship and fosters a stronger ESE and resilience among students. Additionally, the study highlights the significance of empathy in entrepreneurial development, with women exhibiting higher levels of empathy compared to men. The results also support the notion that engaging in extracurricular activities and having role models play a pivotal role in shaping entrepreneurial behaviour and intentions, with gender playing a less significant role. Overall, this study underscores the importance of practical-oriented entrepreneurship education and the role of extracurricular activities and role models in cultivating entrepreneurial skills and fostering entrepreneurial intentions, particularly in the context of a crisis.

Our study has four main implications for universities. When implemented, universities can foster a culture of innovation, bridge gender gaps, and prepare students for entrepreneurial success through practical-oriented entrepreneurship courses. Firstly, universities need to emphasize the importance of designing these courses that provide hands-on experiences and real-world applications to develop entrepreneurial skills and intentions among

students. Secondly, universities should actively promote and support extracurricular activities that enable students to engage in entrepreneurial initiatives and interact with role models (Arranz et al., 2017; 2018). Thirdly, creating an inclusive environment and nurturing skills such as resilience and empathy are crucial. Universities can enhance ESE by providing mentorship, networking opportunities, and experiential learning. Finally, incorporating emotional intelligence and empathy into entrepreneurship education can help students better understand and connect with stakeholders.

Recommendations

No study is without limitations, and this study is no exception. One limitation is that the sample is restrained to students from the Faculty of Economics and Management of Tunis, which may restrict the generalizability of the findings to all Tunisian students. Additionally, the responses are based on students' perceptions of their entrepreneurial skills and intentions after completing the practical-oriented entrepreneurship course. It is important to consider that other factors may contribute to the development of these skills and measuring these competencies before and after the course could provide further insights into their impact. Furthermore, an important aspect for future research is to investigate the potential interaction between these skills and entrepreneurial intention. Understanding how these skills and intentions interact can provide a more comprehensive understanding of the entrepreneurial process.

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Space, Time, and Architecture: Exploring the Urban Narrative of Jakarta

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Abstract: The interplay between literature and architecture as a current significant issue in literary criticism and architectural science has recently much to do with our past and present lives. While some architecture scholars employ literary works to inspire the constructions of people's abode and environment, literary critics use literary works to represent the magnificence or the shortage of such lives. This article shows how urban fiction can function as a social criticism of the contemporary architectural environment in cities and how city dwellers look at it. The subject was investigated mainly by analyzing Ahmad Tohari's short story 'Anak Ini Mau Mengencingi Jakarta?' through the concepts of estrangement, naturalization, and social critique to represent one of the multiple faces of Jakarta City in the 2010s. To uncover the application of such ideas, the researchers employ a qualitative approach and textual analysis of the story as a primary data source supported by secondary sources referenced from the history of worldly architecture. Theoretically, the study uses the amalgamation of literary structuralism and architectural concepts of spaces. The results indicate that realist fiction draws on human history and works on our mundane architecture of life in a peculiar, natural, and critical process, providing us with an imaginative truth of what human-built surroundings might or should look like.

Introduction

The acts of caring and paying attention on social, environmental and cultural sensitivity have been the focus of those interested in rural and urban areas either by literary scholars, linguists, and historians. Human attention on nature and society has been among their concerns for the world's security, including cultural disasters (Oktavianus et al., 2025) and flood calamity (Ferdinal et al., 2025), and cultural capital (Ferdinal et al., 2025). People's sensitivity towards rural environments and human safety has evolved for a long time (Nopriyasman et al., 2024) as well as their mutual aids

(Nopriyasman et al., 2025). Within the framework of diverse and interdisciplinary urban studies (Wolman et al., 2024), cities like Jakarta offers a dynamic life to those with various life activities and those with goals and expectations (Cybriwsky & Ford, 2001). The city provides physical and imaginary experiences to those who come into contact with the metropolis, both residents, authorities and migrants. With space and time at its disposal, the city offers a narrative of urban life that is thematically, linguistically and historically joyful and distressing. The city's architecture, built and shaped over time, has inspired some Indonesian writers to put the city's architecture into words. The city's spaces have become an essential element for writers to portray the city in the world of urban fiction (Tempo, 2013). Regarding the issue, this article argues that some writers, including short story authors, use short fiction to critique the social, political and cultural practices among city dwellers to question the policies made by the authorities regarding their surroundings, by employing concepts such as estrangement and naturalization to deliver their messages to the city stakeholders.

In literary studies, space, time, and architecture are seen as elements that build literary work as a place, time and social setting (Ameel, 2023). For example, in light of the city of Jakarta, readers can read works that emphasize social issues colored by the setting, such as Jakarta in the eyes of Seno Gumira Ajidarma (Fuller, 2010; 2017), Jakarta and the desires of its people in films (Paramadhita, 2011), Jakarta with its diverse people living in this city (Mahdiati et al., 2023), and Jakarta as a teaching material (Febriani, 2019). Some studies concentrate on social issues, such as violence in the works of Seno Gumira Ajidarma (Tempo, 2013), Jakarta with women's rights issues in Kompas short stories (Ferdinal, 2013; 2020; 2021), and the social dynamics of urban Jakarta (Nurfadillah, 2024).

How do scholars see space, time, and architecture in urban fiction? The relationship between space, time, and architecture in fiction has become an important issue in literary criticism, especially in the context of big cities such as Jakarta (Yetti & Mujiningsih, 2021). A number of studies in recent years have shown that urban fiction is understood as one of the spaces in the form of discourse that can describe the dynamics of urban social, political, and cultural life, such as domination, submission, and cooperation between one group and another. These studies combine elements of space and time to depict the transformation of architecture and urban space over time in literary narratives. This kind of fiction, of course, is not only for artistic purposes but is also used as a channel to criticize government policies that are considered inappropriate in making urban architectural governance. Two of the many highlights are the application of the concepts of estrangement and naturalization to society.

Levy (1978) argued that urban literature deals with writing representing the changing function of the city. Literature may represent places (architecture) from physical, sociological, and psychological dimensions (Sabahy, 2018). Social criticism is one of the channels used by many parties, including writers in providing input to the authorities and literacy to readers on the importance of the social environment of society, especially cities colored by capitalism issues. In the context of cities, people are expected not only to act as members of society who live their lives regardless of space and time but also who need to pay attention to and influence the spatial layout of the city. Karl Marx (1978) has philosophically given birth to his critical thoughts on the capitalist economic system, especially the relationship between workers and the results of their labor. For him, the capitalist system applies various means to separate people from their lives, including the concepts of alienation and naturalization. Adorno and Horkheimer (2002), for example,

understood that the culture industry helped strengthen the dominance of capitalism by making people symbolically dominated and socially uncritical.

In the study of capitalism, the concept of estrangement (alienation) can be used to understand social dynamics in society (Jameson, 2019). Marx (1978) argues that alienation is a condition in which people are separated from what they do. The work they do is for the benefit of other groups. This concept does not recognize what is produced, how the goods are produced, and what potential they have in the process of producing these goods. Workers simply do the work to survive and have no social connection to the community and the reality of their lives (Lukács, 1971). Besides alienation, another concept that strengthens capitalist power is naturalization. Through this concept, capitalists internally shape people's beliefs that what they experience is natural and unquestionable. Bourdieu (1991) says that this symbolic domination is used by capitalists to form a belief in society that the social construction that is carried out is natural and permanent. This illusion is instrumental in creating a feeling that the oppression they experience is not intentional, even though they are detached from life tasks, social life, and personal life problems.

Social criticism emerges as a response to the processes of alienation and naturalization. It aims to expose the power structures hidden behind the existing social order and raise people's awareness of the injustices they face. Adorno & Horkheimer (2002), for example, in their critical theory, criticize the culture industry that normalizes consumerism and capitalism, making people passive and uncritical. Mass cultural products are used to distract people from real problems, thus strengthening the capitalist system. With social critique, individuals are encouraged to be more aware of their social reality and understand that they have the power to challenge existing power structures.

Overall, the concepts of alienation, naturalization, and social critique are intertwined in an effort to understand the dynamics of power in modern society. Alienation describes how individuals are disconnected from their work and social environment, while naturalization makes these conditions seem natural and unchangeable. However, through social critique, these power structures can be exposed and questioned, opening up opportunities for more equitable social change. As such, these theories provide an important framework for analysis and action in the face of social injustices happening around us.

Research Methods

This study is qualitative research (Bryman, 2016) with literary text analysis as the method to investigate the depiction of space, time, and architecture portrayed by writers in literary works about Jakarta. This study aims to understand the symbolic values contained in urban narratives and the elements used to introduce these values to depict the sociocultural reality in Jakarta. The analysis focuses on the story 'Anak Ini Mau Mengencingi Jakarta?' (AIMMJ) as a case study by applying the theory of social criticism to urban narratives and the theory of urban architecture with the concepts of estrangement and naturalization. The main data of this study is the story AIMMJ by Ahmad Tohari, which depicts the differences between the lives of informal and formal workers, as well as the architecture and social dynamics that wrap their lives in one corner of Jakarta. Supporting data is taken from other sources, including several literary works that depict the city of Jakarta with all the dynamics considered representative of the depiction of sociocultural life in Jakarta. The primary data sources in this study are fictional urban Jakarta texts that depict city

life, architecture, and social dynamics in them. The selection process is done by choosing works that explicitly contain descriptions of architecture and urban space and integrating the temporal dimension as part of the narrative. As suggested by Flick (2018), in qualitative research, the selection of text samples is made based on thematic relevance, not on the number of works. The works analyzed include novels and short stories that have gained attention in the urban literature scene and are considered to represent the complexity of urban life in Jakarta.

The method of analysis involves a thorough reading of the story by utilizing theories of social criticism, and concepts of estrangement and naturalization to investigate the architectural motifs of the city in time and space. This method follows the thematic analysis guidelines created by Clarke & Braun (2017). This method identifies key themes based on their consistent occurrence in the story and analyzes them contextually. The analysis aims to connect the descriptions of architecture and urban space with the temporal dimension, as well as how they contribute to identity formation and social dynamics in the story. As explained by Dovey (2016), each emerging motif was identified and linked to Jakarta's social and cultural context. This research emphasizes the importance of understanding how urban architecture interacts with social dynamics.

Results and Discussion

Urban life of Jakarta in Indonesian fiction

Jakarta has become a magnet for some Indonesian writers interested in city life representations. The urban life of Jakarta has inspired them to write and criticize such a life. Writers with national acclaim, such as Muchtar Lubis, Pramoedya Ananta Toer, Putu Wijaya, and Ahmad Tohari, and contemporary writers were influenced by the hustle and bustle of the metropolitan. They understand Jakarta as a problematic urban space with a daily and realistic perspective (Tjahjani, 2020). They write about how time, space, and city architecture have painted their minds and horizons. Ahmad Tohari's 'Anak Ini Mau Mengencingi Jakarta?' (AIMMJ) was chosen as an example to represent such hopes. Unlike the short story Hasan Aspahani's 'Penumpang ke Bogor dan Arisan Terakhir' (2023), which tells of an *ojol* driver remembering stories he gathers from his passengers, AIMMJ does not specifically narrate a character with specific professions. Instead, it depicts some occupations. Other stories such as Iwan Setiawan's 'Gender Equity' (2006), Seno Gumira Ajidarma's 'Jakarta Suatu Ketika', 'Potret Jakarta Waktu Malam' were more politically oriented, as compared to stories by Muctar Lubis's 'Senja di Jakarta' and Pramoedya Ananta Toer's 'Ikan yang Terdampar.' Febriani (2019) argued that the expression "mengencingi Jakarta" (to urinate on Jakarta) is a metaphorical expression that implies frustration, insult, or indifference towards the city of Jakarta as a symbol of power, modernity, or the hustle and bustle of big city life. Ahmad Tohari's fiction AIMMJ can be read as his attempt to make Jakarta a space of criticism. He portrays Jakarta as a city full of paradoxes, with modern architecture that reflects injustice and social alienation. By taking one corner of the city's life, namely the life around Pasar Senen train station at dawn, he depicts the difference between those who travel far by train and the marginalized people who live on the edge of the railroad tracks. Tohari does not paint Jakarta with skyscrapers or the lives of the upper class in hotels or big offices, but he presents the contrast between the middle class and the lower class. He mentions characters such as drivers, conductors, waiters, and passengers of various types, including men, women, and children, with all their behavior and mannerisms. On the other hand, Tohari paints the life of the railroad people with their lifestyles and lives, such as small sellers and odd-job workers. To learn how Tohari did it, this writing is organized into three main parts, namely Jakarta as a space

for social criticism in the 2010s, how this criticism targets the issue of alienation due to capitalism, and how the issue of naturalization of fate is made the basis for building this big city.

Jakarta as a space for social criticism in the 2010s

Within the argument that urban fiction is a social criticism (Smith, 2018), Some Indonesian fiction represents urban condition in Indonesia (Ayuningtyas & Kariko, 2022). In AIMMJ, Tohari makes the city of Jakarta a space for fictional criticism of the issues of alienation and naturalization in Jakarta's architecture, as depicted by scholars, including Alice Munro (Ciompi, 2018). He depicts the alienation of urban people in the face of architecture that no longer functions as a communal space but as a tool of power and capitalism. The spotlight chosen by Tohari is on those who live in slums and poor architecture, specifically the Pasar Senen railroad suburbs. As with many big cities in the world, for several writers, Jakarta is portrayed as the capital of Indonesia and as the center of life for various types and layers of people living in different social conflicts. The city is a space that reflects the dynamics of power relations between the government and the people, capital owners and workers, the rich and the poor, and residents and migrants. These power relations affect the lives of marginalized citizens, such as the poor, the unemployed, casual workers, small sellers, and the homeless. Urban fiction about Jakarta is often used to criticize the social injustice arising from government policies that are less favorable to the dominant groups. AIMMJ more specifically critiques the issues of estrangement and naturalization of fate in relation to the government's relationship with the marginalized, the haves and have-nots, regular workers and casual workers, the lives of the homeless, and small sellers and those who eke out a living on the side of the road.

Estrangement of the marginalized and the creation of naturalization

'Anak Ini Mau Mengencingi Jakarta?' in line with other similar fiction, depicts a city government that is not in favor of the common people. The development of the city is more directed toward the development of large infrastructure, such as transportation with its people and facilities in the Pasar Senen railway station area and its surroundings (Antara, 2015). By depicting one corner of Jakarta at dawn, Tohari raises the issue of the 'estrangement' of the lower-class citizens from their environment and the issue of symbolic 'naturalization' by the citizens of a life that seems to be natural and not the result of wrong policies. The government's development accommodates the needs of the upper and middle classes. It pays less attention to the lives of the small people. Tohari uses a binary opposition between the people who live ' 'in the area of life of people on the edge of the railroad, such as fathers, mothers, and their little boys' (p. 357), and those on the journey, ' 'drivers, conductors, passengers from various walks of life such as the rich, women, children' (p. 356). This story echoes other stories about Jakarta, as mentioned above. These works deliver thoughts of Indonesian people who voice the government's indifference to the fate of the city's homeless people.

Similar to the mentioned narratives, AIMMJ protests against the government's policy, which seems more concerned with the needs of the upper/middle class, which needs transportation services from one station to another in this metropolis. Economic development is centered on this group and negates the interests of the underclass. With the metaphor of spectacle, Tohari compares the two classes watching each other's presence. Are the middle and upper

classes watching the lives of the marginalized or vice versa? The upper or middle class sees this scene as an attempt at alienation, while the lower class sees it as natural.

> Kereta itu berhenti di wilayah kehidupan orang- orang pinggir rel. Kehidupan yang sungguh merdeka dan berdaulat, sedang mulai bergerak. Tetapi, sebagian besar mereka masih terbaring dalam gubuk-gubuk kardus yang menyandar ke tembok pembatas jalur- jalur rel. Ada yang hanya tampak kaki, dan tubuh mereka terlindung di bawah atap sangat rendah lembaran rongsok. Dan di sebelah kanan   rangkaian   kereta, di balik semak yang meranggas dan berdebu, seorang lelaki dan anak kecilnya sudah bangun. Di dekat mereka ada perempuan masih tertidur, berbantal buntalan kain melingkar di atas gelaran kardus. (p. 357)
>
> (The train stopped in the area where the people were living on the tracks. A truly free and sovereign life was on the move. However, most of them were still lying in cardboard shacks leaning against the parapet of the railroad tracks. Some had only their feet visible, and their bodies were sheltered under the very low roofs of scrap sheets. And to the right of the train, behind a deciduous and dusty bush, a man and his small child were awake. Near them, a woman was still asleep, propped up in a bundle of cloth on a cardboard deck). (Translation by authors)

The quote portrays a symbolic contrast between the movement of the train, which symbolizes freedom and progress, and the commonplace lives of people living on the poverty line along the train tracks, highlighting their struggle to struggle for dignity and survival amidst societal neglect and governmental ignorance.

Tohari, through this short story, paints the architecture of one corner of the Pasar Senen railway station by highlighting the public space that shows the gap between the rich and the poor. This is compared with Annisa Moezha's 'Cara Kerja Kerumunan,' which exposes the pride and happiness of a poor person. The upper middle class is depicted with comfort and advantages in life, while the poor are depicted as living on the outskirts of the railroad with a shabby space, sleeping on cardboard and in hunger, without valuables and surviving on a pack of instant noodles in the morning, and living on the streets. Tohari shows how the rich can enjoy public facilities while the poor are marginalized by circumstances and alienated from Jakarta's luxury and comfort. In other words, this metropolitan city comes with a capitalist ideology that accommodates a handful of wealthy citizens with station facilities, trains, and all the services needed while traveling. On the other hand, there are groups of lower-class citizens who languish, suffer, and even starve, whose territory is only limited by the station walls. Helplessness and poverty require them to accept their fate as natural and no one's fault.

> Di tangan kanan laki-laki itu ada sebungkus mi instan. Di warung kopi seberang   jalan,   sudut bungkus mi disobek dengan hati-hati sekadar untuk membuat lubang. Saset-saset bumbunya dikeluarkan. Lalu disodorkan selembar uang ribuan kepada perempuan warung yang segera mengambil termos dan membuka tutupnya.(p. 357)
>
> "Pa, lapar, lapar!"
>
> "Bapa bilang, tunggu. Ini masih panas." Kata si ayah. Dia berhenti mengayun-ayun sulur mi itu, ganti meniup-niup dengan mulutnya yang monyong. Anaknya terisak tetapi entahlah, dia bangkit berdiri. (p. 359)

(In the man's right hand was a packet of instant noodles. At the coffee shop across the street, the corner of the noodle wrapper is carefully torn off to make a hole. The sachets of seasoning are taken out. Then, a thousand-dollar bill is handed to the woman at the stall, who immediately grabs a thermos and unscrews the lid.

"Pa, hungry, hungry!"

"Father said, wait. It's still hot." The father said. He stopped swinging the noodle vine and blew on it with his gaping mouth. His son sobbed, but he got up). (Translation by the authors)

The quoted passage decorates a touching note between a father and his kid, which highlights the father's efforts to feed his child's hunger despite the poverty they encounter. It illustrates the thematic issues of care, patience, and the struggle for survival in a capitalistic surrounding.

This short story also highlights the architecture of the workspace between permanent and casual workers. This fiction can also be read as a social critique of the injustice of the urban workplace. What happened in Jakarta is a universal phenomenon as it takes place everywhere, even in America (Ferdinal, 2022) and by the pilgrims to Mecca (Ferdinal et al., 2023). Tohari shows how 'paid' workers such as train drivers, conductors, and waiters perform their routines in serving passengers from diverse backgrounds, such as those with good looks, women, and children. On the other hand, he describes workers who live in deprivation and uncertainty by relying on daily work to survive daily (Hasyim et al., 2022). Tohari wrote about paid jobs such as machinists, conductors, and waiters.

Meanwhile, 'casual' workers include night workers and small sellers. Tohari shows the relationship between these two groups of workers, which suggests the issues of injustice and inequality. The non-formal workers are portrayed as marginalized people who must continue to struggle to live in an informal work environment without job security and safety. Tohari suggests that the marginalized are expected to perceive injustice and inequality as common happenings and each group of community should accept them as destinies they need to live with. He suggests that the issues are natural and all communities should go on with their errands, without complains.

Disana, pintu terdekat kereta api sudah terbuka. Ada satu kondektur dan satu penumpang berdiri tegak.
Mereka berasa menonton pentas dari alam yang berbeda. Kemudian kedua laki-laki itu merapat ke sisi-sisi yang berlawanan untuk memberi jalan kepada orang ketiga yang ingin muncul. Orang ketiga adalah gadis pramusaji yang camntik seperti pramugari.
"Mari kita pergi, "kata si ayah kepada ank dan istri atau apanya. "Di sini kita malah jadi tontonan." (365-7)

(There, the nearest door of the train was open. There was one conductor and one passenger standing at attention. They felt like they were watching a play from another realm. Then, the two men moved to opposite sides to make way for a third person who wanted to appear. The third person was a waitress girl who looked like a flight attendant.

"Let's go," the father said to his son and wife or something. "We're becoming a spectacle here.")
(Translation by the authors)

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Here, readers will find a fictional moment of observation as the family seems to live outside of their beloved city while they witness a peculiar interaction between a conductor, a passenger, and a waitress, who also see them from the train. The father realizes that he must urge his family to leave before they become the center of attention. The quote suggests the theme of alienation and the inconvenience of being both an observer of family and the observed in an unfamiliar situation.

The short story also talks about the lives of the homeless, one of the most vulnerable and extreme groups in cities, including Jakarta. While some writers depict smart city buildings (Wilson & Wyly, 2023; Boehmer, 2022), this short story describes an urban environment (Austin, 2020), where life along the railroad tracks in Jakarta (Artianti & Setiawan, 2021) and a family living on the edge of the railroad tracks of Pasar Senen Station (Astuti & Meiji, 2023), which symbolizes isolation for those who do not have access and ability to own a house. Poor economic conditions force them to live in public locations such as markets and stations. Homeless groups like this family are those who are portrayed as victims of government policies that are not friendly to marginalized people and deny them their rights as members of the Jakarta community who also have the right to housing. Structural violence makes them accept their fate without having to fight for the fundamental rights of the citizens of this capital city. This group is often seen as citizens of the city whose presence is not expected.

> Kereta itu berhenti di wilayah kehidupan orang- orang pinggir rel. Kehidupan yang sungguh merdeka dan berdaulat, sedang mulai bergerak. Tetapi, sebagian besar mereka masih terbaring dalam gubuk-gubuk kardus yang menyandar ke tembok pembatas jalur- jalur rel. Ada yang hanya tampak kaki, dan tubuh mereka terlindung di bawah atap sangat rendah lembaran rongsok. Dan di sebelah kanan rangkaian kereta, di balik semak yang meranggas dan berdebu, seorang lelaki dan anak kecilnya sudah bangun. Di dekat mereka ada perempuan masih tertidur, berbantal buntalan kain melingkar di atas gelaran kardus. (p. 357)

(The train stopped in the territory of the lives of the people of the railroad. A life that was truly free and sovereign was on the move. However, most of them were still lying in cardboard shacks leaning against the parapet of the railroad tracks. Some had only their feet visible, and their bodies were sheltered under the very low roofs of scrap sheets. And to the right of the train, behind a deciduous and dusty bush, a man and his small child were awake. Near them, a woman was still asleep, propped up in a bundle of cloth on a cardboard deck). (Translation by the authors)

The chosen passage depicts a conspicuous difference between freedom, which is symbolically expressed by the approaching train, and the saddening reality of the marginalized poor people living in poverty along the railroad. It highlights their struggles against poverty and inability to cope with mobility and opportunity, which alienate them. This juxtaposition emphasizes the ongoing hard times and lifetime financial challenges that the vulnerable populations face along the city's societal progress.

> Dalam satu menit ketiga warga pinggir rel itu berkemas. Si ayah mengambil satu kotak kardus kecil dari bawah semak berdebu yang meranggas. Si istri atau apa menyambar buntalan pakaian, dan si anak laki-laki usia lima tahunan mengambil harta kesayangannya berupa bekas antena kanopi

radio. Kemudian ketiganya bergerak melawan arah datangnya kereta api. Setelah agak jauh di sana

mereka tertawa- tawa. (p. 367)

(Within a minute, the three rail-side residents were packing. The father took a small cardboard box from

under a dusty, deciduous bush. The wife snatched a bundle of clothes, and the five-year-old boy took his

favorite possession, a former radio canopy antenna. Then, the three of them moved in the direction the train

was coming from. When they were some distance away, they laughed). (Translation by the authors)

In the passage, Tohari escalates a point when the family confronts urgency and resilience as they quickly grab their properties and go away from an approaching train. They finally have a sense of relief and safety in their shared experience. This quote underscores the themes of survival that often befall homeless individuals near public facilities and the importance of familial bonds in the face of danger, be they strangers, government officials or other persons in power.

Street sellers and those who make a living on the side of the road or the edge of public facilities are also highlighted in this short story. Behind the cruel city of Jakarta that is not friendly to those who are poor and have minimal abilities, this group shows their existence through perseverance and resilience in carrying out their profession as servants of the lower class, especially residents or workers who live in the periphery. They tirelessly serve the marginalized people who need their services and goods. Living side by side with small groups of people who struggle for sustenance on the street, these small sellers, including the street vendors (Widyaningrum, 2009) help support and extend their lives even though they are often not the target of government policies and those with capital but are the target of physical, social and symbolic violence. This group is portrayed as daily warriors who must work hard to survive in a city that does not give them enough space to participate fairly. This fiction opens the reader's eyes to how social, economic, and urban planning injustices penetrate the lives of these marginalized groups who have to work in the informal sector without social security, protection, security, and regular income.

Laki-laki itu bangkit , berjalan menyeberang menuju warung yang sepagi itu sudah buka,   bahkan sudah ada   dua penjaga malam duduk menghadapi gelas kopi mereka. (357)

"Pa, aku seperti anak yang di TV-nya ibu warung kopi, kan?" (361)

(The man got up, and walked across to the 'corner shop' that was already open that early, and there were even two night guards sitting with their cups of coffee.

"Pa, I'm like the kid on the coffee shop lady's TV, right?") (Translation by the authors)

The selected sentences depict a time of early morning life where the sentences highlight the man's observation of life near the station environment and the presence of others. They suggest a sense of the railway station community's routines and backyard secrets. Tohari's attempt to make a reference to the coffee shop lady's TV indicates a connection between the man's and his kid's experiences and broader cultural narratives, denoting their ignorance of other communities' socioeconomic differences. In summary, seeming natural does not always mean acceptance towards what the marginalized see, but they might feel alienated and indirectly protest against such imbalance of authority's treatment over different communities in the capital city.

Conclusion

Ahmad Tohari, through the story 'Anak Ini Mau Mengencingi Jakarta?' metaphorically critiques the different impacts of government policy on the use of urban space in Jakarta that cause frustration, insult, or indifference among the people of Jakarta as a symbol of power, modernity, or the hustle and bustle of big city life. It reflects a critical or rebellious attitude towards a social, economic, or political order considered unjust or repressive. Previously, Oktavianus et al. (2024), Revita et al. (2024), Sudarmanto et al. (2020), and Febriani (2019) have reminded readers that some writers use metaphors to express their ideas and criticism of what went on in societies, including those in Jakarta. The depiction of Jakarta in Ahmad Tohari's fiction as a complex city reflects social injustice, mainly through its modern architecture. The concept of estrangement and naturalization in fiction as is applied in the story is essential for understanding how urban residents experience alienation from their social environment while simultaneously being forced to accept the injustices legitimized by architectural development.

In literary works or popular culture, AIMMJ can be understood as a form of symbolic resistance against injustice, exploitation, or the feelings of alienation experienced by marginalized communities in the big city. As the capital and center of political and economic power in Indonesia, Jakarta often becomes a symbol of social inequality, the gap between the rich and the poor, or corrupt bureaucracy. Therefore, the act of "urinating" on this city can be interpreted as a rejection of all forms of injustice it symbolizes. Fictional works play an important role in critiquing the city's architecture by depicting marginal areas, such as the edges of train tracks, as symbols of social injustice. Settings that depict dilapidated architecture, characters living on the economic and social fringes of the city, and plots focused on their struggles against poverty and alienation all contribute to exploring the theme of injustice in urban spaces. Through this analysis, we can conclude that urban fiction, such as the works of Ahmad Tohari, plays a vital role in revealing and critiquing the processes of social injustice occurring within the context of contemporary urban development. Tohari's works depict how modern architecture in Jakarta symbolizes estrangement, where people are not only separated from meaningful social environments but are also forced to accept structural injustices as part of "natural" urban life.

Future Research

This study shows that fiction can be a powerful means of social critique regarding urban development and its associated patterns of injustice. Further research could explore how the concepts of alienation and naturalization can be applied to other literary works that also discuss urban spaces, particularly Jakarta, and how the representation of architecture in fiction can influence the public's perception of the city they inhabit.

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Research Trends of SDG Topics in Chemistry Learning: A Bibliometric Mapping Analysis (2015-2024)

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Abstract: The topic of sustainability in chemistry education has garnered increasing attention over the past decade, aligning with the global focus on the Sustainable Development Goals (SDGs). This study aims to identify research trends related to sustainability topics in chemistry education, commonly used keywords and variables in studies, and authors frequently contributing to sustainable chemistry education research and its implications. This research employed a review method with a bibliometric analysis of 201 articles on sustainability topics in chemistry education, retrieved from the Scopus database between 2015 and 2024. VOSviewer software was utilized to generate visual maps illustrating the relationships and research patterns in this field. The results indicated that sustainable development/sustainability, green chemistry, curricula, and systems thinking have been dominant themes over the past decade, with a significant increase in sustainable chemistry learning observed in 2020. Topics such as green chemistry, nanochemistry, laboratory instruction, and environmental chemistry play a pivotal role in advancing SDG-related themes integrated into learning. One notable contributor in this field is Ingo Eilks, who focuses on developing new methods and approaches in sustainable chemistry education. This study also delves into an analysis of key competencies for achieving Education for Sustainable Development (ESD), with systems thinking, collaboration, and problem-solving being the frequently employed variables for measuring these competencies.

Keywords: Chemistry Material, Future Trends, Sustainability, Systems Thinking, VOSViewer

Introduction

Recently, chemistry education has assumed a pivotal role in fostering sustainability awareness among students. The global emphasis on sustainability has intensified, particularly following the adoption of the United Nations' Sustainable Development Goals (SDGs) in 2015. In response to these developments, chemistry education is increasingly expected to incorporate sustainability principles, aiming to cultivate a comprehensive understanding of the chemical and societal impacts (Constable, 2020). Chemistry education is required to integrate sustainability principles to foster a deeper understanding of the impact of chemistry on the environment and human life, as well as to seek environmentally solutions (Beil et al., 2021; Eilks & Rauch, 2012). This not only supports the advancement of scientific knowledge but also fosters a collective awareness of the importance of sustainability in the future practices of chemistry education. For instance, green chemistry and the concept of energy in thermochemistry represent branches within the field of chemistry that prioritize sustainability, offering environmentally friendly alternatives in the use of chemicals (Fu & Wu, 2021; Solares-Briones et al., 2021).

Through various learning approaches integrated with sustainability topics, chemistry education is expected to offer innovative solutions to mitigate the negative environmental impacts of the chemical industry. Consequently, chemistry curricula have begun incorporating sustainability-related topics, aiming to educate a new generation of scientists to think more critically and responsibly about the global impacts of chemical use (Eaton et al., 2019; Shwartz et al., 2020). This shift necessitates deep and ongoing research within the context of chemistry education, supporting the global agenda toward sustainable development. Furthermore, such research must focus on the integration of chemical concepts with sustainability principles that can be applied in everyday life (Zidny & Eilks, 2020), ensuring that chemistry education is equipped to address future environmental and societal challenges (Chatel, 2020).

As sustainability gains increasing attention, research trends in the field of chemistry education have also undergone significant changes. Various studies have begun to focus on integrating sustainability concepts into chemistry education at different educational levels. The use of innovative ICT-based teaching materials in chemistry learning (Munzil & Rochmawati, 2021; Rahayu, 2017; Ramadhan et al., 2022), friendly experiments (Santoso et al., 2021), and the integration of socio-scientific issues (Rahayu, 2021; Sulistina & Hasanah, 2024), which incorporate science and social issues in teaching, have become central to the development of sustainability-oriented chemistry education curricula (Kiwfo et al., 2021; Whalen et al., 2022). Students are not only expected to understand chemistry concepts theoretically but also to apply them in efforts to maintain ecosystem balance and address environmental challenges (Burmeister et al., 2012). Therefore, an analysis of these research trends is crucial to understanding the extent to which sustainability concepts have been integrated and their impact on the quality of chemistry education globally.

The bibliometric approach has become an effective tool for analyzing research trends across various scientific fields, including chemistry education. Through bibliometric analysis, research can identify publication patterns, influential authors, institutions, and countries that have made significant contributions to the advancement of the field (Allen et al., 2009). Moreover, bibliometric analysis can reveal international collaborations and the most frequently discussed research topics, providing a comprehensive mapping of the research landscape within a particular field (Xu et al., 2017). In the context of chemistry education, bibliometric analysis can offer valuable insights into the development

of sustainability-related research. Additionally, the findings can assist educators in directing their research focus to align more closely with the goals of sustainable development in the future of chemistry education.

This study aims to analyze research trends related to sustainability topics in chemistry education over the past decade (2015-2024) using a bibliometric approach. By analyzing 201 articles sourced from the Scopus database, this research explores publications, authors, journals, and countries that have played a significant role in sustainability-related research in chemistry education. Additionally, this study identifies frequently used keywords. The findings from this research are expected to provide insights into the future direction of research and how sustainability topics can be further integrated into chemistry education. With a deeper understanding of these trends, researchers and educators can collaborate more effectively to create innovative, relevant, and impactful learning programs that contribute positively to global sustainability.

This study is also provided a framework for the development of chemistry education curricula that support the achievement of the SDGs, particularly in the context of reducing environmental impacts and enhancing the quality of chemistry education in the future. The variables in the bibliometric mapping analysis are limited by the results generated through the VOSViewer software. The study aims to uncover the necessary factors by exploring research trends in chemistry education over the past ten years and analyzing the bibliometric mapping of related articles. Through comprehensive bibliometric mapping, we hope our findings will offer valuable contributions to researchers studying sustainability topics in chemistry education. Furthermore, this research is expected to serve as a useful reference for future researchers. The research questions addressed in this study are:

1. How does the bibliometric map analysis of the 201 selected articles appear?
2. What are the frequently used keywords in articles on sustainability topics in chemistry education?
3. When did the topic of sustainability in chemistry education develop and become widely researched?
4. What types of materials are used for applications related to sustainability topics in chemistry education?
5. What variables are investigated in articles on sustainability topics in chemistry education?
6. Who are the most contributing authors in articles on sustainability topics in chemistry education?

Method

Article selection process

This research employs the bibliometric method, which aims to analyze and evaluate the scientific literature related to the researched topic. By utilizing statistical techniques and network analysis, bibliometric methods can identify trends, patterns, and relationships among publications, thus providing in-depth insights into the developments and contributions of research (Donthu et al., 2021). Articles related to sustainability topics in chemistry education over the past decade were identified through a search in the Scopus database. Scopus was selected due to its comprehensive access to high-quality, indexed journals (Baas et al., 2020). The time frame for the research was limited to the years 2015 to 2024 in order to obtain the most relevant and recent publications. The language of publication was restricted to "English," and the document type was limited to "journal articles" to ensure consistent data quality. The keywords utilized in the search process included "sustainability," "chemistry," "learning," "education," and "SDGs topic,"

employing the advanced search feature. The initial search yielded 201 articles relevant to sustainability in chemistry education.
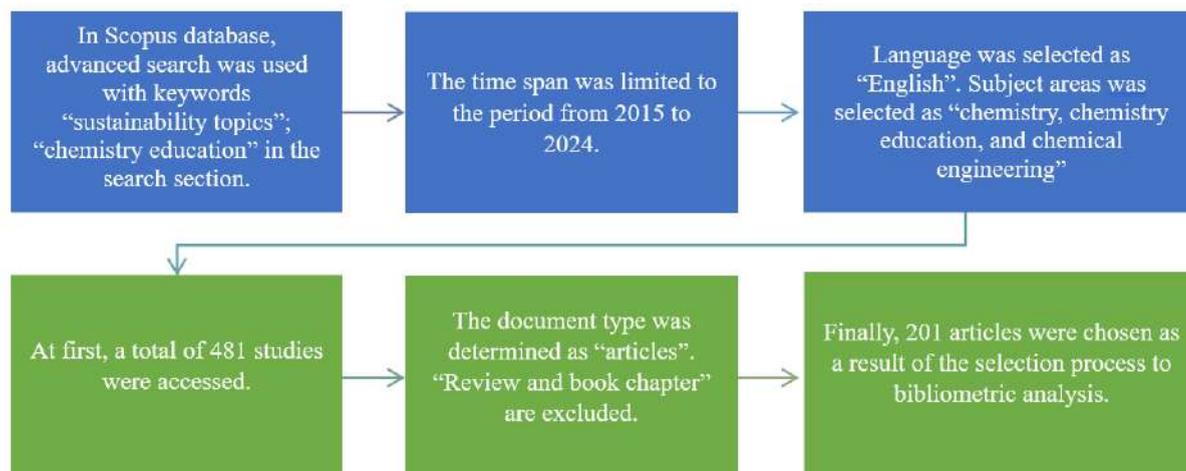
Fig. 1. Article selection process for this study

Bibliometric mapping analysis

To conduct the bibliometric mapping analysis, the selected literature source is Scopus. Utilizing the search function, the keywords entered include "sustainability" and "chemistry education" in the topic section, along with various commonly used terms such as: "sustainable topics in education" OR "sustainable in chemistry" OR "sustainable learning" OR "sustainability content in chemistry" OR "sustainability class" OR "sustainability laboratory" OR "sustainable development goals in chemistry learning" OR "SDGs in chemistry education." A total of 201 published articles that met the search criteria were identified. Subsequently, all complete records and cited references were downloaded in RIS format and uploaded into the VOSViewer program. The bibliometric mapping analysis includes articles published over the past decade (2015-2024). In addition to systematically analyzing and visualizing bibliometric data, VOSViewer also performs author analysis and maps collaborations among researchers based on the number of co-publications, thereby enabling the identification of collaboration networks among authors or institutions. With its ability to generate clear network visualizations, VOSViewer facilitates understanding of patterns and structures within complex literature.

Data coding and analysis

In this study, coding data and bibliometric analysis were utilized to generate network visualizations of the most frequently used keywords, as well as to analyze the terms present in the abstracts, citations, and co-citations of the analyzed articles. The data analysis procedures were conducted by a research team consisting of four members: two master's students, one PhD holder, and one professor, who collaboratively studied and discussed the data throughout the content analysis process. As a result of this process, descriptive statistics were applied to analyze and present the findings obtained, enabling a deeper interpretation of the trends and patterns that emerged from the analyzed data.

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Results and Discussion

The results of the bibliometric analysis were conducted to explore the landscape of sustainability topics (SDGs) in chemistry education. In line with the increasing emphasis on the SDGs which are targeted to be achieved by 2030, this bibliometric study discusses the main trends, influential publications, and geographical distribution of research contributions. The visual map generated by the VOSviewer software illustrates the relationships and patterns that emerged in this field in the span of 2015 to 2024. An in-depth discussion of the most cited authors, leading journals, and dominant keywords with the topic of SDGs and chemistry education highlights the significant impact of shaping the future framework of chemistry education.

Bibliometric mapping analysis

Most used keywords of SDG topics in chemistry learning

To create a map based on text data for the most used keywords, VOSViewer's analysis on the "*co-authorship, keyword co-occurrence, citation, bibliographic coupling*" option is selected. The files that have been exported from the Scopus database are the form .RIS, then the VOSViewer menu that is selected next is the "*reference manager files" option*. Furthermore, in the analysis type menu, there are 2 options, namely "*co-authorship*" to create a visual map related to *the author* in the article being analyzed, and "*co-occurrence*" to create a visual map related to what *keywords* are often used in the article being analyzed. The minimum number of keyword occurrences is set as 3 and the number of keywords to be selected is automatically set as 5. The map illustrated in Figure 2 shows that there are a total of 121 *keywords* that are frequently used in articles. The visual map also shows that there are 6 clusters and the most used keywords are '*sustainability*' (f = 218) and '*sustainable development*' (f = 195), '*chemistry education*' (f = 128), '*curricula*' (f = 122), '*green chemistry*' (f = 266), and '*systems thinking*' (f = 169).

The analysis of keywords that are most often used in research abstracts is important to understand the trends and focus of studies in the context of continuing education development. These keywords not only reflect the interests of researchers, but also describe the challenges faced by the world of education in dealing with global issues, such as climate change, social inequality, and rapid technological developments (Ashida, 2023). These results show that the articles mostly focus on sustainability topics (SDGs) in chemistry learning. It can be seen that studies on the topic of *sustainability* in chemistry education began to grow in number in 2020, although the first study was published in Scopus much earlier, that is, in 2002. When the distribution of the number of articles using keywords per year is displayed, it can be seen that the most recent articles in the field of chemistry education focus on *learning green chemistry*. The distribution of the number of articles per year is presented in Figure 3.

Fig. 2. Most used words found in article abstracts

Based on the bibliometric map in Figure 2, it was found that the most researched topic was "green chemistry". Furthermore, the topic of green chemistry is widely connected with other topics trends such as sustainable development, curricula, and engineering education. This shows that the topic of green chemistry is not only seen as an environmentally friendly chemical approach, but as an integral part of broader sustainable development efforts (Chen et al., 2020). In addition, some topics relevant to green chemistry include chemical education and life cycle, which shows that many studies focus on the impact of chemical products throughout their life cycle, from manufacture to disposal. This approach is important to minimize waste and increase efficiency in the use of natural resources, which is in line with the sustainable development goals that must be achieved by 2030.

Furthermore, in the context of education, topics such as student-centered learning and problem-solving show a trend towards a more interactive and student-oriented pedagogical approach to understanding the implications of sustainability in chemistry. This is an effort to produce a generation that cares more about the environmental impact of chemical products and processes. Green chemistry is the center of attention in sustainability-related research in the field of chemistry (Obaideen et al., 2022). Its close relationship with a variety of other sustainability topics shows that this approach is not only scientifically relevant, but also important for encouraging a more environmentally conscious society through education, research, and the application of environmentally friendly technologies. The results of the bibliometric analysis also produce SDGs trends in chemistry education in the range of 2015 to 2024 which are visualized in Figure 3.

Based on the image above, it can be seen that the topic of sustainability has been of concern to researchers in chemistry education and has shown an increase in recent years, especially in the period 2020 to 2024, which is marked in yellow on the bibliometric map. The increase in research on the topic of SDGs in the field of chemistry education in this

period indicates a higher global awareness of the importance of education that supports the achievement of sustainability goals. As attention to the SDGs increases after 2020, researchers are also starting to highlight more inclusive and innovative approaches to learning, such as computer-based learning and hands-on learning. Furthermore, research at the undergraduate education level also plays an important role in promoting SDGs integrated learning.
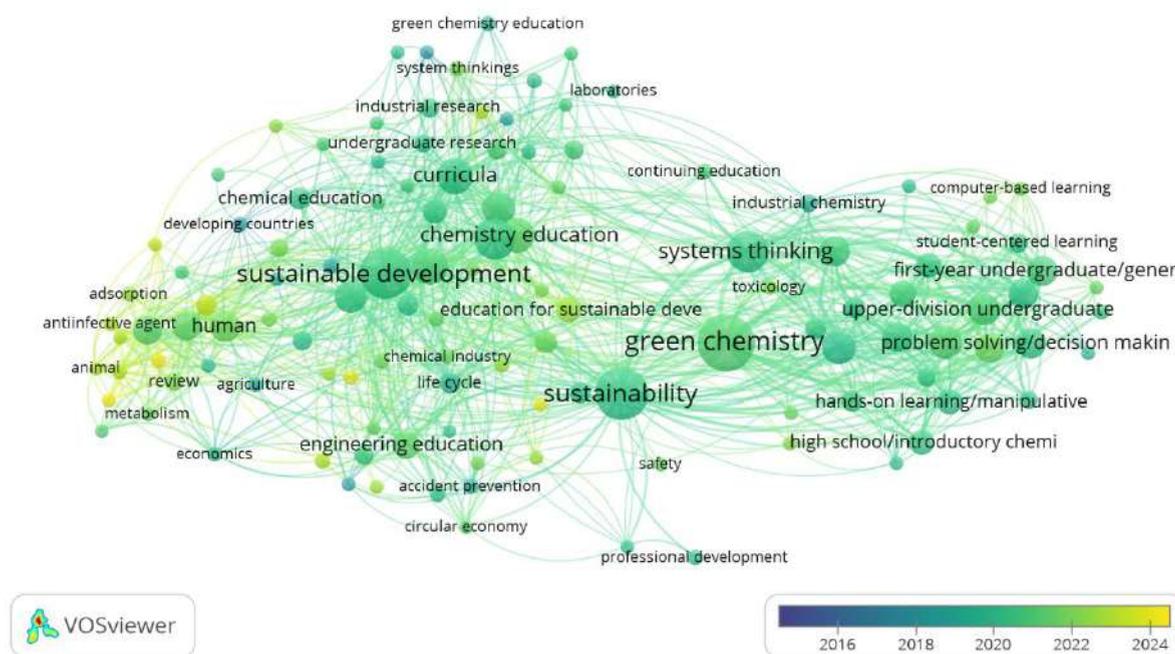
Fig. 3. Distribution of most used words in article abstracts by year

The existence of a learning approach that is integrated with the SDGs topic shows efforts to develop students' critical thinking skills and understanding of sustainability issues through learning methods that are relevant to today's needs (O'Neil et al., 2021). From the bibliometric map, it can be concluded that from 2020 to 2024, there has been a significant surge in research related to the SDGs in chemistry education. This trend emphasizes the importance of education's contribution in shaping students' awareness and skills on global issues, especially those related to sustainable development goals. Therefore, chemistry education plays an important role in preparing a generation that not only has scientific knowledge, but also high environmental awareness and commitment to sustainability.

Most types of chemistry materials related to sustainability topics

The topic of sustainability has become a major concern in chemistry education, as seen in the bibliometric analysis shown in Figure 4. Green chemistry occupies a central position as the material most often associated with continuing education in the field of chemistry. Green chemistry teaches principles of environmentally friendly chemistry that lead students to an understanding of how chemical products can be designed in an environmentally friendly manner. This approach emphasizes the importance of education and the application of green chemistry in various aspects such as industry, higher education, and school curricula (Zuin et al., 2021). This is in line with the goals of modern chemistry education which seeks to instill environmental awareness among students and introduce safer chemical

practices for the ecosystem.
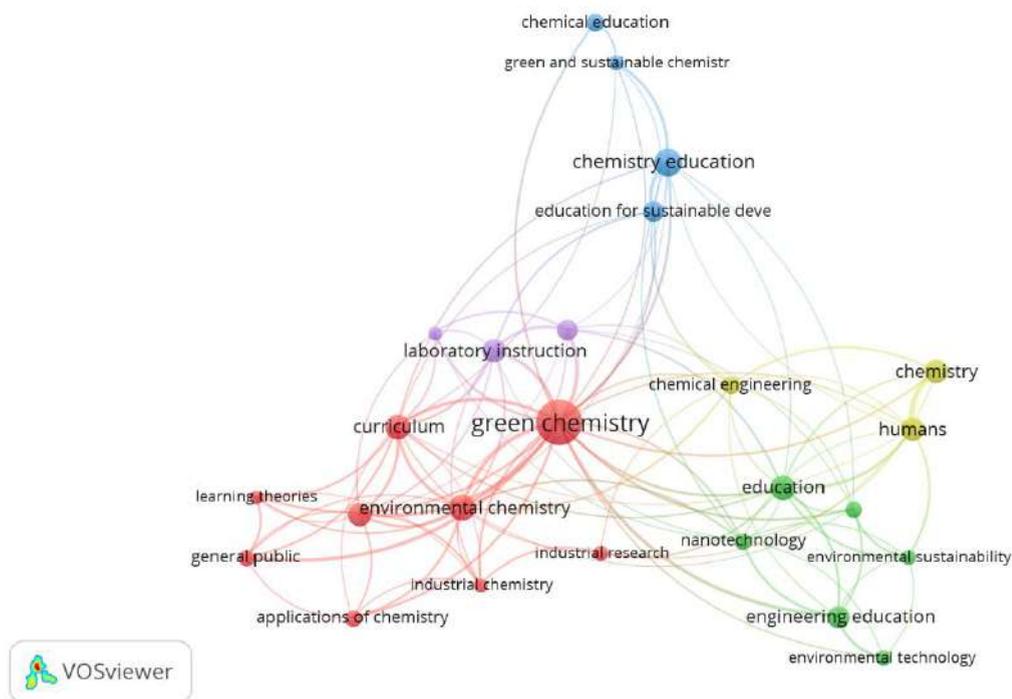
Fig. 4. Trends of SDG topics in chemistry
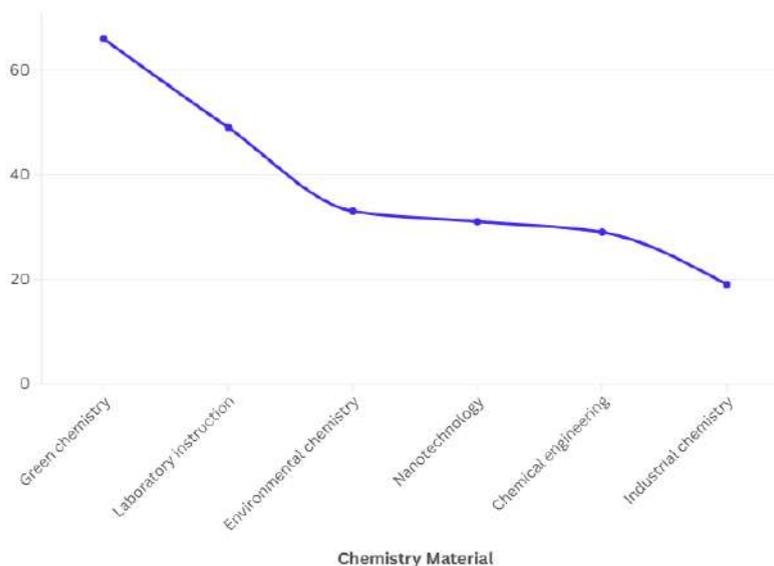
Fig. 5. Number of chemistry material related SDG topics

Green chemistry is a field of study that aims to design chemical products and processes that reduce and form harmful substances (Kurniawan et al., 2021). Furthermore, green chemistry material is very closely related to the concept of sustainability, considering that the goal is to reduce negative impacts on the environment. In addition to green chemistry, various other topics such as environmental chemistry, chemical engineering, and nanochemistry are also part of chemistry education efforts that focus on sustainability. Environmental chemistry discusses the impact of

chemicals on the environment as a whole, from pollution to the life cycle of chemicals in nature (Khare et al., 2023), while chemical engineering provides knowledge on how to design more efficient and environmentally friendly chemical processes (Anastasiou, 2024). This interdisciplinary approach integrates aspects of chemistry, engineering, and the environment that create a holistic understanding in students of the role of chemistry in dealing with global sustainability issues. The predominant SDG topics in chemical materials are shown in Figure 5.

In addition, nanotechnology also has strong relevance in sustainability-based chemistry curricula. Nanotechnology allows the development of new materials and technologies that are more efficient in the use of resources and energy, as well as offering practical solutions to environmental problems through technological innovation (Baig et al., 2021). The application of these topics in chemistry education allows students to learn and develop critical, collaborative, and problem-solving skills that are relevant to real-world challenges. Through this integrated approach, chemistry education not only teaches theory, but also prepares students to become scientists and professionals capable of contributing to sustainable development. Some of the materials in chemistry that have a context with the SDGs in the articles analyzed are presented in Table 1 below.

Table 1. Sustainability topics trends in chemistry materials

Point of SDG	Chemistry material
SDG 3 (Good Health and Well-Being)	Nanochemistry, nanotechnology, chemical bonds
SDG 4 (Quality of Education)	Learning theory, chemistry curricula
SDG 7 (Affordable and Clean Energy)	Thermochemistry, electrochemistry
SDG 9 (Industry, Innovation, and Infrastructure)	Green chemistry, catalysis, laboratory instruction, chemical engineering, industrial chemistry
SDG 12 (Responsible Consumption and Production)	Stochiometry, waste management
SDG 13 (Climate Action)	Biochemistry, material gases
SDG 14 (Life Below Water)	Pollution control, water treatment
SDG 15 (Life on Land)	Soil chemistry, environmental chemistry

Table 1 explains the linkages between the various SDG points and relevant chemistry learning materials to support sustainability goals. SDG 3 is closely linked to nanochemistry and nanotechnology, which play an important role in the development of cutting-edge medicines and health technologies. SDG 7 refers to electrochemical materials and fuels that focus on the development of more efficient renewable energy sources. SDG 12 explains that the concept of sustainable chemistry and waste management is emphasized so that students understand the importance of environmentally friendly production. The adjustment of chemical materials with various aspects of the SDGs aims to prepare a generation that is able to think critically and play an active role in solving global environmental challenges.

Most variables used in sustainability topics of chemistry education

The most frequently used variables in the topic of sustainability in chemistry education are becoming important to analyze, given the global trend that increasingly emphasizes on integrating sustainability principles in educational curricula. Based on the visualization of the bibliometric map in Figure 6, it can be seen that there is a network of

relationships between the main variables such as systems thinking, inquiry-based learning, and problem-solving/decision-making with the topic of sustainability that is the center of attention. Which of these several keywords are key competencies in achieving Education for Sustainable Development (ESD) issued by UNESCO. Furthermore, the map also shows the central role of sustainability development, sustainable chemistry, and curricula in building interdisciplinary connections in the development of education that supports the achievement of the SDGs in the future.
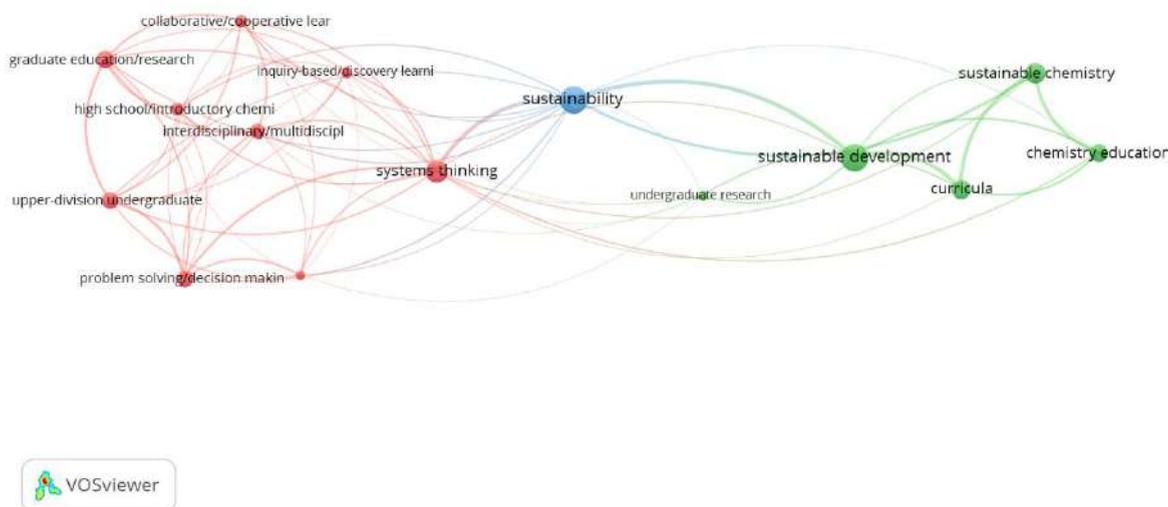
Fig. 6. Most variables used

UNESCO (2017) emphasizing the importance of developing various key competencies in achieving ESD which are categorized into three domains, namely the cognitive domain (system thinking, anticipatory, normative, critical thinking), the socio-emotional domain (collaborative and self-awareness), and the behavioral domain (strategic and integrated problem solving). These competencies complement each other and help individuals to contribute effectively to sustainable development. Some of the keywords that stand out related to key competencies are systems thinking, collaborative, and problem solving. By integrating key competencies in the chemistry curriculum, educational institutions can equip students with the necessary skills to face increasingly complex global challenges. Key competencies that are most often used in the study during the 2015-2024 period as visualized in Figure 7.
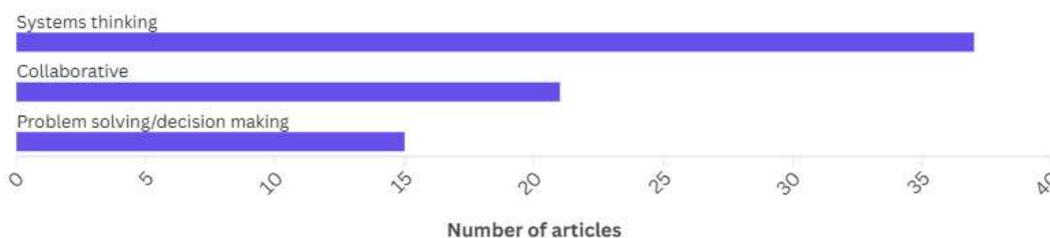
Fig. 7. Most variables used of ESD key competencies

Systems thinking aims to see the big picture and recognize patterns and interactions that affect social and environmental dynamics (Karaarslan Semiz & Teksöz, 2020). In the context of education for sustainability, systems

thinking helps students see how different elements (such as the environment, economy, and society) interact with each other. By focusing on existing relationships and patterns, students can develop the ability to analyze problems from a more holistic perspective. This ability is not only important to understand local issues, but also to address global challenges, such as climate change and social injustice, in a more effective and sustainable way.

Collaborative is a key competency in ESD that emphasizes the importance of cooperation and communication in groups. The ability to work with others from diverse backgrounds is indispensable for creating innovative and sustainable solutions. Collaboration allows individuals to share knowledge, experiences, and perspectives, which enriches the problem-solving process (Khoo & Jørgensen, 2021). By applying collaborative principles, students not only learn to appreciate differences, but also to build mutually beneficial relationships, which are the foundation for the success of sustainability initiatives at the community and global levels.

Problem solving is a very important competency in achieving ESD, where individuals are taught to identify, analyze, and solve various challenges faced in the context of sustainability. These abilities include a critical and creative approach to problem-solving, as well as the use of various strategies and tools to find effective solutions (Sass et al., 2024). Through the development of problem-solving skills, students are encouraged to think out of the box and innovate, so that they can contribute to the achievement of sustainable development goals. Education that emphasizes problem-solving not only prepares students to face today's challenges, but also directs teachers' efforts to create a learning environment that is more relevant and responsive to the needs of society in the era of sustainability.

Most contributed authors

The contributions of prominent authors greatly determine the direction of scientific development in the world of research related to continuing chemistry education. Based on the visualization map of the author's contributions in Figure 8, Ingo Eilks dominates as one of the authors with significant contributions in this field, followed by Stephen A. Matlin and Peter G. Mahaffy. Their contributions in the form of publications and research play an important role in enriching the discourse and innovation of sustainable chemistry learning. Other writers such as Andrew P. Dicks and Glenn A. Hurst also had equally important contributions. This sub-chapter will discuss the extent to which the contributions of these authors have an impact on the development of new methods and approaches in chemistry education that focus on sustainability topics.

Several articles written by *Ingo Eilks* have made significant contributions to integrating the principles of the SDGs into chemistry. One of his important works is an article titled *"Greening the chemistry curriculum as a contribution to education for sustainable development: When and how to start?"* (Eilks & Linkwitz, 2022) that explores how chemistry education can begin to implement sustainability concepts. This article emphasizes the importance of introduction to the principles of green chemistry from the early stages of learning, to encourage students to understand the relationship between chemical practices and the resulting environmental impact. This approach not only prepares students to become ethically responsible scientists, but also supports the achievement of related SDGs such as quality education (SDG 4) and action on climate change (SDG 13).
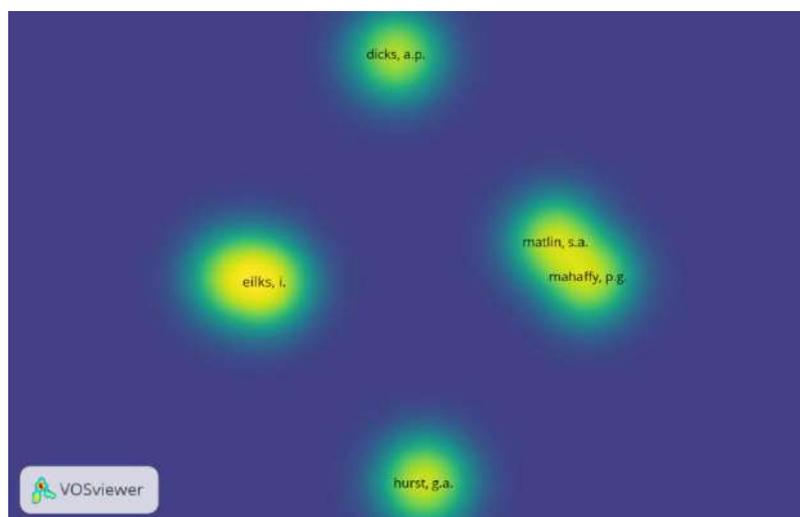
Fig. 8. Most contributed authors

In addition, Ingo Eilks' other research offers easy-to-implement laboratory experiments using immobilized enzymes, which aims to educate students about sustainable chemistry practices in his article titled *"Simple experiments with immobilized enzymes as a contribution to green and sustainable chemistry education in the high school laboratory"* (Linkwitz & Eilks, 2022). These activities provide a hands-on understanding of the application of green chemistry, such as reaction efficiency and waste reduction, as well as demonstrate how these principles can be integrated into high school laboratories. Through this approach, students learn not only the fundamental concepts of chemistry, but also the relationship between chemistry science and environmental conservation efforts, in line with the goals of the SDGs. Eilks' contributions in the works highlight the importance of curriculum reform that includes sustainability education holistically, preparing a new generation to be actively involved in sustainable and responsible scientific solutions.

Furthermore, Glenn A. Hurst highlighted the importance of systems thinking as a key competency in achieving ESD in the field of chemistry education. In his article entitled *"International Perspectives on Green and Sustainable Chemistry Education via Systems Thinking"* (Hurst et al., 2019), it is explained that systems thinking helps students to identify the linkages and impacts of chemical practices on the global ecosystem and sustainability. By leveraging systems thinking, chemistry education can move beyond the traditional approach that focuses on discrete aspects, towards a holistic approach that emphasizes sustainable solutions. This not only enhances students' understanding of how chemical practices impact various systems, but also prepares them to think critically and act proactively in the face of environmental challenges, which is in line with SDG goals such as action on climate change and life on land and water (SDGs 13, 14, and 15).

Conclusion

Research trends on sustainability topics in chemistry education over the past almost decade were analyzed through a bibliometric map of 201 articles taken from the Scopus database and visualized with the VOSviewer software, this study managed to identify frequently used keywords, contributions of prominent authors, and variables used in

sustainability-related chemistry education research. Key findings show that green chemistry and sustainability are the dominant topics, demonstrating the relevance of environmentally friendly chemical approaches in achieving sustainable development goals. A significant increase in publications related to continuing chemistry education occurred from 2020, reflecting a heightened global awareness of the importance of education that supports the SDGs. The research also highlights the important role of systems thinking, collaboration, and problem-solving skills in achieving key competencies for ESD. Chemistry education plays a strategic role in shaping a generation that has environmental awareness as well as critical and collaborative thinking skills. Materials such as green chemistry, nanochemistry, and environmental chemistry support the achievement of SDGs related to health, clean energy, and environmental management. The results of this bibliometric analysis emphasize the need for an interdisciplinary approach in chemistry curriculum to encourage more relevant and effective learning in the face of global challenges, as well as the importance of the research's contribution in promoting innovative and sustainable educational practices.

Recommendations

Based on the results of the analysis, it is suggested that research in the field of chemistry education increasingly integrate the concept of sustainability with a stronger interdisciplinary approach. Researchers and educators are expected to develop learning materials that include not only theory, but also practices that promote green chemistry and innovative solutions to environmental problems. Measurements related to systems thinking and problem-solving skills should be strengthened in the curriculum to improve students' competence in understanding the complexity of global challenges related to the SDGs. To support the sustainability of this research, it is suggested that future review studies focus more on the collection of longitudinal data that include recent developments in the approach to continuous learning in chemistry education. Collaborative efforts with various stakeholders such as curriculum developers, education practitioners, and environmental experts will also strengthen the relevance and application of research results to support the effective achievement of the SDGs.

Acknowledgements

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Development of an E-Book of Local Wisdom of Panji Malang with EARLS Feature to Improve Tolerance Skill of 5th Grade Elementary Students

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Abstract: The moral degradation experienced by students causes students to have a poor character background. This is also due to the extinction of local wisdom that contains noble values, especially in civic education. Local wisdom is considered ancient and irrelevant to the development of education in the current era, so its integration in education is also less massive. Based on these problems, it is necessary to develop teaching materials using the latest technology, one of which is by carrying out the development of e-books integrated with local wisdom material to support improvement in tolerance attitudes and channeled using the latest technology utilization. Research and development is an appropriate method in the research approach carried out. The model used in this research is Lee & Owen which focuses on developing products that contain multimedia in them. The validation results from material experts showed a validity of 95.8%, teaching material experts gave a score of 90%, and users (teachers) gave a score of 90.7%, all of which were classified as very valid. The validators suggested some improvements, such as adding challenge quizzes, adjusting the font size, and improving the usage guide. In the trial to students, the e-book received a positive response with a percentage of media attractiveness assessment of 100% in the individual trial, 93.6% in the small-scale trial, and 96% in the large-scale trial. This shows that students find it helpful in understanding the material and are actively involved in learning.

Keywords: Civic Education, Character Education, Local Genius, Culture, Empathy

Introduction

Character education needs to be instilled from an early age, especially after the COVID-19 pandemic that hit it affected the way students behave. This needs to be considered because character education, especially tolerance, aims to maintain harmony in society, as a preventive measure from the emergence of conflict and division (Damayanti et al.,

2021). Not only does it improve social attitudes, students, but tolerance is also an effort to strengthen the values, norms and morals in culture and customs that apply in society, thus creating a comfortable and peaceful environment (Sodik, 2020).

The implementation of tolerance in education has the main goal of educating the nation's life with the form of application in civic education. One of the main objectives of civic education in schools at grade 5 level is: "Presenting the results of identifying attitudes of respecting, maintaining and preserving cultural diversity within the framework of Bhineka Tunggal Ika (the motto of the Indonesian nation, which means unity in diversity) in the home, school and community environment".

This goal is carried out in elementary schools by realizing learning activities with an inclusive environment and active learning about cultural and religious diversity and increasing the active participation of students, teachers and school residents (Fristy et al., 2023).

In realizing an optimal attitude of tolerance, it is necessary to have a learning approach that is able to provide good understanding facilities and content to students. One of the obstacles to attitude learning in civic education is the difficulty of books and media provided to provide concrete examples, considering that the growth of students at the elementary school level is not too abstract. So, it requires learning strategies, teaching materials and media that can visualize the content well. One of the things that can be done is to develop an e-book that can embed examples in everyday life in the form of multimedia such as video, images, animation and audio. So that it not only helps in terms of visualization but also provides a variety of activities in personalizing the learning style of each student.

This learning activity is not only approached in the teaching strategy, but also by the technology used. The technology used must be able to support student learning. One of the latest technologies that can introduce students to the surrounding environment with visualization is augmented reality. Technology combines virtual reality with the real world so that it can give students a more real impression and experience.

Based on the needs analysis that has been carried out at school from 3 study groups of grade 5 students in elementary schools, it shows that learning related to tolerance attitudes in civic education has not been maximized. Not only in the attitude shown, but in the learning outcomes of students there are also still some who have not completed their learning achievements and are still below the standard achievement value. Many students still have an egocentric attitude and do not have a sense of mutual respect and care for their fellow friends. Contextual learning implemented in schools has not maximally carried out the theme of local local wisdom. This makes students have a narrow insight into the noble values of local wisdom and local community culture. So that it causes difficulties for teachers in preparing teaching materials with local wisdom material due to lack of knowledge and information circulating that discusses local wisdom.

The availability of technology in the target schools is also good and complete, but not all teachers can use these tools because of their lack of expertise in operating the computers that have been provided at school. This causes the learning carried out to not be well integrated with technology and the learning carried out is only fixated on the lecture

method and monotonous. Less than optimal implementation also causes the development of teaching materials to be less massively implemented by teachers due to the obstacles that have been described.

The problems that have been described give rise to solutions to develop teaching materials that are in accordance with local cultural values that can help students improve tolerance attitudes and insights in the development of civic education materials. Previous research shows that insight in civic education has a relationship with the attitude of tolerance shown by students still at a moderate level, so it is necessary to transform learning in increasing students' attitude of tolerance, especially at the basic education level (Ramadhaniar et al., 2020). Research conducted by Wahyunengsih & Rahmawati (2022) also shows that one of the activities that is quite effective in increasing students' tolerance is by introducing cultural diversity through reading books. Through these reading books, students are able to develop and form an attitude of tolerance through the various stories presented in them.

The development of e-books bridges the problems found in elementary schools related to optimizing the use of digital devices in schools and improving digital skills by both teachers and students. The material presented in it can be adjusted to the characteristics of grade V elementary school students, with the presentation of material integrated with culture combined with one of the subjects, one of which is Pancasila Education (Khoirurosyadah & Rachmadyanti, 2022). The advantages of using e-books are that they can be used independently and students do not depend entirely on the explanation given by the teacher, so that the content studied is tailored to the needs, abilities, talents and interests of students, besides that it also provides habituation to students in expanding knowledge through reading activities (Khikmawati et al., 2021). The presentation of this teaching material can be done by integrating technology to make it easier for students.

The role of ebooks as a form of book that contains information about various cultures, values and local wisdom from one of the regions in Indonesia carries important messages about diversity, tolerance and national unity (Adha & Perdana, 2021). The existence of culturally integrated ebooks in independent curriculum learning is relevant to strengthening national identity rooted in cultural diversity. One of the local wisdoms that can be raised in elementary school learning materials is the local wisdom of Malang in the form of Panji Malang (Wulandari et al., 2023).

Panji Malang is one of the typical legends of Malang which is an important part of cultural heritage in East Java and even ASEAN (Kieven, 2020). Panji Malang has local wisdom values that are important for the younger generation to learn, including respect for diversity of opinion, tolerance, honesty, courage and justice (Ali & Hutagalung, 1996). Tolerance can be realized by respecting each other in a cross-cultural context, it is necessary to implement a multicultural education system (Ekwandari et al., 2020). So that the making of teaching materials in accordance with this form and content is in accordance with the needs of students

Method

The type of research used in this study is research and development (R&D) which is a research model and development stages carried out by analyzing product tests to determine the feasibility of the products developed through relevant research. The development model used is the Lee & Owen Model (Lee & Owens, 2004). This model is one of the

relevant models in developing products that have multimedia elements in them.

The Lee & Owens model is implemented with a development model that focuses on interactive multimedia principles, and the topic relates to technology-based media that has a high need, especially in elementary schools (Aka, 2019). The need assessment and front-end analysis stages in the model are to deepen the collection of data information before research related to the application of multimedia used in learning, so that a solution design can be determined from the problem and according to the needs (Kuswandi et al., 2022). Through this model, the media development carried out can support learning using the Learning Management System (LMS) which can be used in facilitating e-learning which facilitates accessibility to learning at unlimited places, times and spaces (Lee & Owens, 2004).
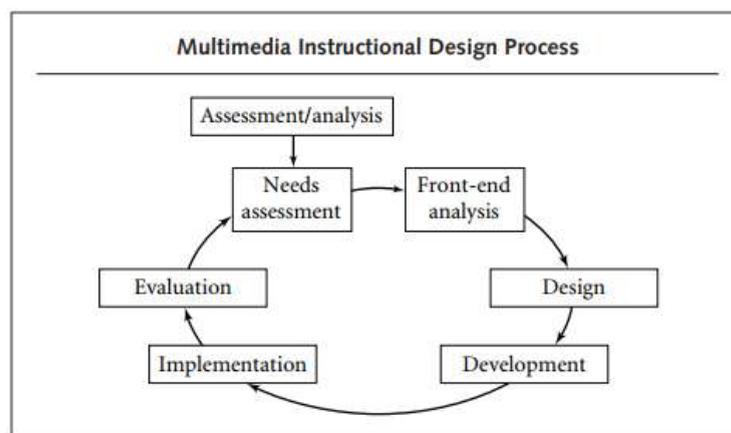
Picture of Multimedia Design Development Procedure (Lee & Owens, 2004)

Based on Figure 3.1, it is shown that the research and development procedure developed by Lee & Owens (2004) amounts to five research stages consisting of (a) assessment and analysis including needs assessment and front-end analysis, (b) design, (c) development, (d) implementation and (e) evaluation.

Results

The results of the development of EARLS-based local wisdom e-books include the results of validation by material experts and experts, users (teachers) in class V and the results of the response to the attractiveness of the practicality of the learner media. The results of product development are presented in accordance with the stages of the ADDIE development model. The initial step is analysis which aims to detect the initial needs of the product to be developed. The stage was carried out on October 03 and 04, 2024, by conducting a review of student needs, curriculum review and learner characteristics. The results of the study of student needs were carried out by conducting interviews with students who revealed that learning media in Civics learning were still lacking in variety and monotony. This was also conveyed by the class teacher, one of which was the material on cultural diversity. Curriculum analysis is carried out by reviewing the learning outcomes in the independent curriculum at grade V level, namely phase C. Finally, the implementation of student character analysis, based on the results of interviews with students, they feel bored and want new things in Civics learning. This is the background for the development of EARLS-based local wisdom e-book development media which contains 3D illustrations, written information, videos and audio explanations which

are expected to create new learning experiences for students with easy access flexibility.

The second step is designing the product design. This stage was carried out in December 2023, by preparing a design for making e-books with material on tolerance integrated with Panji. Then, the preparation of augmented reality-based applications including the initial appearance, main menu, learning outcomes, material, about the application, and AR display was carried out. The last is the design of the guidebook for using the developed application.

The third step is product development, which was carried out in January - March 2024 with the realization of products developed using the Canva application and Adobe Photoshop 2020 as a flash card design developer application, with a total of 23 cards designed. Furthermore, 3D illustration development was carried out using the Blender application which was then converted using the fbx format. The 3D format was processed in the form of a learning application using AR created using Vuforia and Unity.

The fourth stage is product implementation. This step was carried out in March - April 2024, by carrying out validity assessment activities by experts and trial activities. Product validity testing activities were carried out by 3 validators, namely 3 expert validators of teaching materials and materials from the State University of Malang and 1 user validator (teacher) from elementary schools. The validators assessed the development of EARLS-based local wisdom e-books as relevant to the parameters indicated on the validation sheet. Augmented reality flashcard media is declared very valid and feasible to use if it gets a percentage result of 85.01% - 100.00%. The results of the validation carried out by the four validators are presented as follows.

The completed product development was then carried out a material validity test which was carried out on March 22, 2023 - April 05, 2024. The purpose of this implementation is to ensure the feasibility of the material presented and the shortcomings of the presentation of the material as evaluation material. Validation was carried out by one validator, a PGSD lecturer at the State University of Malang with a concentration in Civics and Social Studies learning. The validation sheet assessed includes five aspects in it, namely the suitability of the material, the scope of the material, the scope of the material, the exposure of the material and the validity of the language. The results of validation by material experts amounted to 95.8%, these validation results indicate that the results of media validity are classified as very valid and suitable for use.

Expert validation of teaching materials was carried out by one validator, namely experts from learning resources and media in SD on March 20, 2024. The validation sheet that was assessed included five aspects in it, namely the feasibility of content, design presentation and product usefulness. The results of the media expert validation reached an average value of 90%, according to the media validity category table, this gain is in the interval 85.01% - 100.00% with a very valid category and suitable for use. Even so, the validator also provided input regarding improving the appearance of the application, it should be given an initial appearance before entering the main menu display. Other input given is the inclusion of card categories that have been determined in the product usage guide, as well as the use of font sizes that need to be enlarged along with the size of flash cards to make it easier for students to read.

Validation by users (teachers) was carried out by fifth grade teachers in elementary schools on April 06, 2024. The

assessment on the validation sheet by the user includes three aspects including the feasibility of material content, language feasibility and media presentation. The results of validation by users (teachers) stated that the results of validation carried out by users (teachers) obtained a result of 90.7%. In accordance with the media validity category table, this figure is part of the interval 85.01% - 100.00% with a very valid category and suitable for use. Validators provide suggestions for providing challenge quizzes to students; besides that it is also necessary to add audio explanations to the appearance of the usage guide menu in the application.

The fourth stage after the implementation of media validation is to carry out implementation by conducting media trials to students. This activity was carried out in three stages, namely individual trials, small-scale trials and large-scale trials which were carried out on April 06-07, 2024. The implementation of the individual trial, the test subject was 1 respondent, on a small-scale trial as many as 9 respondents, on a large-scale trial as many as 26 respondents conducted by class V A and V B in elementary schools. The student response questionnaire includes aspects of media attractiveness, ease of use, display presentation, and language presentation. The results of individual, small-scale and large-scale trials showed that the accumulated results of student responses, namely individual trials obtained 100%, small-scale trials amounted to 93.6% and large-scale trials obtained 96%. These results are in accordance with the media validity criteria in the interval 85.01% - 100.00% with the category very valid and suitable for use. Based on the results of the trial above, it can be interpreted that the EARLS-based local wisdom e-book is suitable for use in Civics learning on cultural diversity in grade V elementary school. These results show that students respond positively to teaching materials.

The fifth stage, namely evaluation, researchers made improvements to the suggestions of supervisors and validators based on the comments and suggestions contained in the validation questionnaire. This stage is not only carried out at the end of making the product but also carried out at other stages. This aims to examine the mistakes and shortcomings of the product so that it is in accordance with the concept.

Discussion

The final product of this research and development is the e-book of local wisdom of Panji Malang based on EARLS for grade V elementary school. This media was developed with the guidelines of the results of teacher interviews and analysis of student needs that have been reviewed previously in elementary schools. This is motivated by the lack of varied media used in learning civic education. The media was declared valid and suitable for use after going through a trial process which was carried out 4 times. Product validity is guided by the validity results stated by material and teaching material experts, as well as users (teachers) & student responses. Discussion of the validity results will be presented as follows.

Material Expert Validation Results

The results of the material expert validation obtained an average of 95.8% with very valid and feasible criteria. This can be seen in the five aspects of the assessment carried out in the validation. First, the suitability of the material with learning outcomes, indicators and learning objectives. The advice given by the validator in the suitability of the

material is the need to include learning outcomes in the application so that the competencies to be achieved in learning are met. This is in line with the opinion expressed by Magdalena et al. (2020) that the material developed in a medium should be relevant to the established competency standards and contain the facts, concepts and principles of the material being taught.

Second, namely the aspect of the scope of material in the media that contains material on cultural diversity in the community environment. These limits are given so that the content delivered is focused and easily understood by students. This statement is in accordance with the opinion of Muthmainnah et al., (2021) that material in learning, especially civic education material, should be presented with a clear scope so that students can apply the concepts and principles of the material in their daily lives.

Third, namely the aspect of material coverage that discusses the suitability of the material with the cognitive abilities of students at the fifth-grade level, and the material presented can develop knowledge in Civics learning. This is related to the opinion of Gani (2019) that elementary school students at the high grade level show the nature that learning is used to train memory, so the role of educators is needed to help students to learn in a pleasant situation and in accordance with the cognitive abilities of students even though the material being studied is difficult to understand.

Fourth, namely the aspect of presenting material that has been presented in a coherent and systematic arrangement, accompanied by appropriate images and making it easier for students to capture the material. This is in line with the opinion of Ernawati (2019) that the sequence of material needs to be implemented by presenting material that is easy to difficult, and each part of the material is presented continuously, so that the previous part can contribute to understanding the next content. The use of images that are tailored to the material is used to provide a concrete picture of abstract concepts (Nurseto, 2012).

Fifth, the language feasibility aspect contains the use of communicative language in learning content, the use of language is aligned with the level of student development and is simple, and the language used is in line with Indonesian language rules, namely PUEBI and EYD. This is supported by the opinion of Neni & Hildayah (2020) that learning media should use clear language so that the learning described can be captured easily by students.

Teaching Material Expert Validation Results

The validity of the EARLS-based local wisdom e-book according to the teaching material expert obtained 90%. Based on the media validity category table proposed by (Akbar, 2015) these results are included in the range of 85.01 - 100%, with the category being very valid and suitable for use. This is shown from each aspect of the assessment. First, in the aspect of content feasibility in the developed media that has contained the multimedia identity displayed on the initial display of the application and instructions for use that are presented in clear stages. . This is in accordance with the explanation put forward by Mandasari et al. (2020) that the instructions for use used in the media should be explained in clear stages to make it easier for users.

The presentation aspect of the design in the product includes three categories, namely readability, communicative and

appearance. The readability of the media has shown the suitability of the font used, but the font size used needs to be adjusted again so that the material is easily read by students. This is in line with the opinion expressed by Sulistiyawati et al. (2017) that determining the type of font, the appropriate font size, and the right placement will also help readers more easily read the material. The use of language in the media has used effective, simple and clear language, besides that the choice is aligned with the cognitive level of students and does not cause double meaning. Both of these are in line with Kosasih's (2020) opinion that learning materials are presented with several categories including the presentation of clear material, easy to read, and adjusted to the level of student understanding. The learning media developed has displayed an attractive appearance and appropriate color composition. This is in line with research conducted by Sukmawarti (2021) that learning media can be used effectively with students, with aspects of media attractiveness both in terms of appearance, illustrations, color composition, and *fonts* used in the media.

The aspect of product usefulness has shown that the media is presented to help students to increase student interest in learning and understanding, and the media is presented with ease of use. This is in accordance with the opinion of Putriningsih & Putra (2021) that the use of learning media in the classroom that is packaged in an attractive manner results in increased student interest and motivation in learning, the media used in appropriate situations and conditions can support student learning success.

Conclusion

Based on the results and discussion of the development of EARLS-based local wisdom e-books for grade V students, it can be concluded that this product meets the criteria of high validity and feasibility to be used as a Civics learning media on the topic of cultural diversity. The development process followed the ADDIE model, starting from analyzing student needs which revealed a lack of variations in Civics learning media in the classroom. The developed e-book includes 3D, text, video, and audio elements integrated with augmented reality (AR) technology to provide an interactive and engaging learning experience.

The validation results from material experts showed a validity of 95.8%, teaching material experts gave a score of 90%, and users (teachers) gave a score of 90.7%, all of which were classified as very valid. The validators suggested some improvements, such as adding challenge quizzes, adjusting the font size, and improving the usage guide.

In the trial to students, the e-book received a positive response with a percentage assessment of media attractiveness of 100% in individual trials, 93.6% in small-scale trials, and 96% in large-scale trials. This shows that students find it helpful in understanding the material and are actively involved in learning. The implementation of EARLS-based e-books is considered effective in increasing students' attractiveness and interest in Civics learning, as well as supporting their increased understanding of cultural diversity through easily accessible and interactive media.

Recommendations

For further research related to EARLS-based local wisdom e-books, several recommendations can be considered. First, e-books can be developed for other levels of education, such as junior high school or high school, so that the

benefits are felt by students at various levels. In addition, the enrichment of e-book content by including local wisdom stories from various regions in Indonesia can also enrich students' understanding of the cultural diversity of the archipelago and strengthen tolerance values. It is also recommended to improve the integration of AR technology by improving visual quality and interactivity, for example through simulations or educational games that involve students directly in the story.

Furthermore, media development with learning evaluation features, such as quizzes or attitude reflections, can measure students' understanding and attitudes towards cultural diversity after using e-books. An e-book-based collaborative learning model can also be implemented to encourage students to explore local wisdom values through group discussion activities. Long-term research on the impact of using e-books on student character, especially the values of tolerance, cultural appreciation, and nationalism, can be the basis for more in-depth evaluation.

Finally, it is recommended to test the effectiveness of e-books in various educational settings (urban, rural, private, or public schools) to see variations in response and effectiveness in various contexts that have different characteristics of students and facilities. This follow-up research is expected to enrich the content, increase the effectiveness, and expand the positive impact of local wisdom-based e-books in the world of education.

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The Correlation Between Science Literacy and Argumentation Ability: A Study of High School Students in Biology Learning

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Abstract: Science literacy plays an important role in supporting 21st-century skills. Science literacy in biology refers to students' skills to understand biological concepts, use scientific understanding to solve problems, and make responsible decisions related to biological issues relevant to everyday life. Through the argumentation process, it is expected that individuals will be trained to seek evidence, analyze information, and build a deeper understanding of science (science literacy). This study aims to determine the relationship between science literacy and students' argumentation ability, especially biology subjects on environmental change material. The instruments used were multiple choice test questions from the OECD Science Literacy İnstrument (2019) and Toulmin Argumentation Pattern (TAP) model essay questions through indicators of argumentation skill levels according to Osborne, Eduran, & Simon (2004). The research method used quantitative research with correlation statistical tests. A total of 51 students of tenth-grade SMA Negeri 6 Malang were selected as samples in this study. The results showed that the average science literacy was 42.8% with a very low category. The results of the description of each indicator, among others, explaining phenomena scientifically scored 46% with a low category, evaluating and designing scientific investigations scored 34% with a very low category, and interpreting data and evidence scientifically scored 47% with a low category. The argumentation results also show comparable to the results of science literacy which is 27.7% with a very low category based on the Toulmin Argumentation Pattern (TAP) indicators and shows that the level of students' argumentation Ability is still at level 1-2. The correlation test results show a value of 0.958 (Pearson correlation) with a significance value of 0.000 <0.05 which means that there is a positive relationship between science literacy and argumentation ability. This finding indicates that strengthening science literacy in biology learning is not only important for concept understanding but also crucial in shaping students' critical thinking and argumentative ability.

Keywords: Science Literacy, Argumentation Ability, High School

Introduction

Science literacy is the skills to apply scientific knowledge and develop a reflective mindset to participate in addressing issues and ideas related to science (OECD, 2019). Science literacy is an important aspect of modern education and societal well-being that encompasses the fundamental knowledge, skills, and attitudes needed to understand and engage with scientific concepts, processes and applications (Nwoke et al., 2022). Scientific literacy refers to the ability to use scientific knowledge and processes to understand scientific phenomena, solve problems, and make informed decisions (Smith et al., 2015). Science literacy is the main goal of science education. Science literacy is considered essential to avoid science-related misinformation and enable better decision-making individually and collectively (Howell & Brossard, 2021).

Science literacy is not limited to the academic environment, it is a life skill that empowers individuals to engage with scientific information in everyday life, involving an understanding of health issues, environmental challenges, or technological advances (Osborne & Allchin, 2024). Science literacy is often defined as knowing the basic facts established by science, but what matters are the concepts themselves. There are three aspects of science literacy that are commonly used in this term: content knowledge, understanding scientific practices, and understanding science as a social process (Snow & Dibner, 2016). Science literacy involves students actively participating in informed discussions about science, sustainability and technology for decision-making and action. It requires the ability to explain phenomena scientifically, design and assess scientific investigations, and critically examine and interpret data and evidence, which are indicators of science literacy (OECD, 2023).

Science literacy in Asian countries varies widely. Asian countries fall into the low category for science literacy results. Singapore, Japan, and Chinese Taipei, have good science literacy. In contrast, countries such as Indonesia and the Philippines scored lower than the OECD average in the PISA assessment (Cordon & Polong, 2020). China is still far from the average science literacy in other developed countries (Zhou, 2019). The science literacy of Indonesian students at the international level is still at a very low rank, this is stated in the PISA assessment standard data (OECD, 2023). Based on these results, it can be said that current learning has not been able to emphasize science literacy which should be important to emphasize in students, especially in junior high school and high school. In science, argumentation serves to expose and address inconsistencies among ideas and evidence related to science literacy, one of which is in science lessons (Berland & Hammer, 2012).

Argumentation is a core component of science literacy as it involves the construction and justification of knowledge claims that are critical to understanding and engaging in the practice of science (Sengul, 2019). Argumentation is a key communicative practice in science. One reason for this is that argumentation is concerned with the decisions that scientists make (e.g., how to support or refute scientific claims, what evidence to use, what procedures to apply to arrive at conclusions, etc.) (Archila, 2018). Argumentation ability play an important role in the development, evaluation, and validation of scientific knowledge and are practices that make science different from other ways of knowing (Clevenger et al., 2023). Argumentation ability can improve students' conceptual understanding and enable them to actively participate in learning activities (Swastika et al., 2022). Argumentation ability refer to a person's ability to express ideas coherently, persuade others, and support claims with relevant facts. This ability is essential for

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effective communication and is considered a high-level thinking skills for learning (Jakavonytė-Staškuvienė, 2020).

Students' argumentation ability in Indonesia are still relatively low. Where a number of studies, such as those revealed by Abduh et al. (2019), Zairina & Hidayati (2022), Hardini & Alberida (2022) show that the majority of students are still at a low level of argumentation, level 1 and level 2. Improving the quality of science learning at the senior high school level needs to be based on strengthening science literacy and scientific argumentation Ability as an important foundation in preparing students to face the demands of the professional world and higher education.

In the context of biology learning at the high school level, students' ability to express opinions scientifically, defend claims, and use biological data and concepts as the basis for argumentation is still often neglected in the learning process. Therefore, this research is important to examine the extent of the relationship between science literacy and students' argumentation Ability, as well as to provide strategic recommendations for the development of biology learning that is more meaningful, contextualized, and empowers science literacy and argumentation ability. Based on the above background, researchers conducted a study on the relationship between science literacy and argumentation Ability that occurred in students of State Senior High School 6 Malang which aims to (1) determine students' science literacy, (2) determine students' argumentation ability, and (3) determine the relationship between science literacy and students' argumentation Ability. The results of this study are expected to be the basis for developing students' science literacy and argumentation ability in science learning.

Methods

The research method used quantitative research with correlation statistical tests. The sampling technique used was *simple random sampling* with a sample of 51 students from tenth-grade students, one of the high schools in Malang, East Java. The research data used ten multiple-choice questions for science literacy and four essay questions for students' argumentation Ability. The science literacy assessment instrument was measured based on science literacy indicators according to OECD (2019). Argumentation ability is seen based on the Toulmin Argumentation Pattern (TAP) model and then measured through indicators of argumentation ability levels according to Osborne, Eduran, & Simon (2004).

İndicators of science literacy according to OECD (2019) have three indicators including explaining phenomena scientifically, evaluating and designing scientific investigations, and interpreting data and evidence scientifically. Students' argumentation Ability measured in this study used Toulmin's argumentation pattern (TAP) with each argument consisting of *claim, evidence, warrant, backing, qualifier, and rebuttal.* Details of these indicators can be seen in Table 1.

Table 1. Levels and indicators of Toulmin's argumentation pattern (TAP)

Level	Indicator
1	Contains only claims
2	Contains claims and data (evidence/basis)
3	Contains claims, data (evidence/basis) and warrant

| 4 | Contains claims, data (evidence/basis), warrants and support |
| 5 | Contains claims, data (evidence/basis), warrant, support, qualifications, and rebuttal |

Source: Toulmin Argumentation Pattern (1958)

Results

Science Literacy

The science literacy of students measured in this study uses indicators in PISA 2018 or OECD (Organization for Economic Co-operation and Development), explaining phenomena scientifically, evaluating and designing scientific investigations, and interpreting data and evidence scientifically. The test used is multiple choice with a total of ten questions.
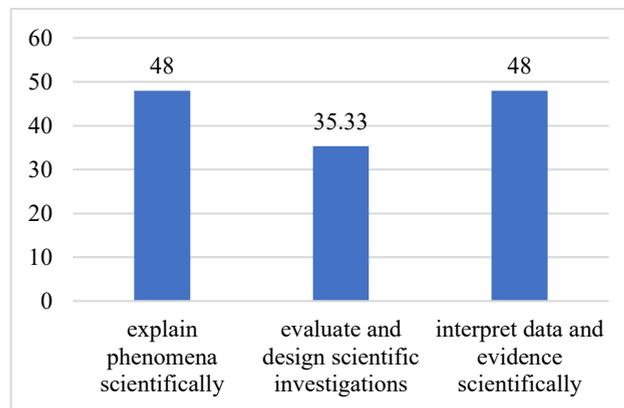
Figure 1. Graph of the Percentage of Science Literacy Results Per Indicator

Figure 1 shows that the highest aspects of science literacy are found in two indicators, explaining phenomena scientifically and interpreting data and evidence scientifically with an average of 48%. Meanwhile, the aspects of evaluating and designing scientific investigations had an average of 35.33%. The results showed that the average score of students' science literacy was 44.2%. Figure 2 is an example of a problem for the indicator of explaining phenomena scientifically with cognitive aspects in the form of content and context aspects in the form of personal.

Table 2. Indicators Of Science Literacy Questions Indicators Of Science Literacy Questions Explain Phenomena Scientifically

Competency Aspect	Question
Explaining phenomena scientifically	**Stimulus for number 1-3** Currently, in a number of areas, especially in urban areas and areas around industries, it is difficult to get clean water. This is because the soil around the area is polluted by factory waste and household waste. The government's effort to reduce the impact of household waste is through WWTP.

Illustration source: PT Eticon Engineering Engineering

Wastewater Treatment Plant (IPAL) is a wastewater treatment system that is carried out centrally, there is a building used to process domestic liquid waste that functions communally (used by a group of households) to make it safer when discharged into the environment, in accordance with environmental quality standards. Liquid waste from people's homes is channeled to the IPAL reservoir building through a pipe network **(Dinas Perumahan, Kawasan Pemukiman dan Pertanahan Kabupaten Probolinggo, 2024).**

1. In a village, there is a river that is the main source of water for residents for bathing, washing, and irrigation. Along with the development of the village, many residents dispose of household waste and garbage into the river without prior treatment. This causes pollution of the river water. The village government then planned to build a communal wastewater treatment plant (IPAL) to address river water pollution. However, some residents rejected the plan because they were worried about the high cost of building and maintaining the WWTP. Which is the most appropriate solution to overcome river water pollution in the village?

   A. Build a communal WWTP and require all residents to use it (*correct answer*)

   B. Prohibit residents from dumping waste and garbage into the river.

   C. Educate residents on the importance of keeping the river clean.

   D. Build clean water wells for residents and prohibit the use of river water.

   E. Moving the village to another location with cleaner water sources.

The indicator of explaining phenomena scientifically means that a person must be able to recognize and understand the question being investigated scientifically in a particular situation, find scientific information and identify keywords in exploring scientific information, and recognize the basic methods or patterns of scientific inquiry (Latard et al., 2017). This indicator has a higher percentage than other indicators, but many students cannot answer the questions correctly.

Based on previous research, this is caused by several things including the low independence of students in learning science so that students are less trained in analyzing a problem and low motivation in learning related to science (Uus et al., 2022). This also occurs in the indicator of interpreting data and evidence scientifically which has the same percentage of 48%. The indicator of evaluating and designing scientific investigations has an average of 35.33% which is lower than the other two indicators because in this aspect students are required to understand the basic concepts of science so that there are no misconceptions (Salmento et al., 2021)

Argumentation Ability

The average value of the argumentation ability test using the Toulmin Argumentation Pattern (TAP) is 28.1. The average value of argumentation Ability at each indicator level shown in Figure 3.
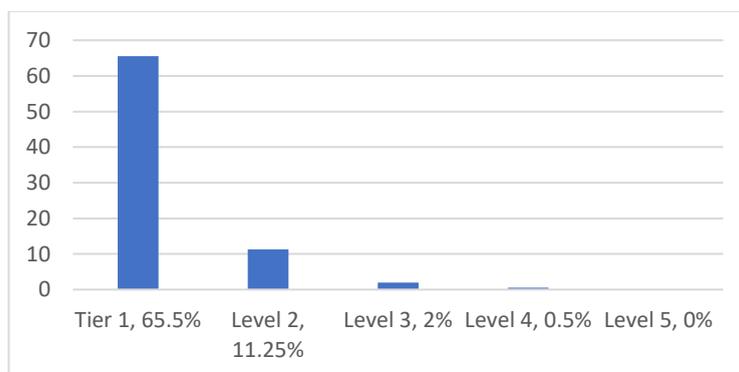
Figure 2. Percentage Graph of The Results of Argumentation Ability Per Indicator

Figure 3 shows that students' argumentation ability is highest at level 1, which is 65.5%. The averages of level 2, level 3, level 4, and level 5 are 11.2%, 2%, 0.5%, and 0%, respectively. This shows that students can only make claims either agreeing or disagreeing with a statement or issue, with little supporting evidence or data and no assurance, support, qualification or refutation of the claims or data they provide. Table 2 shows examples of answers to the questions used to measure students' argumentation Ability.

Table 3. Sample Answers For Argumentation Aspect Sample Answers For Argumentation Aspect

Respondent Code	Level of Argumentation	Answer
Q1 : A textile factory in X city discharges its liquid waste directly into the river without any treatment. The effluent contains dyes and hazardous chemicals that can threaten the survival of both the community around the river area and the river ecosystem itself. Do you agree with the actions of the textile factory? Give your reasons!		
S10	Level 4	No, I do not agree with the actions of the textile factory. **Discharging liquid waste containing dyes and hazardous chemicals directly into the river without prior treatment (claim)** can have very bad consequences for the community and the river ecosystem **(mertani.co.id) (data). The effluent can contaminate river water (warrant),** which can **affect water quality (backing) and make it unsafe for consumption by humans and animals.**

A claim is a statement that repeats a statement already in the question. Many students correctly provided claims that matched the question, but not many were able to provide data that matched the question. In addition, many students provided rebuttals and support for the claims given but could not provide data. Students often struggle with argumentation due to a lack of prior knowledge and experience. Those with higher prior knowledge tend to be better

at making refutations compared to their peers with lower prior knowledge (Wu & Liu, 2021).

Relationship between Scientific Literacy and Argumentation Ability

Before conducting the correlation test, normality test and linearity test were conducted. After the data were normally distributed and linear, the research hypothesis was tested, that there is a relationship between science literacy and argumentation Ability. Hypothesis analysis using Pearson correlation as shown in Table 3.

Table 4. Correlation Table Between Science Literacy and Argumentation Ability

		Argumentation Ability	Science literacy
Argumentation Ability	Pearson Correlation	1	.958**
	Sig (2-tailed)		.000
	N	51	51
Science literacy	Pearson Correlation	.958**	1
	Sig (2-tailed)	.000	
	N	51	51

**. Correlations are significant at the 0.01 level (2-tailed).

The correlation test results show that the coefficient of science literacy and argumentation Ability is 0.958 (Pearson correlation). The correlation coefficient shows a positive value with a significance value of 0.000, which is sig <0.05, which means that the research hypothesis is accepted, that there is a positive relationship between scientific literacy and argumentation Ability.

Discussion

Science Literacy

Students have relatively similar science literacy Ability among the three aspects in the science literacy indicators. The aspect that has a low average is evaluating and designing scientific investigations with a percentage of 35.33%, slightly lower than the aspect of explaining phenomena scientifically and the aspect of interpreting data and evidence scientifically at 48%. This low achievement shows that students still have difficulty in designing experiments independently, identifying variables, compiling scientific procedures, and evaluating the validity of an investigation. Students' different science literacy is certainly influenced by certain backgrounds, one of which is that students have not been able to integrate Ability such as decision-making and appropriate arguments and engage in persuasive communication (Gresch et al., 2017).

Argumentation Ability

The results of argumentation Ability show that the highest level is level 1 or student argumentation consists only of claims. Students provide claims or statements to the problems or questions given, but it is difficult to provide data or

evidence to support claims. Most students who can provide data or evidence to support claims, do not provide reasons and rebuttals to statements or arguments that have been made. This causes students' argumentation Ability to still be in the low category. Students who have low argumentation Ability are caused by the absence of curiosity about information, not yet having a sense of skepticism about problems or questions, because students who are more skeptical about whether information or data, really support claims can detect more weaknesses in their arguments (Kadayifci et al., 2012). In addition, the type of questions teachers ask can significantly affect students' argumentation Ability. When teachers more often ask questions that aim to recall rather than understand or apply knowledge, students tend to develop low-level argumentation (Erdogan et al., 2017).

Relationship between Science Literacy and Argumentation Ability

In this study, the results showed a positive relationship between science literacy profiles and students' argumentation Ability. The results of this study are in line with previous research which states that there is a significant relationship between science literacy profiles and argumentation Ability. Argumentation Ability are fundamental in developing science literacy because they enable students to effectively analyze, reason and articulate scientific concepts (Snow & Dibner, 2016). Interventions that focus on argumentation Ability significantly improve students' scientific reasoning ability, which is a key component of science literacy. Improving argumentation Ability will foster better understanding and attitudes toward science, ultimately contributing to overall science literacy among secondary school students (Lieskovský & Sunyík, 2022) .

Other studies have also shown a relationship between science literacy and argumentation Ability where a component of science literacy, critical thinking, is essential for effectively constructing and evaluating arguments (Puig et al., 2023). Improved argumentation, especially evidence-based arguments, significantly improved students' science conceptual knowledge and overall science literacy, demonstrating the importance of integrating argumentation in science education (Chen & Liu, 2018). Science literacy and argumentation ability enable meaningful engagement with science, fostering deeper understanding and confidence in science concepts and processes. On the other hand, teachers need to equip students to analyze and solve complex problems that are integral to argumentation (Alarcón-Orozco et al., 2024).

Efforts to improve science literacy and argumentation Ability

The lack of qualified teachers and resources is one of the causes of low science literacy and argumentation Ability. In some countries, there is a shortage of qualified science teachers and inadequate teaching resources, for example in Nigeria, the absence of science communication and lack of government support for science education contribute significantly to low science literacy (Maina, 2018). Similarly, in the United States, the lack of qualified teachers and low participation in science at the high school level will hinder the achievement of science literacy in college. Innovative and alternative teaching methods and approaches are often not used due to lack of resources or training (Lewis & Baker, 2021). This suggests the need for innovative teaching practices to improve science literacy and argumentation ability.

Efforts to improve science literacy are to improve critical thinking skills to critically analyze information, evaluate arguments, and form evidence-based opinions (Emery et al., 2017). Inquiry-based learning is one pedagogical approach that has emerged as a promising strategy to foster science literacy by engaging students in active investigations and problem-solving scenarios (Monsang et al., 2021). This approach emphasizes hands-on activities, data collection, and collaborative discussions, which empower students to construct their own understanding of science concepts (Ongowo, 2017). Through inquiry-based learning, students develop a deeper appreciation of the nature of science, recognizing that science knowledge is tentative, subject to revision, and based on empirical evidence (Jegstad, 2024).

The *Modified Argument-Driven Inquiry* (MADI) approach significantly improved argumentation ability and science process skills in biology practice (Ping et al., 2020). Adapting the *Argument-Driven Inquiry* (ADI) model involves collaborative learning and practical activities that promote deeper understanding and better argumentation ability (Liu et al., 2024). Debate can improve communication skills, including persuasion so that students learn to detect and explain the difference between strong evidence and weak evidence for effective argumentation (Engleberg, 2025). In addition, utilizing online platforms for argumentation activities can improve students' science competence and argumentation ability by providing a structured environment for students to practice and receive feedback on their arguments (Tsai, 2023).

Based on the research that has been conducted, it is known that there is a relationship between science literacy skills and argumentation Ability in science learning, especially in biology lessons for tenth-grade students of SMA Negeri 6 Malang. However, this study also has some limitations. *First*, the focus of the research was only limited to 51 tenth-grade students in high school. *Second*, this study has not compared argumentation Ability in all or some high schools so that the results of the study cannot be generalized. *Third*, this research is limited to one material on environmental changes, so the results do not necessarily reflect the overall skills of students in all biology materials. This limitation is the basis for further research that is more comprehensive and generalizable.

Conclusion

Based on data analysis, the results show that (1) the most prominent science literacy of tenth-grade high school students in biology learning is interpreting data and evidence scientifically which has the same percentage of 48%, (2) the argumentation ability of tenth-grade high school students in biology learning is the most prominent aspect of *claim* or in the level 1 category 65%, and (3) there is a positive relationship between science literacy skills and students' argumentation ability with a correlation value of 0.958 with a significance value of 0.000 <0.05 so it can be concluded that if the student's science literacy score is high then the student's argumentation ability will also be high, and vice versa.958 with a significance value of 0.000 <0.05 so it can be concluded that if the value of students' science literacy is high, the value of students' argumentation ability will also be high, and vice versa. In addition, it is recommended for further research, not only conducting tests and interviews but also conducting direct observation in the classroom. Based on these conclusions, learning approaches that integrate the development of science literacy and scientific argumentation training need to be implemented systematically in the biology curriculum at the high school level.

Recommendation

This study reveals the relationship between science literacy and argumentation ability, especially in science subjects, biology lessons in high school. On this basis, future research can develop specific themes in other science lessons, such as chemistry, physics and math lessons. In addition, science literacy can also be introduced in advance to students in accordance with competency aspects, cognitive aspects, and context aspects.

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Assessing Second Language Writing Without Technology: A First-Year University Study

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Abstract: In higher education, easy-to-administer diagnostic measures of second-language students' writing are in high demand. Asking such students to write essays is not only time-consuming but also likely to induce anxiety, which interferes with the accurate assessment of their competencies. The present study examined whether a game requiring sentences to be combined or built can adequately predict the quantity and quality of second-language learners' writing. At the start of the semester, 300 undergraduate students who were enrolled in a communication course completed a sentence-combination task and a sentence-building task modeled after those of the Wechsler Individual Achievement Test-Third Edition (WIAT-III). Specifically, participants (a) combined two or three brief sentences into one without altering the overall meaning (sentence-combination task) or (b) created sentences that contained a particular function word (i.e., article or preposition; sentence-building task). One week later, participants were given 10 minutes to write independently an essay on a common topic in a Unicode text file. Sentences were scored for grammatical, spelling, and semantic errors. Instead, essays were assessed by estimating the learners' effort (i.e., number of words and sentences written) and writing quality (e.g., use of academic vocabulary, syntactic complexity, and lexical cohesion). The sentence-building task was overall a better predictor of effort and academic vocabulary (a quality measure). However, neither sentence-building nor sentence-combination performance predicted the syntactic complexity or lexical cohesion of students' essays. In sum, sentence-level games represent enjoyable and time-saving diagnostic tools useful for capturing students' effort devoted to the activity of writing. However, they fail to apprehend more complex properties of their writing. Alternative time-saving diagnostic techniques are suggested.

Keywords: Writing, Second Language, Assessment, Diagnostic Tool

Introduction

Nowadays, students' writing is aided by technology (Alhusban, 2016). Technological aids range from simple spell checkers to artificial intelligence programs that write entire essays in ways that mimic human-generated text. At the very minimum, students are likely to use spell checkers, online thesauruses and dictionaries, and paraphrasing programs to facilitate their writing. Although reliance on word-level technological aids may not be considered plagiarism in the classical sense, it is unclear how well students write without such aids. Indeed, if the ethical issue of intentional plagiarism is temporarily set aside, faculty across disciplines are likely to be confronted with the task of estimating the extent to which submitted assignments accurately represent the capabilities of their students (Farahian et al., 2022; Pecorari & Petrić, 2014). The answer to this question is particularly pressing for students who possess English as their second language. If their writing capabilities are overestimated due to their reliance on technological tools, the instruction offered by any written communication course will be utterly inadequate and not conducive to improvements in their linguistic knowledge and skills.

Of course, English language proficiency for admission to undergraduate programs is usually determined through standardized language proficiency tests (e.g., IELTS, TOEFL, etc.). The minimal competency required for admission is often indexed by comprehensive scores of fitness ranging from modest-user to competent-user classifications. Scores include an array of skills necessary for academic success at English-medium institutions, such as reading and listening comprehension, speaking, and writing skills. Rarely do instructors of communication courses possess the breakdown of the scores. Another issue is the extent to which students' performance on timed and high-stakes language proficiency tests (e.g., IELTS, TOEFL, etc.) predicts writing performance in academic tasks once students are admitted to university studies (Riazi, 2016). Communication courses, which are part of the general education curriculum, are intended to build and reinforce the knowledge base and skills that first-year students need for academic success. Scant information regarding students' writing skills is likely to detract from the effectiveness of the instruction administered.

In university settings, diagnostic assessment tools are at a premium (Aryadoust & Riazi, 2017), specifically those that predict writers' competencies using the linguistic features of their essays (Riazi, 2016). Cognizant of the importance of offering instruction that targets students' communication weaknesses and promotes growth, instructors may rely on subjective solutions. For instance, to identify the particular weaknesses and strengths of individual students relative to the demands of a written composition course, instructors may use self-made diagnostic tools at the start of a course. Asking students to write a brief essay while being monitored is one of the most common solutions, which can also inform instructors of the qualitative aspects of students' writing. More detailed knowledge of students' competencies can be acquired through not only diagnostic writing tasks given at the start of the semester but also writing-intensive exams administered during the semester. However, the reliability and validity of such diagnostic tasks or exams for the student population that a given instructor serves often go unchecked. Furthermore, if diagnostic tools are

administered without warnings, they may generate anxiety, especially in students who possess little confidence in their writing skills (Pilotti et al., 2023; Pilotti et al., 2024; Sabti et al., 2019). Yet, exams for written communication courses, irrespective of whether they are announced or not, tend to produce anxiety (Powers et al., 1979). Not surprisingly, anxiety is often inversely correlated with confidence in one's abilities (Bensalem, 2018). Thus, even if the administration of diagnostic tests is advertised in advance, students whose abilities, confidence in their abilities, or both are poor may choose behavioral avoidance (i.e., absence) as a way to cope with the likely outcome of the diagnostic test.

Writing requires the use of cognitive and linguistic resources, which are depleted or seriously curtailed under anxiety-inducing circumstances (Karr & White, 2022). As a result, performance in writing tasks is generally inversely related to anxiety (Güvendir & Uzun, 2023). Here, we ask whether simple games at the sentence level can detect features of students' writing without raising the anxiety often associated with essay writing. Specifically, we ask whether such games can predict specific characteristics of a student's writing that can inform written communication instructors of the basic weaknesses and strengths of a student's composition skills.

The Present Study

The present study rests on the recognition that knowledge of how sentences are constructed in the English language is a critical competency in the activity of writing (Graham & Alves, 2021; Hidayah et al., 2024). Thus, in this study, we examine how sentence-level tasks, treated as a game, can predict students' essay performance. According to Barnitz (1979), assignments requiring 'text manipulation' may include tasks in which two or more sentences (e.g., "Rick plays football" and "Rick is a student") are to be combined into a single unit, without substantially changing the original meaning (e.g., "Rick is a student who plays football"). This task, which relies on paraphrasing skills, is intended to assess writers' ability to move from writing single sentences to writing paragraphs (Jenkinson, 1999; Saddler, 2012). Another way to manipulate text at the sentence level is to ask that sentences be formed around the use of particular function words (e.g., "write a sentence that contains the word until"). The latter allows more freedom of expression as it merely places a single constraint on the choice of words, syntactic structure, and semantic content for sentence construction. That is, the meaningful sentence produced by the writer must contain a specific function word. These types of tasks have been used primarily to develop sentence comprehension in reading (Barnitz, 1979), but they can also be used to assess writing skills (Jenkinson, 1999).

In our study, we focus on second-language freshmen who are enrolled in a written composition course in an English-medium institution. Standardized tests classify them as modest or competent users of the English language. This population tends to be understudied as most research focuses on younger second-language speakers or those who are enrolled in English-language preparatory programs before university admission is granted. Through a convenience sample, we ask the following questions, each accompanied by its hypothesis and rationale.

Q1   Is there a performance difference between sentence-combination and sentence-building tasks? On one side, performance on both tasks relies on competencies that students at the selected level should possess. On the other side, the sentence-building task allows more freedom of choice (i.e., learner-generated content), and thus it may be more

engaging (Lambert et al., 2017). Engagement is often positively associated with effort and good performance (Allen et al., 2014). Thus, if students find the task more engaging, their performance will be superior to that of the sentence-combination task (H1).

Q2-3   Can sentence-level tasks predict the effort devoted to essay writing and the quality of the written product? If constraints posed on the students' expressive options matter, sentence-building performance will be a better predictor of students' exerted effort in essay writing than sentence-combining (H2). Furthermore, if constraints posed on the students' expressive options matter, sentence building will predict the quality of students' essays to a greater extent than sentence combination (H3). However, not all measures will be equally predictive. Predictability rates will depend on whether quality measures are at the word or sentence level rather than at the paragraph level (H4). Students' sentence-building performance will predict their use of academic vocabulary (a word-level measure), syntactic complexity (a sentence-level measure), and language fluency (number of words per sentence) in their essay writing. It will not predict the lexical cohesion of their writing, which measures how thoughts are connected across phrases.

Method

Participants

The participants were 300 undergraduate female students whose first language was Arabic. Their English competency was deemed to range from modest to competent in grammar and vocabulary, reading, listening, writing, and speaking (as per the Aptis Placement Test, EPT, administered before admission). Students' academic majors included either a STEM field (53%) or a non-STEM field (47%). Their ages ranged from 18 to 27 years of age. Participants were a convenience sample of students enrolled in a written communication course taken during the first year of enrollment. The participation rate was 81%.

Materials and Procedure

At the start of the semester, students completed a sentence-combination and a sentence-building task modeled after those of the Wechsler Individual Achievement Test-Third Edition (WIAT-III). Specifically, participants (a) combined two or three brief sentences into one without altering the overall meaning (5 trials) or (b) created sentences that contained a particular function word (i.e., article or preposition; 7 trials). Fifteen minutes were allocated to the completion of both tasks. One week later, participants were given 10 minutes to write independently an essay on a common topic in a Unicode text file. The topic was their favorite game to guarantee interest. Students completed the sentence-combination task, the sentence-building task, and the essay-completion task in class while being monitored by an instructor to ensure that performance would not rely on any technological aid (e.g., spell checker, thesaurus, paraphrasing tool, etc.).

It is important to note that the sentence and essay tasks were presented to students as games that did not contribute to class grades (see Allen et al., 2014). They were self-assessment games that would give students feedback about the ease with which they approached English writing without any aids. Students gave their informed consent to participate in the study. Files were anonymized after the data of each participant in the different tasks were matched. Codes were

then used to identify the data produced by individual students. The data-collection process (including informed consent) was deemed to conform to the guidelines of the Office for Human Research Protections of the U.S. Department of Health and Human Services by the Deanship of Research of the hosting institution.

Data Analyses

Sentences were scored separately for grammatical, spelling, and semantic errors in a binary fashion (1 = correct; 0 = mistake). The value of a student's performance in each sentence task was then translated into a percentage. Instead, essays were assessed by estimating exerted effort (i.e., the number of words and sentences written) and their quality. The ETS TextEvaluator (Sheehan, 2016; Sheehan et al., 2014) was used to collect quality measures. The average number of words per sentence served to index students' English language fluency (De Haan & van Esch, 2007). Other quality measures included indices of students' use of academic vocabulary, the syntactic complexity of their sentences, and their lexical cohesion. Academic vocabulary was meant to index the sophistication of the word choices made by the writers. It measured the words in each text that would be more typical of academic texts than non-academic texts or ordinary conversations (Biber et al., 2004; Coxhead, 2000). The syntactic complexity index was intended to measure writers' difficulty in organizing words into sentences. It incorporated an assortment of sentence-level features (e.g., mean sentence length, mean number of modifiers per noun phrase, mean number of dependent clauses per sentence, and a measure of the memory load imposed by sentences with different syntactic structures; Yngve, 1960). Lexical cohesion was meant to refer to the connections across sentences so that information arising from the written text could be interpreted as a coherent message instead of an assembly of unrelated clauses and sentences.

Reliability and Validity Analyses of the Sentence-Level Tasks

The internal consistency of the sentence-level tasks was 0.73 (as indexed by Cronbach's alpha). Their test-retest reliability was assessed by measuring the performance of 15 students who completed both tasks twice within two weeks. There were no significant differences in their performance [ts(14) < 1, *ns*].

Content validity was operationalized as the degree to which the trials sampled for inclusion in the sentence-level tasks adequately represented the content of cognitive operations exercised in written communication courses. The content validity index was computed by asking three instructors who had expertise in written communication courses to indicate the extent to which each of the five trials of the sentence-combination task and each of the seven trials of the sentence-building task represented cognitive operations that students enrolled in their classes would carry out in class or as take-home assignments. Instructors rated each trial on a 5-point Likert scale from 0 = not at all to 5 = always. All trials received a score of 4 or above from each rater (Polit & Beck, 2006).

Results

The descriptive statistics (Mean = *M*; Standard Error of the Mean = *SEM*) of the collected data are displayed in Table 1. Pearson correlation analyses were conducted between sentence-task measures and essay-task measures to determine

whether the former (i.e., accuracy of sentence-level performance) could predict the latter (i.e., quantity and quality of essay performance). Correlations were assumed to be significant at $p < 0.05$.

Table 1. Descriptive Statistics for the Sentence-Task Measures and Essay-Task Measures

Essay-task	*M*	*SEM*
Quantity measures (i.e., estimated effort)		
No. of words	123.25	3.25
No. of sentences	6.47	0.20
Quality measures (range: 1-100)		
M words per sentence (language fluency)	25.05	1.37
Academic vocabulary	38.46	1.05
Syntactic complexity	59.17	1.12
Lexical cohesion	50.23	0.46
Sentence-level tasks' accuracy (range: 1-100)		
Sentence-combination task	68.93	1.16
Sentence-building task	74.26	1.15

In agreement with our prediction (as exemplified by H1), students yielded better performance in the sentence-building task than in the sentence-combination task, $[F(1, 299) = 8.72, MSE = 248.41, p < 0.001, partial\ \eta^2 = 0.054]$. In essence, the latter task was a paraphrasing task, whereby students were largely constrained to use the words in each phrase. The sentence-building task gave them more freedom of expression, allowing them to choose the words and, to a certain extent, the sentential structures. In debriefing sessions, the latter task was judged as more interesting, engaging, and even easier to carry out.

Pearson correlation analyses between sentence-task measures and essay-task measures illustrated that the sentence-building task was overall a better predictor of the quantity and quality of students' essays than the sentence-combination task (see Table 2), thereby supporting H2. For instance, students' sentence-building performance predicted their effort as quantified by the length of the essays (i.e., the number of words and sentences written by students). Sentence-combination performance only predicted the number of sentences students wrote. As noted earlier, students during debriefing sessions reported that the sentence-building task was more interesting, engaging, and easier to carry out. As performance is often linked to effort (Gneezy et al., 2019), this task also yielded higher performance.

Concerning writing quality, students' sentence-building performance predicted their reliance on academic vocabulary. Their sentence-combination performance also predicted students' reliance on academic vocabulary, but to a lesser degree. H3 was supported. Yet, neither sentence task predicted syntactic complexity or lexical cohesion, thereby partially supporting H4. Interestingly, for all significant correlations, the coefficients of determination indicated that no task measure predicted more than 6% of the variance in the essay measures. The small size of the coefficients of determination underscored that the selected diagnostic tools were limited in their ability to identify deficiencies above the sentence level.

Table 2. Pearson Correlation Coefficients between Sentence-Level Tasks and Essay-Task Measures

Quantity measures	Sentence Combination	Sentence Building
No. of words	+0.08	**+0.24**
No. of sentences	**+0.14**	**+0.21**
Quality measures		
M words per sentence	-0.10	-0.02
Academic vocabulary	**+0.11**	**+0.24**
Syntactic complexity	+0.07	-0.02
Lexical cohesion	+0.01	+0.08

Note. Values that are significant at $p < 0.05$ are marked in bold.

Discussion

The results of the present study can be summarized into two main points. First, tasks that ask students to write under a few constraints (e.g., sentence-building) are more likely to be engaging, thereby triggering enhanced effort and producing higher performance. As such, they are also better able to predict effort in essay writing. Second, tasks devoted to the manipulation of text within sentences have limited predictability when the quality of written essays is considered. Performance on such tasks can predict students' use of academic vocabulary, but it falls short on quality measures that go beyond the word level. The results of the present study appear to be inconsistent with those that advocate the use of sentence-level exercises to improve reading and writing (Jenkinson, 1999) or to improve content knowledge in particular disciplines (Nezhad et al., 2013). Yet, it is reasonable to assume that such exercises are effective with learners whose knowledge and skill base are less than desirable. The convenience sample of the present study included students judged to be either modest or competent users of the English language. Notwithstanding their proficiency classification, they made mistakes in sentence combination and building, suggesting that timed tasks are also informative, as they may uncover important information about learners' language fluency.

Our research has limitations that need to be addressed in future studies. First and foremost, the participants of our study comprised a convenience sample of entirely female students. Gender differences were not assessed. Second, other types of sentence-level tasks may have yielded different results depending on the linguistic competencies required. Third, although performance in all tasks was not considered a contributor to class grades by the students, writing anxiety was not directly assessed. If writing anxiety played a role in essay writing carried out without the technological aids to which students were accustomed, it may have depressed essay and sentence performance differentially. Fourth, the first language of the participants was Arabic, whose writing format and style (including morphosyntactic, orthogonal, phonological, and prosodic features) are quite different from those of English (Khatter, 2019). As a result, linguistic idiosyncrasies, through negative transfer, may have played a role in students' performance and thus limited the generalizability of our findings to other second-language speakers. Thus, our study simply gave us a glimpse into the abilities of a common but not entirely understood population of undergraduate students for whom English is the second language.

Conclusion

The main implication of our findings is that sentence-level tools may be limited in their predictive validity of writing capabilities in second-language learners who have been judged to be either modest or competent users of the English language. As such, diagnostic tools that target the paragraph level may be better suited for these learners. Of course, it is challenging to develop contexts of assessment that can reduce the anxiety second-language learners often experience when asked to write individual paragraphs or entire essays. Thus, the identification of the unique features of students' writing is not the only task that instructors need to address in their classrooms.

Recommendations

The results of the present study suggest that sentence-level assessment measures may not be sufficiently diagnostic of key features of the writing of either modest or competent English speakers. Sentence-level measures may be more suitable diagnostic tools for learners whose knowledge of the English language is much weaker. For instance, Safari and Ahmadi (2023) developed a detailed, descriptor-based checklist for a very common form of writing at the university level (e.g., integrated or source-based writing). They argued that the checklist offered fine-grained diagnostic information not only for the judgments that instructors need to make but also for the feedback that students need to receive about their assignments. The latter was the main aim of their checklist under the assumption that informative feedback given to students can induce both awareness of weaknesses and behavioral change to address such weaknesses. Our goal was different as we sought a quick and simple proactive assessment measure that would predict essays' quantity and quality and thus inform instruction about two critical dimensions of learning how to write well: exerted effort and quality. We only partially achieved our aim due to the limitations of the selected sentence-level tools.

Acknowledgments

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Academic Word Mastery in ESL Contexts: A Study of Malaysian Undergraduates

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Abstract: The mastery of academic words is essential for university students to effectively comprehend and engage with complex academic texts, such as textbooks and journal articles. Hence, limited knowledge of these words may hinder students' ability to fully grasp the concepts they are studying, thereby impacting their academic success. The current study investigated Malaysian English as a Second Language (ESL) undergraduates' knowledge of academic words, based on their English Language proficiency and academic specialization. Two hundred and sixty undergraduates from multiple universities in Malaysia participated in this study. Data were collected using a questionnaire comprising a total of 140 academic words adopted from two vocabulary lists; Academic Word List (AWL) and Academic Vocabulary List (AVL). Findings revealed that almost half of the participants knew less than 60% of the academic words listed. Another half of them knew around 60 % to 90% of the academic words listed. The findings also showed that there is a significant difference in academic word knowledge among participants with different level of English proficiency and academic specialization. While the findings are generally evident, identifying mastery of academic word knowledge among undergraduates is crucial for guiding targeted vocabulary instruction. This enables both instructors and students to focus on the most essential words, optimizing class time and independent study to support academic success.

Keywords: Vocabulary; Academic Vocabulary; Academic Vocabulary List (AVL); Academic Word List (AWL)

Introduction

Vocabulary is indispensable in language learning for learners to convey their ideas, express opinions, and seek understanding in any language learning. McCarthy (1990) asserted that L2 learners who did not master extensive vocabulary would have a difficulty in expressing a meaningful conversation in that language despite mastering the grammar part of the language. The same idea was expressed by Schmit et al., (2017) that lexical development and knowledge are crucial in acquiring the language. Despite the significant role of vocabulary, the process of acquiring it according to Oxford (1990) involves a complex cognitive process making it challenging for language learners to remember the vast number of words needed for fluency. Nation (2006) agreed that learning a word is indeed a dauting task faced by learners especially English as a Second Language (ESL) learners as it requires learners to grasp the meanings, stylistic appropriateness, pronunciation and even grammar of the words.

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In Malaysian national curriculum, English is a Second Language for students which it is a compulsory subject to be learned at school since primary to secondary schools. Malaysian students typically spend about 10 to 11 years learning English. By the time they complete high school, it is assumed they will have acquired a substantial vocabulary, ranging from 3,000 to 5,000 words, which should adequately prepare them for tertiary-level studies (Chu et.al., 2019). Nevertheless, past literature has shown that Malaysian university students generally have low threshold vocabulary level (Mathai et.al., 2004) and struggle with academic texts. Harji, Balakrishnan, Bhar, and Letchumanan (2015) found that Malaysian undergraduates had only achieved a 2000-word level, with none mastering the University Word List (UWL) of Nation and Laufer's (1999) Vocabulary Levels Test. A more recent study by Chu et al. (2019), utilizing receptive vocabulary tests for Malaysian secondary school students, revealed that most respondents failed to achieve vocabulary proficiency beyond the 2000-word level. Consequently, it is unsurprising that upon entering tertiary education, these students lack knowledge of many common academic words. This aligns with the findings of Sulaiman, Salehuddin, and Khairuddin (2018), who noted that even high-proficiency university students were unfamiliar with many common academic terms. Overall, these studies indicate that Malaysian students have not reached a threshold level of vocabulary competency despite years of English education.

The inability to master vocabulary beyond the 2000-word level is concerning, as it suggests that students will struggle with academic texts at the tertiary level. This is due to the fact that most academic reading materials such as report, journal articles and academic textbooks are mostly published in English. It is aligned with Nation and Warring (1997) who suggested that mastery of the 3000-word level, 5000-word level and academic words level is crucial especially for ESL learners to perform their academic studies in the target language. As Paquot (2010) suggested to undergraduates to master three main vocabulary lists that includes a core vocabulary of 2000 high frequency words, academic vocabulary and technical terms. For academic vocabulary, it could pose a significant challenge for readers, even those who are skilled, as these words are not commonly found in everyday texts (Krashen, 2011). A number of previous studies have investigated on Malaysian undergraduates' vocabulary knowledge such as Kamariah et al., 2016; Harji, Balakrishnan, Bhar & Letchumanan, 2015; Ahmad Azman et al., 2010. Meanwhile, Sulaiman et al. (2018) has conducted a study on the academic vocabulary proficiency of Malaysian ESL undergraduate students. However, less study has focus on investigating on size of academic vocabulary knowledge and its influence on Malaysian University English Test (MUET) results. Hence, this study aims to investigate the coverage of academic vocabulary knowledge among ESL undergraduates and to identify whether there is any difference between the size of academic vocabulary knowledge and English language proficiency.

Methodology

The researcher utilised a quantitative methodology to address the research inquiries. This approach encompasses the quantification and analysis of phenomena by gathering and interpreting measurable data. For this study, the participants comprise 260 ESL undergraduates from public universities in Malaysia who were chosen via purposive sampling. They consist of 88 males and 172 female students from social science, engineering, and education programmes. The participants were first-year students enrolled in an English language proficiency course and obtained Malaysian University English Test (MUET) scores ranging from Band 3 to Band 6. The questionnaire was designed based on wordlists from Academic Word List (AWL) by Coxhead (2000) and Academic Vocabulary List

(AVL) by Gardner and Davies (2015). The selection of target words based on Sulaiman et. al (2018)'s list of AWL known and unknown words among Malaysian ESL learners. The total number of target words tested is 140 academic words that were grouped into 35 sections. The participants need to choose the accurate meaning that explains the targeted academic vocabulary knowledge. Each section consists of four target words with their meanings and two distractors.

Findings

Academic Vocabulary Knowledge Coverage

Table 1 presents the descriptive analysis of the academic vocabulary knowledge coverage based on vocabulary scores among Malaysian ESL undergraduates.

Table 1: Academic Vocabulary Knowledge Score by Respondents

		Frequency	Percentage
Score	0 - 10	1	0.4
	11 - 20	33	12.7
	21 - 30	48	18.5
	31 - 40	18	6.9
	41 - 50	18	6.9
	51 - 60	8	3.1
	61 - 70	16	6.2
	71 - 80	29	11.2
	81 - 90	65	25.0
	91 - 100	24	9.2
	Total	66	100.0

Findings revealed that almost half of the participants knew less than 60% of the academic words listed. Another half of them knew around 60 % to 90% of the academic words listed. Overall, the findings indicated a moderate level of mastery. Based on the wordlist, it was indicated that low-frequency words showed lower familiarity among participants. This indicated that Malaysian ESL learners are still having a relevantly low size of academic vocabulary knowledge. However, this is apparent as the respondents are first year students in tertiary education. They are most probably having less exposure to academic vocabulary words since secondary school thus it is reflected in the result.

Moreover, a study by Amerrudin, Nor Liza and Sarimah (2013) reported that students' vocabulary knowledge learned at Malaysian secondary school has not prepared them with the essential vocabulary needed in tertiary education especially academic vocabulary. This is backed with their findings that showed in Malaysian English language syllabus booklets the words analysed have only found 0.93% of a total of 322 words in Form Four and Form Five syllabus booklets are academic words. It is more disheartening that in Form One to Form Three the academic words were only 4 academic words out of 994 words. This finding implicate that the Malaysian secondary English syllabus has mostly not emphasizing academic vocabulary rather it caters for most common and frequent words of English. And the adverse impact of this, is the size of Malaysian vocabulary knowledge is limited even until their tertiary education.

Difference between the level of academic vocabulary knowledge and English language proficiency

Independent T-Test between Different Language Proficiency and Academic Vocabulary Knowledge Score

		Levene's Test for Equality of Variances		t-test for Equality of means		
		F	Sig.	T	df	Sig. (2-tailed)
PERCENTAGE_SCORE	Equal variances assumed	12.586	.001	-2.965	64	.004
	Equal variances not assumed			-2.639	34.879	.012

The tables show different means between different language proficiency. The purpose of this research question is to find out whether different language proficiency influences the academic vocabulary knowledge score. The null hypothesis (H₀) for Levene test is the variances in academic vocabulary knowledge scores are equal across different language proficiency levels. Meanwhile, the alternative hypothesis for Levene test is the variances in academic vocabulary knowledge scores are not equal across different language proficiency levels. Since the significance value (Sig.) is .001, which is less than .05, the null hypothesis of equal variances is rejected. This indicates that there is a significant difference in the variances of academic vocabulary knowledge scores between the different language proficiency groups. The same goes for t-test. Since the p-value is less than .05, the null hypothesis of no significant difference between the two variables is rejected, concluding that there is a significant difference in academic vocabulary knowledge scores between different language proficiency levels. The language proficiency of the participants was based on Malaysian University English Test (MUET). Othman and Nordin (2013) reckoned MUET as a proficiency test that has the ability to segregate and identify the good and low proficiency students in preparing them to operate and understand English in college or university campuses. Based on this study, most respondents are Band 3 achiever and some of them are Band 4 and it shows that different language proficiency has a slight impact on the size of academic vocabulary knowledge. This can be concluded that the level of academic vocabulary knowledge aligned with general vocabulary size of participants. The more proficient participants would have a broader vocabulary size which includes academic vocabulary knowledge as compared to less proficient participants.

Discussions

This study aims to identify level of academic vocabulary knowledge among Malaysian ESL undergraduates. It also seeks to investigate the highest known and unknown academic vocabulary words other than to explore the differences between language proficiency and academic vocabulary knowledge. Based on these findings, knowledge of academic vocabulary among Malaysian L2 undergraduates is a concern that must be taken an imperative action from the authorities involved. Academic vocabulary knowledge is relatively still low and it could hinder their comprehension of academic reading material and also understanding in academia lecture speech. Knowledge of academic vocabulary would greatly contribute to their interest in reading extensive academic material and also enhance their vocabulary in speech and effortlessly writing in academic discourse. This low percentage confirmed the findings from previous scholars such as from Harji et al., (2015). They identified the vocabulary level and size of Malaysian undergraduates were only at 2000-word level using Nation and Laufer (1999) instrument Productive Vocabulary Level Test. And in

that study as well, almost all of the students fell in lower band score of 50 or lesser points in University Word Level (UWL) indicating that their vocabulary knowledge is inadequate to manage the reading academic demands at the university level. Sulaiman et. al., (2018) also resonates the same finding which tertiary students showed a higher percentage of unknown words for low frequency and low utility academic words from Coxhead's (2000) AWL in comparison with high frequency academic word. This is considered a concerning issue because mastering vocabulary at the 3000 level, 5000 level, and academic level is essential for students to understand reading texts and effectively complete exercises, tests, and exams in the target language. These numbers of 3000 and 5000 levels also being emphasized by Nation and Warring (1997) to help for fundamental comprehension in English as a second language. Nation (2006) also stated that for L2 reading, the knowledge of around 8,000 - 9,000 of the most frequent word families could help reading comprehension.

The second conclusion could be inferred is that vocabulary knowledge is an incremental process that needs multiple, extensive and explicit exposure of academic vocabulary learning and teaching instruction. The intricate natures of vocabulary knowledge need learners to not only know the word's meaning but also to give attention to contexts in which the words are used, its associations with other words, and its syntactic behaviour in sentences (McKeown, 2019). Briefly, words are polysemous which their meanings are dynamic and could shift according to context. The same goes for academic vocabulary knowledge which scholars as cited in Warnby (2023) (e.g., Lim Falk & Holmberg, 2016; Nagy & Townsend, 2012; Schmitt, 2008) agreed it requires explicit instruction and intentional learning as incidental acquisition of this academic vocabulary through everyday encounters—such as reading novels, newspapers, listening to podcasts, or watching movies—is unlikely. Yet, it is reported by Kamariah et al., (2016) there was a lack of explicit academic vocabulary guidance and instruction for teaching the words during the early stages of tertiary education which could hinder L2 learner's vocabulary growth. Amerrudin et al., (2013) also shared the same concern which he stated there was minimal focus on fostering academic vocabulary during secondary education. Thus, this explained why the size of academic vocabulary knowledge among tertiary students especially first year undergraduates are insignificant.

On the other hand, for research question number two, it is evident that there is a significant difference between language proficiency and the level of academic vocabulary knowledge achievement among the respondents. In this study, the high proficiency in English language is those who scored Band 4 and above meanwhile medium to low proficiency in English language is for those who scored Band 3 and below. For Malaysian pre-university students, Malaysian University English Test (MUET) is a compulsory English test before entering their tertiary education. It aims to quantify pre-university students' proficiency level in the English language and has been acknowledged as a standardized proficiency test similar to IELTS and TOEFL (Rethinasamy & Chuah, 2011). Othman and Nordin (2013) reckoned MUET as a proficiency test that has the ability to segregate and identify the good and low proficiency students in preparing them to operate and understand English in college or university campuses. MUET has four papers that tested on four different skills namely listening, reading, writing and speaking. Candidates are placed on a band of 1 to 6 based on the aggregated band score of the four language components. A study from Musa et al., (2021) shared that the student database shows majority of the students entered the university with MUET Bands 3 to 5. And there is a small number of students in the range of Bands 5 and 6. This finding reveals that most proficiency students could at least score better level of academic vocabulary knowledge compared to the least proficiency students. It

resonates the hypothesis of most previous studies which states that vocabulary size influences academic achievement of an individual. The correlations between academic vocabulary knowledge and academic achievement could be found in Masrai and Milton (2017, 2018) study. Based on the study, it was found that the grades achieved in English course exams by the participants were impacted by their academic and general vocabulary knowledge, among other factors. Their findings revealed a strong correlation between academic vocabulary knowledge and academic performance, suggesting that familiarity with academic words contributes uniquely, albeit marginally, to academic success beyond general vocabulary proficiency. Similarly, a recent study by Masrai and Milton (2021) on 61 Saudi EFL university students in an English language program demonstrated that general vocabulary size, assessed through a yes/no test, explained 47% of the GPA variance, while knowledge of the AWL accounted for an additional 11.5%. In a previous study, Loewen and Ellis (2004) observed that vocabulary size, particularly the UWL level test, had a significant impact on GPA variance among English for academic purposes students, further emphasizing the crucial role of L2 academic vocabulary knowledge in predicting academic success at the university level.

Conclusion

The findings of this study revealed that the level of academic vocabulary knowledge of Malaysian ESL undergraduates generally is still inadequate based on the percentages that the respondents mostly scored. The highest percentages that the respondents managed to get all the questions right is 21% to 30% from 140 academic vocabulary questions tested. It also showed there is a difference between the students' English language proficiency and the level of academic vocabulary knowledge that the respondents' scored. In tertiary education level, English language is mostly the medium of delivery in teaching and learning. It requires students to comprehend the lectures, academic reading materials such as academic article and academic texts in English. Thus, it is an advantage for the students to have prior knowledge of the general academic vocabulary knowledge to achieve greater academic success as have proven by the past researches. This study would help students and academic instructors to focus more in improving the acquisition of the academic vocabulary knowledge for their own academic development.

This study only focuses on the level of academic vocabulary knowledge of Malaysian ESL undergraduates and influence of English language proficiency towards their academic vocabulary knowledge. It is recommended for future research to consider looking at pre and post learning of academic vocabulary.

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Narrative-Animation STEAM Enrichment Program: Enhancing Creativity, Writing, and Affective Skills in Primary Students

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Abstract: The integration of STEAM (Science, Technology, Engineering, Arts, and Mathematics) in primary education is essential to equip students with critical thinking, creativity, and problem-solving abilities relevant to today's dynamic world. However, traditional STEM approaches often face challenges in sustaining young learners' engagement and nurturing their holistic development. This study introduces the *Narrative-Animation STEAM Enrichment Program* (NA-STEAM), a creative and interactive learning intervention aimed at enhancing primary students' cognitive and affective skills through storytelling and animation. The primary objective of this research is to evaluate the effectiveness of NA-STEAM in developing creativity, writing skills, and interest in learning, alongside broader cognitive and affective outcomes such as motivation, engagement, and confidence. A mixed-methods design was employed, combining quantitative and qualitative data collection. Quantitative data were obtained through a survey completed by 78 primary school students, focusing on creativity, interest, and writing proficiency. Qualitative data were collected through classroom observations and interviews with selected students and teachers to gain deeper insights into changes in students' cognitive and affective engagement during the program. Findings reveal that students who participated in NA-STEAM showed significant improvements in creativity, writing abilities, and learning interest. Qualitative analysis further indicated growth in higher-order thinking, emotional engagement, and self-confidence. These results suggest that incorporating narrative and animation within STEAM education is an effective strategy to promote both creative expression and affective development among young learners, offering valuable implications for future curriculum design and STEM education initiatives.

Keywords: Affective Skills; Cognitive Skills; STEM Education, Narative-Animation, Primary School

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Introduction

The integration of STEM (Science, Technology, Engineering, and Mathematics) in primary education is increasingly recognized as a critical component for equipping students with the necessary skills to thrive in an ever-evolving world. STEM education fosters critical thinking, problem-solving, and adaptability, which are essential skills in the 21st century (National Research Council, 2012). However, traditional STEM approaches often face significant challenges in maintaining young learners' engagement and interest, which can hinder the development of both cognitive and affective skills (Mayer, 2001). This has prompted educators to explore innovative strategies that combine creativity and interaction to enhance learning outcomes.

The 'Narrative-Animation STEAM Enrichment Program' (NA-STEAM) is one such innovative approach. By integrating storytelling and animation into STEM education, the program aims to create a more engaging and interactive learning environment. This approach aligns with the principles of STEAM (Science, Technology, Engineering, Arts, and Mathematics), which emphasizes the integration of the arts to foster creativity and holistic learning (Yakman & Lee, 2012). The NA-STEAM program seeks to improve students' cognitive abilities, such as critical thinking and memory retention, while also enhancing affective skills like motivation, engagement, and self-confidence. This study aims to evaluate the effectiveness of the NA-STEAM program in enhancing both cognitive and affective skills among primary school students. The research adopts a mixed-methods approach to provide a comprehensive assessment of the program's impact. By combining quantitative data from standardized assessments with qualitative insights from observations and interviews, the study seeks to offer a holistic understanding of the program's effectiveness.

Cognitive development in children is influenced by their ability to engage with and understand complex concepts, which can be significantly enhanced through interactive and narrative-based learning (Bruner, 1990). Similarly, affective development, which includes motivation, engagement, and self-confidence, plays a crucial role in a student's overall learning experience (Bandura, 1997). The NA-STEAM program leverages these insights by incorporating narrative and animation elements to make STEM learning more relatable and enjoyable for young learners. By addressing the limitations of traditional STEM education and integrating creative elements, the NA-STEAM program aims to foster a more inclusive and effective learning environment. This study contributes to the growing body of literature on innovative educational strategies and provides valuable insights for educators and policymakers seeking to enhance STEM education in primary schools. Therefore, this study was conducted to:

1. Evaluate the effectiveness of the Narrative-Animation STEAM Enrichment Program (NA-STEAM) in enhancing primary school students' creativity, writing skills, and interest in learning through a post-program survey.
2. Explore how the Narrative-Animation STEAM Enrichment Program (NA-STEAM) contributes to the development of students' cognitive and affective skills—such as motivation, engagement, and self-confidence—based on classroom observations and interviews.

Literature Review

STEAM Education and Cognitive Skills

STEAM education is rooted in the belief that integrating the Arts into traditional STEM subjects can foster creativity, critical thinking, and problem-solving abilities, all of which are essential in today's knowledge-based economy. Bequette and Bequette (2012) argue that STEAM education encourages students to think in a more interdisciplinary manner, recognizing the interconnectedness of science, technology, engineering, mathematics, and the arts. The STEAM approach moves away from siloed learning, encouraging students to use creative processes to solve real-world problems. Research has demonstrated that STEAM education promotes cognitive development by enhancing students' problem-solving and analytical thinking skills. For instance, students who engage in STEAM-based curricula are more likely to develop higher-order thinking skills, such as reasoning, analysis, and the ability to make connections between concepts from different disciplines (Bequette & Bequette, 2012). Moreover, by integrating creativity and artistic expression into scientific inquiry, STEAM education allows students to engage with STEM subjects in ways that are both intellectually stimulating and personally meaningful.

The Role of Narrative in Learning

Narrative learning has long been recognized as an effective pedagogical tool. Stories engage students on both cognitive and emotional levels, helping them make sense of complex ideas and fostering a deeper understanding of the material. Mandler (1984) suggests that stories activate cognitive processes by providing structure, context, and relevance to abstract concepts, allowing students to better comprehend and remember new information. Narrative-based learning can also foster engagement and motivation by drawing on students' emotions and personal experiences. According to Bruner (1991), stories create meaning by situating learning within real-world contexts, enabling students to see how abstract concepts are relevant to their lives. In the context of STEM education, narratives can make scientific principles more accessible and interesting by framing them within a story that students can relate to or be intrigued by.

Animation and Technology in Education

The integration of animation into education has gained prominence in recent years due to its ability to simplify complex concepts and engage students visually. Animation allows for the dynamic visualization of phenomena that would be difficult or impossible to demonstrate in a traditional classroom setting, such as molecular structures, the functioning of machines, or the movement of celestial bodies (Zhang, 2012). By making abstract concepts more concrete, animation helps students better understand the underlying principles of science and mathematics. Moreover, animation provides students with an opportunity to actively engage in the creation of content. Creating animated stories encourages students to think critically about the subject matter, develop technical skills, and apply their creativity to solve problems (Davis et al., 2008). Animation is also particularly effective in fostering collaboration, as students work together to develop, animate, and present their ideas. This collaborative process encourages communication, teamwork, and collective problem-solving—skills that are critical for success in both academic and real-world contexts.

Affective Outcomes of Narrative and Animation

Affective outcomes such as engagement, motivation, emotional response, and social collaboration play an important role in effective learning. Motivation has been identified as a key predictor of academic success, and it is especially important in subjects like STEM, which some students may find difficult or intimidating (Guthrie & Wigfield, 2000). Narrative and animation have been shown to increase student motivation by making learning more enjoyable and relevant to students' interests and emotions. In addition to motivation, the emotional connection students form with the content is critical for learning. Narrative and animation can foster empathy and emotional expression, helping students connect with the material on a deeper level (Guthrie et al., 2004). When students are emotionally engaged with a subject, they are more likely to persist in their learning, collaborate with peers, and experience a greater sense of accomplishment.

Integration of Narrative and Animation in STEAM Education

Despite the extensive research on STEAM education, narrative learning, and animation individually, there has been limited exploration of how all these elements can be integrated into a cohesive teaching approach for young learners. However, studies suggest that combining these elements can lead to improved cognitive and affective outcomes (Barker et al., 2017). By using animation to visualize STEM concepts within a narrative context, educators can create a dynamic and engaging learning experience that fosters both critical thinking and emotional engagement. In particular, the integration of narrative and animation in primary education presents a unique opportunity to make STEM subjects more accessible and enjoyable for younger students. As they engage with these mediums, students are more likely to develop a deeper understanding of STEM principles while also enhancing their creativity, social interaction, and emotional intelligence.

Methodology

A mixed-methods approach was adopted to comprehensively evaluate the impact of the NA-STEAM program. This approach combined quantitative data from standardized assessments with qualitative insights from observations and interviews to provide a holistic understanding of the program's effectiveness (Creswell & Plano Clark, 2011).

Quantitative Data Collection

The quantitative component of the study focused on evaluating the effectiveness of the NA-STEAM program in enhancing students' creativity, writing skills, and interest in learning. Data were collected through a one-time post-program survey administered to 78 primary school students from several schools who had participated in the program. The survey instrument consisted of both closed-ended and Likert-scale items adapted from validated instruments measuring creativity, writing competence, and learning interest (Cohen, Manion, & Morrison, 2018). The items were age-appropriate and designed to capture students' self-perceptions in these domains after completing the program. The data were analysed descriptively to identify trends and evaluate the program's perceived impact on the targeted affective and cognitive areas.

Qualitative Data Collection

To gain richer, contextualized insights into how the NA-STEAM program influenced students' cognitive and affective development, qualitative data were collected through classroom observations and semi-structured interviews. Observations were conducted throughout the implementation of the program using an observation protocol focusing on student engagement, collaborative behaviour, task persistence, and visible expressions of creativity and enjoyment (Patton, 2015). Field notes were taken systematically to capture behavioural indicators related to motivation and participation. In addition, semi-structured interviews were conducted with 10 selected students and 5 teachers who were directly involved in the program. The interviews explored participants' perceptions of the learning experience, including aspects they found meaningful, motivating, or challenging. Interview data were audio-recorded, transcribed verbatim, and analyzed thematically using a coding framework based on the study's conceptual focus (Merriam & Tisdell, 2015). These qualitative insights complemented the survey findings by providing depth and explanation to the observed patterns in students' affective and cognitive responses.

Results

This section presents the findings of the study based on the implementation of the *Narrative-Animation STEAM Enrichment Program* (NA-STEAM), which was designed to enhance primary students' learning experience through the integration of storytelling and animation in STEAM education. The findings are organized according to the two research objectives to provide a clear and structured overview of the program's impact.

Effectiveness of the NA-STEAM Program in Enhancing Students' Creativity, Writing Skills, and Interest in Learning

This subsection presents the quantitative findings related to the first research objective: to evaluate the effectiveness of the Narrative-Animation STEAM Enrichment Program (NA-STEAM) in enhancing primary school students' creativity, writing skills, and interest in learning. Data were obtained through a one-time post-program survey involving 78 participants. The survey responses were analyzed to determine the extent to which students perceived improvements in their creative thinking, ability to express ideas in writing, and sustained interest in STEAM-related activities. The results provide empirical evidence of the program's impact on these key areas of student development.

Table 1: Levels of Creativity, Interest, and Writing Skills Among Primary Students

Item	Mean (M)	Standard Deviation (SD)	Mean Interpretation
1) Creativity Level	3.80	1.06	Moderately High
2) Interest Level	3.87	1.05	Moderately High
3) Writing Skills Level	3.89	1.05	Moderately High

As shown in Table 1, students reported a moderately high level of creativity (M = 3.80, SD = 1.06) in applying STEAM concepts within their Malay language learning experiences. Regarding their interest, the findings indicate

a mean score of 3.87 (SD = 1.05), also interpreted as moderately high, suggesting that the NA-STEAM program successfully sustained student engagement and curiosity in STEAM-integrated Malay lessons. Finally, students' self-perceived writing skills yielded a mean score of 3.89 (SD = 1.05), reflecting a moderately high level of competence in expressing ideas in written form after engaging in the program. These results collectively demonstrate the positive perceived impact of the NA-STEAM program on students' creativity, interest, and writing skills in the context of Malay language education.

Contribution of the NA-STEAM Program to the Development of Students' Cognitive and Affective Skills

This subsection presents the qualitative findings related to the second research objective: to explore how the Narrative-Animation STEAM Enrichment Program (NA-STEAM) contributes to the development of primary students' cognitive and affective skills. Data from classroom observations and semi-structured interviews were analyzed to uncover patterns of change in motivation, engagement, and self-confidence. The results illustrate how the integration of narrative and animation elements in STEAM activities fostered students' active participation, critical thinking, emotional involvement, and increased confidence in expressing ideas and solving problems.

Cognitive Outcomes

The NA-STEAM program was found to significantly contribute to students' cognitive growth. Observations during classroom activities revealed that students consistently demonstrated critical thinking and problem-solving when constructing their narratives. For instance, in creating animated stories that depicted scientific processes, students were observed making logical decisions about sequencing, cause and effect, and scientific accuracy. They frequently debated which information to include, how to represent abstract scientific ideas visually, and how to link those ideas to their storylines. This process promoted not only deeper comprehension of STEAM content but also higher-order thinking.

Teachers highlighted notable improvements in students' planning and reasoning skills. Students began to ask more exploratory questions such as "What happens if...?" and "How can I show this clearly in my animation?"—indicating an internalisation of inquiry-based learning. The ability to deconstruct complex topics into manageable, creative outputs helped students retain knowledge better. Additionally, students displayed improved metacognitive skills by reflecting on their work, identifying weaknesses, and making informed changes to their animated projects. This reflective practice encouraged self-regulation and learning ownership, critical aspects of lifelong learning.

Affective Outcomes

In terms of affective development, the NA-STEAM program had a visibly positive impact on student motivation and engagement. Many students reported feeling more excited about learning compared to traditional science or language classes. Interviews revealed that students appreciated the freedom to personalise their learning through stories and characters that reflected their own interests and backgrounds. This sense of relevance and autonomy was key to increasing their emotional investment in the learning process.

Observational notes recorded increased attentiveness, eagerness to participate, and sustained interest during sessions. Students who typically showed signs of disengagement or low confidence in class were observed volunteering to present their stories or assist peers with animation tasks. These changes in classroom behaviour suggest that the program successfully nurtured intrinsic motivation by making learning enjoyable and personally meaningful. Teachers echoed these sentiments, reporting that the creative nature of the activities reduced anxiety and resistance, especially in students who usually struggled with science or writing tasks. By shifting focus from rote memorisation to imaginative construction, students found new ways to succeed, which led to positive emotional reinforcement and a more resilient learning mindset.

Social and Emotional Outcomes

The program also facilitated significant growth in students' social and emotional skills. The collaborative structure of NA-STEAM, which required students to work in pairs or small groups to brainstorm ideas, divide tasks, and produce animations, promoted teamwork and mutual support. Students showed increased empathy and respect for each other's ideas, and were frequently seen negotiating roles, resolving disagreements, and celebrating each other's successes.

Teachers observed improved classroom dynamics, with students demonstrating greater patience, listening skills, and openness to diverse viewpoints. Even quieter or more withdrawn students were gradually encouraged to contribute during group work and took on leadership roles in guiding animations or narrations. These experiences allowed students to build a sense of belonging and shared purpose, key components of social-emotional well-being. Emotionally, students expressed pride and joy upon completing their projects. Several interviewees mentioned that they felt a strong sense of achievement and were proud to share their animated stories with classmates and teachers. This contributed to an increase in self-confidence and a more positive self-concept as learners. For many, the opportunity to be "the storyteller" or "the animator" gave them a voice in the classroom that they hadn't experienced before.

Discussion

The findings of this study provide meaningful insights into the impact of the Narrative-Animation STEAM Enrichment Program (NA-STEAM) on the development of primary school students' creativity, writing skills, interest, and broader cognitive and affective attributes. Based on the first research objective, which aimed to evaluate the effectiveness of the NA-STEAM program in enhancing students' creativity, writing skills, and interest in learning, the survey data revealed that students reported a moderately high level across all three domains. These findings suggest that integrating narrative and animation elements into STEAM education is not only engaging but also effective in supporting students' ability to express themselves, generate original ideas, and sustain interest in the learning process. This supports prior studies indicating that creative instructional approaches such as storytelling and animation promote deeper engagement and imaginative thinking in primary education (e.g., Özdemir & Korkmaz, 2020; Kim et al., 2019).

In relation to the second objective, which was to explore how the NA-STEAM program contributes to the development of students' cognitive and affective skills—including motivation, engagement, and self-confidence—the qualitative data obtained through classroom observations and interviews further enriched the interpretation of the survey results. Observations revealed that students displayed enthusiastic participation, willingness to collaborate, and persistence when completing STEAM tasks. Interviews with both students and teachers confirmed that the use of narrative-animation helped create a learning environment that felt safe, enjoyable, and intellectually stimulating. Students expressed greater confidence in presenting their ideas, especially through storytelling and animated content, while teachers noted improvements in students' attention span and willingness to take intellectual risks. These findings resonate with educational theories suggesting that affective engagement is a key precursor to cognitive development and that emotional investment in learning tasks enhances memory retention and problem-solving ability (Immordino-Yang & Damasio, 2007).

Overall, the integration of narrative and animation within a STEAM framework shows promising potential in supporting both the academic and personal growth of primary school students. By embedding creativity and storytelling into structured learning, NA-STEAM appears to bridge the cognitive and emotional domains, making learning more holistic and meaningful. This study underscores the need for innovative, student-centered pedagogies in 21st-century classrooms, particularly in early education, where engagement and foundational skills are crucial to lifelong learning.

Conclusion

In conclusion, the Narrative-Animation STEAM Enrichment Program offers a promising approach to enhancing both the cognitive and affective development of primary school students in STEM education. By combining the engaging power of storytelling with the visual impact of animation, this program fosters deeper understanding, increased motivation, and enhanced emotional engagement. These findings underscore the potential of interdisciplinary learning to make STEM subjects more accessible, enjoyable, and relevant to young learners. The results of this study have important implications for future educational practices. Schools and educators looking to implement innovative teaching methods in STEM education may find that integrating narrative and animation offers a valuable strategy for improving student outcomes. Further research is needed to explore the long-term effects of such programs and their potential for broader application across different educational contexts.

Acknowledgement

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Attend or Not to Attend: First-Year Dilemma in Second-Language Writing

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Abstract: High-performing students are assumed to have good class attendance. However, little is known about students' attendance in the first weeks of a course in relation to preexisting skills, particularly for English-as-a-second-language students in written communication courses. This study specifically examined whether this belief would apply to students who have been deemed competent speakers of English (i.e., a prototypical undergraduate student population at English-medium universities). Furthermore, the study assessed the extent to which attendance could be predicted by students' basic writing skills at the start of the course. A sentence-combination task and a sentence-building task administered under time constraints served to assess students' basic writing skills. A self-efficacy scale measured students' confidence in their academic abilities. Then, attendance in the first 5 weeks was collected. In this study, students with high writing skills at the start of the course (as measured by the sentence-level tasks) had better attendance than students with lower writing skills. However, sentence-level writing skills were modest predictors of students' attendance. This latter finding was mostly due to the views that students held regarding the contribution of written communication instruction to their existing abilities. Some high-skill students were so over-confident that they saw class attendance as unnecessary, even though their sentence-level performance had weaknesses. It was concluded that inquiring about and addressing students' views of instruction may be useful for developing early interventions to address potentially at-risk students.

Keywords: Writing, Second Language, Assessment, Diagnostic Tool

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Introduction

Sentences are the building blocks of the more complex structures that define students' writing (Graham & Alves, 2021; Hidayah et al., 2024). Thus, sentence-level tasks, such as sentence combination and building, are useful, albeit not exhaustive, indices of writing proficiency. For writers for whom English is a second language, challenges are considerable. Writing is a cognitively demanding task that taxes working memory, a limited capacity mental device writers rely upon to hold information for immediate use and manipulation (Güvendir & Uzun, 2023). Furthermore, interference from their first language may add to the cognitive demands of writing (Kazazoğlu, 2020), whereas writing anxiety may deplete the already scarce resources (Waked et al., 2023; 2024). In this context of challenges, class attendance becomes a synonym for not only engagement but also distributed linguistic practice (Fryer et al., 2018). Thus, it is not surprising that undergraduate students' performance is linked to their attendance. For instance, Fay et al. (2013) examined exam performance in a content course taught in English, which involved a substantial amount of passive learning and enrolled students ranging from modest to advanced English language users. They also examined exam performance in an English communication course that taught listening, speaking, reading, and writing skills to English language beginners, and involved a substantial amount of active learning. Fay et al. found that attendance benefits were greater in the English communication course devoted to beginners. Of course, the purported benefits of attendance are not unique to English language learning. In the meta-analysis of Credé et al. (2010), class attendance was found to correlate with course grades across a large number of fields and preexisting abilities. According to Credé et al., attendance has several advantages conducive to academic attainment. It offers distributed practice, which is known to increase the retention of class contents (Cepeda et al., 2006), exposes students to additional information above and beyond class materials, and gives students diverse opportunities to interact with such materials (e.g., lectures, reviews, demonstrations, etc.).

Our research rests on the notion that class attendance, at the very minimum, means knowledge of class activities. Often, it also means participation in class activities and thus enhanced performance (Kim et al., 2020). One set of foundational skills of second-language learners is their ability to understand sentence construction in English, including the ability to develop increasingly complex syntactic structures (Graham & Alves, 2021; Hidayah et al., 2024; Jagaiah et al., 2020; Shalawati & Hadijah, 2020). The mastery of lower-order writing skills (e.g., vocabulary and sentence construction) is considered as important as the mastery of higher-order writing skills (e.g., planning, drafting, and revising; Kim & Zagata, 2024). Thus, we assess the sentence-level skills of freshmen at the start of a written composition course. Our aim is twofold: First, we want to test the belief that writers differing in proficiency (at least at the sentence level) also differ in attendance rates during the initial 5 weeks of the course. Second, we want to determine whether sentence-level skills assessed at the start of the course can predict early attendance. Our ultimate aim is to develop early interventions for at-risk students who can be identified at the start of the semester through easy-to-administer tools.

Considerable research has targeted second-language learning in beginners, but little is known of competent second-language users of English. Such speakers comprise a sizable population of students in undergraduate and graduate programs at English-medium institutions of higher learning. The label 'competent user' is used to refer to students who have a reasonable command of the English language in speaking, reading, listening, and writing, as attested by

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standardized English tests. For instance, IELTS (International English Language Testing System) defines a competent English language user as somebody who has an "effective command of the language, despite some inaccuracies, inappropriacies, and misunderstandings in some situations. Can use and understand fairly complex language, particularly in familiar situations" (IELTS, 2007, p.4). Thus, the data collection of the present study entails an understudied population of second-language English freshmen at an English-medium university who have been judged to be competent English speakers through standardized tests. The selected sample reflects the entry-level undergraduate population of second-language speakers of many higher education institutions around the world. In this study, the following questions are asked:

Q1   Do students proficient in writing have better early attendance? Several studies (Credé et al., 2014; Khan, 2022; Lukkarinen et al., 2016) have reported that attendance and good academic performance are linked. In these studies, attendance is viewed as a mark of students' engagement with course materials. Thus, it is reasonable to ask whether attendance in the first weeks of the semester differs between high- and low-skill students. If attendance is treated as an index of initial engagement with a course, early attendance will differ between the two groups of students (H1).

Q2   If students proficient in writing have better early attendance, to what extent can sentence-level skills, which index students' basic abilities in written communication, predict their attendance? Fryer et al. (2018) found that students' English competence, broadly defined, as well as the importance attributed to class activities (task value), modestly predicted their attendance (+0.18 and + 0.24, respectively). However, they relied on second-year students with intermediate English competency. We are interested in first-year students as the formation of study habits is likely to be defined during periods of environmental changes (Carden & Wood, 2018). In this context, the extent to which attendance is predicted by initial writing skills may depend on how students conceptualize their abilities (self-efficacy; Graham, 2022) in comparison with in-class instruction (task value). Some high-skill students may see in-class instruction as failing to add to their current abilities (e.g., "I can do this task myself"), whereas some low-skill students may see in-class instruction as helping them improve their abilities. If these attitudes exist in students, early attendance will only be weakly predicted by sentence-level skills (H2).

Q3   Do high- and low-skill students differ in their appreciation for the differential degrees of freedom possessed by various writing tasks? If students' freedom of expression reflects their engagement in writing, sentence-building performance will be higher than sentence-combination performance. In the former, the writer is free to select and combine content and function words within a text defined by a few constraints. Yet, not all students may appreciate this freedom of expression equally. Low-skill students may see the fewer constraints of the sentence-building task as confusing instructions. If so, high-skill students will do better in the sentence-building task, whereas lower-skill students will do better in the sentence-combination task (H3).

Method
Participants

The participants were a convenience sample of 370 undergraduate female students who were enrolled in a written

communication course taken during the first year of university studies. Their first language was Arabic. Their English proficiency was determined to be at least at the competent level in grammar and vocabulary, reading, listening, writing, and speaking (as per the Aptis Placement Test, EPT, and IELTS administered before admission). Students were pursuing either a STEM major (50%) or a non-STEM major (50%) at an English-medium university. Ages ranged from 18 to 27 years. The written communication course was taught in English and organized into 10 sections of 30-32 students, each taught through active learning methodology (e.g., guided inquiry learning; Lin et al., 2023; Palupi & Subiyantoro, 2020) to vigorously engage students in the learning how-to-write process. The use of Arabic in class was vigorously discouraged. The participation rate was 94%.

Materials and Procedure

During the second week of the fall semester, each student independently completed a sentence-combination task and a sentence-building task mirroring those of the Wechsler Individual Achievement Test-Third Edition (WIAT-III). In the sentence-combination task (5 trials), students (a) combined two or three brief sentences into one under the constraint that the overall meaning would not be altered. In the sentence-building task (7 trials), students develop sentences under the constraint that a particular function word (i.e., article or preposition) would be used. Each student was given 15 minutes to complete both tasks in class while being monitored by a faculty member. A time restriction was necessary to measure individual differences in the fluency of writing (Nguyen, 2015) among a purportedly homogeneous competence-level group. Monitoring was necessary to ensure that students' performance would not rely on technological aids (e.g., spell checker, thesaurus, a paraphrasing tool, or any other AI-powered composition tool, etc.). Furthermore, to diminish the occurrence of second language writing anxiety (Pilotti et al., 2024; Powers et al., 1979; Waked et al., 2024), the sentence-level tasks were presented to students as games that did not contribute to class marks (see Allen et al., 2014). Games were described as ways to freely self-assess one's knowledge of the English language. Self-assessment would provide feedback about how each student dealt with English writing without the assistance of technological aids.

Self-efficacy (confidence in one's abilities) ratings were also collected. The New General Self-Efficacy (NGSE) scale of Chen et al. (2000; 2001) was used to measure students' general confidence in their ability to complete academic tasks. Students were asked to indicate their degree of agreement with each of its 8 statements of confidence on a 5-point Likert scale from strongly disagree (i.e., -2) to strongly agree (i.e., +2). On this scale, 0 served as the neutral point.

Attendance in the first 5 weeks of the semester was collected from the instructors who taught the selected written composition sections. Excused absences were counted as absences. Classes included were those that met either three times a week for class meetings of 50 minutes or twice a week for class meetings of 1 hour and 15 minutes. Attendance was then computed as a percentage of the total time of class meetings a student attended out of those offered.

Informed consent was collected in advance of participation. Immediately before completing the sentence-level tasks, participants were asked a few questions concerning demographic information (e.g., age, major, etc.). Response files were anonymized immediately after the attendance data were matched with the sentence-level task performance and

self-efficacy ratings. Debriefing sessions during the semester were used to collect the anonymized views of the participants regarding their attendance, writing skills, and self-confidence. The guidelines of thematic analysis based on a coding reliability approach (see Braun & Clarke, 2021) were used to organize comments into themes. Students' comments informed the interpretation of the quantitative results obtained from the same students. The data-collection process was approved by the Deanship of Research of the hosting institution. It was deemed to comply with the guidelines of the Office for Human Research Protections of the U.S. Department of Health and Human Services.

Scoring, Reliability, and Validity Analyses of the Sentence-Level Tasks

Each sentence produced by students was scored separately by two independent raters for grammatical, spelling, and semantic errors in a binary fashion (1 = correct; 0 = mistake). To index a student's performance in each sentence task, correct completion scores in each task were translated into percentages.

Cronbach's alpha, an index of the internal consistency of the sentence-level tasks, was 0.73. Test-retest reliability was assessed by considering the performance of 15 students who completed both tasks twice in a span of two weeks. No significant differences in their performance were obtained [ts(14) < 1, ns], thereby attesting to the reliability of the sentence-level tasks.

A content validity index was also assessed. Content validity was operationalized as the degree to which the trials in the sentence-level tasks adequately reflected the content of the cognitive processes that students engage in written communication courses. Three faculty members who had taught written communication courses for at least 5 years served as raters. They were asked to indicate the extent to which each trial of either the sentence-combination task or the sentence-building task reflected the cognitive operations that students would be expected to carry out in a written communication course. Faculty rated trials on a 5-point Likert scale from 0 (not at all) to 5 (always). Each rater assigned a score equal to 4 or above to all trials (Polit & Beck, 2006).

The Cronbach's alpha of the NGSE scale was 0.90, thereby illustrating acceptable reliability (i.e., internal consistency). The validity of this scale for the selected population was assessed in earlier studies (Pilotti et al., 2024). Validity assessment found the scale suitable for administration.

Results and Discussion

H1: Do Students Proficient in Writing Have Better Early Attendance?

A median split was performed on the average sentence-level performance, thereby creating two groups characterized by differing initial writing skills: high-skill students (n = 189) and lower-skill students (n = 181). In Table 1, the descriptive statistics (Mean = M; Standard Error of the Mean = SEM) of the data collected about performance, self-confidence, and attendance are organized by skill group. Through analysis of variance (ANOVA), we assessed whether there were differences in attendance between skill groups. ANOVA was also used to determine whether performance and self-efficacy differed between sentence-level tasks for high-skill and lower-skill students. Instead, Pearson correlation analyses were conducted between either of the sentence-task measures and attendance records to

determine the degree to which the former (i.e., sentence-level skills) could predict the latter. All inferential statistics were assumed to be significant at $p < 0.05$.

Table 1. Descriptive Statistics for Attendance Records, Sentence-Level Tasks, and Self-efficacy

Factors	High-Skill		Lower-Skill	
	M	SEM	M	SEM
Attendance (range: 0 –100)	80.50	1.12	71.61	1.15
Sentence-level tasks (range: 0 –100)				
Sentence-combination task	82.01	1.10	55.86	1.12
Sentence-building task	87.45	1.09	59.91	1.11
Self-efficacy (range: -2 – + 2)	+1.01	0.05	+0.93	0.05

A one-way between-subjects ANOVA was conducted to determine whether attendance differed between students with high or lower sentence-level skills. In agreement with H1, there were significant differences between high- and lower-skill students in attendance records [$F(1, 368) = 30.68$, $MSE = 238.69$, $p < 0.001$, $partial\ \eta^2 = 0.077$]. Namely, high-skilled students had better attendance records.

H2: To What Extent Do Sentence-Level Skills Predict Attendance?

To determine the extent to which sentence-level skills might predict attendance, Pearson correlation analyses were conducted between each sentence-level task and attendance records. Overall, we found that higher sentence-level skills corresponded to greater attendance in the first 5 weeks of the semester. Attendance was predicted by the sentence-combination performance [$r = +0.37$, $n = 370$, $p < .05$] as well as by the sentence-building performance [$r = +0.40$, $n = 370$, $p < .05$]. However, coefficients of determination indicated that the percentage of variance in attendance accounted for by the performance in either sentence-level task was rather minor (14% and 16%, respectively). The modest strength of the association between attendance and each sentence-level performance indicated that other factors might contribute to attendance, such as the value students attributed to course activities.

Although the attendance of high- and lower-skill students differed, evidence indicated that sentence-level tasks might be less than ideal predictors of early class attendance. One possible reason might be individual differences in the way students conceptualized their abilities concerning course demands. However, there were no differences between high- and lower-performing students in the self-efficacy (i.e., confidence in their abilities) they attributed to academic tasks [$F(1, 368) = 1.25$, ns]. Not surprisingly, when in each group we tested the relationship between general self-efficacy in academic tasks and attendance, no significant relationship was uncovered [rs ≤ 0.07, ns]. The reasons for this null finding emerged from debriefings. In high-skill students, a recognition of one's abilities was often accompanied by a low consideration for class attendance. An attitude that some students summarized as "I know this stuff. I do not need to attend every class". Surprisingly, this attitude was supplemented by reports that performance in the two sentence-level tasks had not been effortless or trouble-free. In low-skill students, over-estimation of abilities, however, took a different form. Denial that class meetings would aid learning was encapsulated by comments, such as "I do not need to attend every class. I learn better at home!". Denial of the utility of class meetings was often accompanied by the

desire to avoid potential comparisons with classmates' abilities. Thus, individual differences in the ways the value of class activities was conceptualized by students in each skill-level group might have rendered a relationship between attendance and self-efficacy moot.

H3: Do High- and Low-Skill Students Differ in Their Appreciation for Autonomy in Writing Tasks?

A mixed factorial ANOVA was then conducted with skill level (high versus lower) as the between-subjects factor, and task type (sentence combination versus sentence building) as a within-subjects factor. In support of the median split performed on average sentence-level skills, there were group differences in students' overall sentence-level skills [$F(1, 368) = 698.02$, $MSE = 190.99$, $p < 0.001$, partial $\eta^2 = 0.655$]. However, students' skills were higher in the sentence-building task than in the sentence-combination task, [$F(1, 368) = 15.93$, $MSE = 261.35$, $p < 0.001$, partial $\eta^2 = 0.042$]. Both high- and lower-skill students [$F(1, 368) < 1$, ns] displayed the same pattern, thereby failing to support H3.

Students' comments in debriefing sessions indicated that the two sentence-level tasks were viewed differently. Namely, the sentence-combination task was regarded by students as a mere paraphrasing task. Performance was constrained by the words in each sentence that needed to be joined into one structurally cohesive unit. Instead, performance in the sentence-building task had more degrees of freedom. As such, it was viewed by students as granting them more autonomy. It allowed them to select words and, to a certain extent, the sentential structure within which such words would be embedded. The sentence-building task was reported to be more interesting, engaging, and even easier to carry out.

Discussion

The results of the present study can be summarized into two main points. First, in a written communication course, students whose preexisting sentence-level skills are high tend to have better attendance in the first weeks of the semester than those who possess lower skills. Second, preexisting sentence-level skills are modest predictors of early class attendance. Students may view in-class instruction as not adding much to what they already know, especially if they are affected by overconfidence. Thus, although self-confidence by itself does not predict attendance, the relationship between self-confidence and view of instruction can offer a window into how English-as-a-second-language students initially approach learning in written composition courses. Thus, it is not surprising that there were no differences between high- and lower-performing students in the self-efficacy (i.e., confidence in their abilities) attributed to academic tasks. Our findings, combining quantitative and qualitative evidence, also help explain prior mixed evidence on the relationship between self-efficacy and performance collected from the same population (Pilotti et al., 2021; Pilotti, 2022). Our results are consistent with those of Fryer et al. (2018), who found that students' preexisting English competence (as measured by a pre-test) and task value (i.e., the importance students attributed to class activities) modestly predicted their attendance (+0.18 and + 0.24, respectively).

One of the limitations of our study is that it concerns female freshmen. It is unclear how male students may respond to the same assessment. Gender differences in attendance and participation have been reported in face-to-face

classrooms. For instance, Woodfield et al. (2006) found females to exhibit higher attendance rates than males, whereas Caspi et al. (2008) found males to exhibit greater participation (e.g., activities such as asking or responding to questions). Thus, one of the unknown variables in our study is the extent to which the attendance rates that we recorded in the first 5 weeks of the semester corresponded to a measurable index of participation (i.e., degree of engagement in the learning process; Kim et al., 2020). Furthermore, the study does not analyze attendance patterns across broader subject areas (e.g., general education courses in basic skills, such as writing and mathematics, and thematic general education courses, such as those in the social and behavioral sciences). Other factors that we did not examine are writing anxiety (Waked et al., 2024), which is often correlated with the quality and quantity of one's communication skills (Waked et al., 2023), and self-awareness of one's competence. Often, overconfidence is associated with poor performance (Pilotti et al., 2023). In the current study, overconfidence appeared to be linked to reasonably good language abilities at the sentence level, which then might have depressed attendance (as per students' unprompted admissions).

Conclusion

Among the factors that students can typically control in educational settings, class attendance is the factor that has often been linked to academic achievement. Nevertheless, the evidence linking the two variables is mixed. The main reason is that attendance is the precondition for participation, which is the embodiment of the engagement that defines active learning (Kim et al., 2020). Furthermore, in dispute is the generality of the relative beneficial effect of active instruction compared with more passive approaches, such as lecturing. For instance, Kozanitis and Nenciovici (2023) reported greater benefits for introductory courses that enroll freshmen and sophomores than for upper-level courses taken by juniors and seniors, whereas Freeman et al. (2014) reported no differences in course level. Our study demonstrated that in an active learning setting devoted to written composition, class attendance in the first 5 weeks of this entry-level course differs between high-skill and lower-skill students. However, skill level only modestly predicted attendance. Qualitative evidence indicated that a crucial ingredient in moderating this relationship might be how high- and low-skill learners view the utility of in-class instruction (i.e., task value). Whether individual differences in task value are carried on to the end of the course and determine final grades is yet a matter to be investigated.

Recommendations

One of the lessons that the findings of this study offer is to suggest that two distinct types of at-risk students exist, both requiring instructional interventions. Conventionally, high-risk students are those characterized by low skills and performance. In our study, these students fell into two clusters: those who viewed in-class instruction as helpful and thus had good attendance, and those who viewed self-directed work at home as more effective. The latter students relied heavily on written instructions posted on Blackboard. They often justified their less-than-desirable writing performance by attributing it to the unclear written instructions posted on Blackboard by the instructor. The other group of high-risk students is less conventional. It comprised students with reasonably good writing skills who were affected by overconfidence and exhibited low attendance. They saw in-class instruction as needless because they

believed they had already done all the learning required by the course. Thus, they also believed that self-directed work at home was sufficient to do well. Consequently, they tended to miss exposure to important class materials and activities and acted genuinely surprised when their absences led to undesirable outcomes (e.g., misunderstanding an assignment, missing a quiz or exam, etc.).

The students of both groups need an instructional intervention that rectifies their overconfidence. Of course, when undesirable outcomes are faced, some of these students may increase their attendance (i.e., choose behavioral change), whereas others rely on external attributions (e.g., unclear written instructions) to reject behavioral change. Students' views of self-directed work at home as being more effective than in-class instructions are those to address at the start of a class with practical demonstrations that knowledge acquired in class can not only clarify possible misunderstandings of written instructions but also make academic tasks easier to accomplish. Additionally, if in-class work is assessed and graded, attendance may become part of the students' reward system.

Acknowledgments

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Pre-Service Teachers' Professional Identity: A Case Study of Sociocultural Perspective in Indonesian EFL Context

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Abstract: Teaching practicum is an important phase for pre-service teachers to create a chance for them to begin solid teacher's identity that would help in the future profession. Then, this study aims to investigate the professional identity of pre-service teachers during their teaching practice in the context of EFL in Indonesia. This study involved two pre-service teacher who taught at one of the junior high schools (SMP) and vocational high schools (SMK) in Indonesia. The data collection method used was the semi-structured interviews, and then the data were analyzed using critical discourse analysis (CDA) with Milles and Huberman's framework analysis. The results of the study were divided into three aspects, namely pre-service teachers as pedagogical experts, subject matter experts and pedagogical content experts. These findings discussed the professional identity of pre-service teachers during teaching practicum included their beliefs, philosophies, self-imaging, role and agency through sociocultural perspective. Therefore, the results of this study provide empirical insights for other pre-service teachers regarding the formation of pre-service teachers' professional identities during teaching practicum that will help them in shaping their teacher professionalism in the future.

Keywords: Pre-Service Teacher, Professional Identity, Teaching Practicum.

Introduction

Teaching practicum is an important phase for pre-service teachers to gain more experience. It creates a chance for

them to begin solid teacher 's identity that would help in the future profession (Timoštšuk & Ugaste, 2010). In addition, Izadinia (2015) research articulates that teaching practicum program can offer students an opportunity to develop an understanding of the teacher 's role and a sense of self-efficacy in their ability to cope with future challenges. Moreover, in particular, pre-service teachers have a unique chance to—try‖ on some of the professional roles and explore what it means to be a teacher in real practice (Meyer, 2009, p.27). Therefore, during this phase, it is necessary for pre-service teachers to start creating an identity as a teacher.

In line with this issue, pre-service teachers must build their teacher professional identity as a way to be a professional teacher. Trent (2013) states that pre-service teachers 'professional identity construction is the uniting of past experiences of teachers and teaching and imagined future as a full-time teacher. In other words, it is a process of learning which means the realignment of —experience‖ and —competence‖ (p.437). Apparently, many pre-service teachers are less attention to this process of forming a professional identity. For instance, based on researcher experience, pre-service teachers do not carry out seriously in teaching practices, such as teaching without lesson plans, did not observe the situation of class, and did not prepare the materials. They are only carrying out seriously when the examination will be held. It shows that they do not realize that teaching practicum is one of the most influential components of teacher education to create their professionalism ((Ferrier-kerr, 2009).

Moreover, the role of teacher educators is also important to build pre-service teachers '-awareness of their professional identity. Same as Rodrigues '(2018) findings that experienced teachers have a considerable impact on the development of pre-service teachers 'identity that embodies the pedagogical, technical and ethnical dimensions of teaching, and responds to social and cultural diversity. Hence, the professional identity of pre-service teachers needs to be explored to get the empirical study of forming teacher identity. It is necessary because teacher identity provides a framework for teachers to construct their own ideas of —how to be‖, —how to act‖ and —how to understand‖ their work and place in society (Beauchamp & Thomas, 2009, p.178).

In the last decade, pre-service teachers 'identity construction has become a focus of much empirical discussion (Yuan & Lee, 2015, p.469). While some researchers have found that pre-service teacher identity is constructed by sociohistorical, social and emotional processes, few studies have tracked the social factors which help the identity construction such as teacher educator, school-based supporting teachers, and students. Some researchers have focused on emotional processes and explored how emotion plays a role in pre-service teachers 'identity construction (e.g. Timoštšuk & Ugaste, 2010; Yuan & Lee, 2015, 2016). Meanwhile, another research draws on the sociohistorical perspective and explores how the identity of pre-service teachers emerges out by their participation in teaching practicum programs (e.g. Timoštšuk & Ugaste, 2010). Further, some researchers have investigated how pre-service teachers 'identity is constructed and helped by teacher educator and position of themselves in the social context (e.g. Trent, 2013; Rodrigues, de Pietri, Sanchez, & Kuchah, 2018).

Given the significance of the pre-service teachers 'identity, the present study investigates the professional identity of pre-service teachers who had passed the teaching practicum program in one of the universities in Tasikmalaya. This study investigates the pre-service teachers 'professional identity viewed from sociocultural perspective. Sociocultural means the situation of learning belongs to place and society. In other words, it is the interaction between people to

people and people to the environment. Drawing on the aforementioned discussion, in this study I addressed the following question, ―How do pre-service teachers describe and understand their professional identity viewed from a sociocultural perspective?

Pre-service Teachers' Identity Concept and Urgency

The concept of pre-service teachers 'identity begins with an understanding of identity itself. Norton (2010) defines identity as ―how a person understands his or her relationship to the world, how that relationship is constructed across time and space, and how the person understands possibilities for the future‖ (p.5). Danielewicz (2001) conceptualizes identity as ―our understanding of who we are and who we think other people are‖ (as cited in Trent, 2013, p.427) or ―the way we make sense of ourselves to ourselves and the image of ourselves that we present to others‖ (Day, 2011, p.48).

Given the well-established operationalization of identity, Gee (2000) added that identity is a matter of―being recognized as certain kind of person‖ (p.99). He identifies four ways that identity might be perceived: nature-identity (stemming from one 's natural state), institution-identity (derived from a position recognized by authority), discourse-identity (resulting from the discourse of others about oneself), and affinity-identity (determined by one 's practices in relation to external groups). According to Gee (2000), identity is not a permanent, fixed or stagnant concept; it is constantly changing and is very dynamic. In addition, a person may assume multiple identities based on the various roles s/he has to play in society. The perspectives are presented concisely in Table 1.

Table 1. Adapted from ―Identity as an Analytic Lens for Research‖ (Gee, 2000).

Perspective	Description	Process	Power	Source of Power
nature-identity	A state	Developed from	Forces	In nature/Biological
institution-identity	A position	Authorized by	Authorities	Within institutions
discourse-identity	An individual trait	Recognized in	The discourse/ dialogue	Of/with rational 'individuals
affinity-identity	Experiences	Shared in	The practice of	affinity groups

According to the Nature perspective (N-Identities), identity is seen as ―a state that I am in, not anything that I have done or accomplished‖ (Gee, 2000, p. 101). The second is the Institutional perspective (I- Identities), where the identity is derived from some ―position‖. Gee writes that ―the process through which this power works is authorization; that is, laws, rules, traditions, or principles of various sorts allow the authorities to "author" the position‖ (2000, p. 102). In the third perspective of identity, the discursive perspective means that rational individuals recognize this identity or individual trait in a certain person and acknowledge it in discourse. The final perspective presented by Gee is of Affinity identities (A-Identities); A- Identities are formed by participating and being part of distinctive social practices, attending events or forums, or even internet-based groups/ activities.

Hence, the definition of pre-service teachers 'identity can be understood within a sociocultural perspective. The view of pre-service teachers 'identity is seen not only as a product of individuals being positioned within discourse but also

as a dynamic process (Trent, 2013). It is in line with Day, Kington, Stobart, & Sammons '(2006) and Beijaard et al., (2004) idea that pre-service teachers 'identity is fluid, multi- faceted and dynamic, borne out of their participation and practice in their situated professional and sociocultural contexts. It is a continuous process of pre-service teachers negotiating and modifying their roles, self-knowledge, values and behaviours through engaging in varying discourses and practices (Beauchamp & Thomas, 2009). According to the definition above, pre-service teachers 'identity broadly can say a result of negotiation between pre-service teachers 'professional experiences and a variety of external factors within and outside the classroom and school.

To be a professional teacher, pre-service teachers must gain and understand their role and identity as a teacher. Yuan & Lee, (2015) argue that teachers 'identity is not only about intellectual and rational (e.g. Involving the development of knowledge and critical reflection), but also is social, political, and emotional. So, in its formation, it takes a long time to reach the professional stage. This is the reason why some researchers declare that teachers 'identity is a long process formation of learning (Wenger, 1998; Beauchamp & Thomas, 2009; Rodrigues et al., 2018). It can be interpreted that the teachers 'identity is a process of learning to teach that can help pre-service teachers hone a professional identity that supports effective teaching and continuous professional growth.

As stated previously that teachers 'identity is a process of learning, Wenger (1998) claims that ―Learning is not solely the collecting of skills and information, but a process of formation-a formation of a certain personality or, on the contrary, avoiding the information of a certain personality‖ (p.215). In other words, learning changes what we are and what we can do. Furthermore, he sees learning as social participation, an activity that can be described as the process of being active participants in social communities and constructing identities about these communities. Hence, Wenger (1998) describes the following as the intrinsic components of learning:

[1] Meaning-learning as experiencing: an ability to experience one 's life and the surrounding world as meaningful.

[2] Practice-learning as doing: joint action relying on common (shared) historical and social resources, background systems, and viewpoints.

[3] Community-learning as belonging: belonging to a social community in which our activities are recognized as valuable and competent.

[4] Identity-learning as becoming (someone): an understanding of how learning in the context of the community affects and moulds us. (p.5)

In Wenger 's opinion, these four components are closely and mutually connected and subject to the definition with the help of other components and this concept of learning helpful to explore the complex process of becoming teacher.

The Teaching Practicum as a Platform of Pre-service Teachers' Professional Identity Construction

Teaching practicum program for pre-service teachers believes as an important activity in implementing their knowledge and gaining teaching experiences through the teaching practice. It is supported by Abongdia, Adu & Foncha (2015) statements that ―most teaching practice scholars agree that the exercise is thought- provoking but a

very important part of a student teachers 'preparation and training, especially in the developing and underdeveloped worlds where teaching can be disrupted by a range of challenges‖. Teaching practice known as a program to expose pre-service teachers to the real teaching practice (Abongdia, Adu, & Foncha, 2015). During the practicum period, pre-service teachers are given the opportunity to apply and try their current knowledge and skill of teaching based on their belief before facing the real world of the teaching profession. Thus, Abongdia, Adu & Foncha (2015) stated that teaching practicum provides pre-service teachers with the chance to express their educational values, theories and understanding. It also creates an opportunity for them to create their professional identity.

In an attempt to gain a complete understanding of pre-service teachers_ professional identity, Timoštšuk & Ugaste, (2010) articulates that professional identity is a person self-knowledge in teaching related to the situations and relationships that manifest themselves in practical professional activities. These ideas are supported by Lasky (2005) by identifying several factors included in professional   identity formation such as―commitment, knowledge, beliefs, values, emotional well-being and vulnerability‖ (p.90). Meanwhile, Watson (2006) states that ―professional identity is doing professional action‖ (p.50). In other words, the way we perceive ourselves influences our choice of action and judgment. Viewing from the definitions above, understanding professional identity will help the pre-service teacher to understand what a good teacher is and the educational ideas of the teacher.

Furthermore, there are three main points of knowledge defined by Shulman (1986) which can help pre- service teachers to improve their professionalism: Content Knowledge, Pedagogical Knowledge and Pedagogical content knowledge. First content knowledge, according to Shulman (1986) content knowledge includes an understanding of concept knowledge, theories, ideas, and thinking framework and method of teaching. Content knowledge relates to knowledge about actual subject matter that is to be learned or taught. Second, Pedagogical Knowledge, Shulman (1986) states that pedagogical knowledge is about strategies and principles and processes of teaching that contain knowledge about classroom management, assignments, lesson planning and student learning. Pedagogical knowledge allows the teacher to continually develop their own teaching practices. Third, Pedagogical content Knowledge Shulman (1986) represents pedagogical content knowledge as the combination between content and pedagogical knowledge into an understanding of how particular topics, problems or issues are organized, represented, and adapted to the diverse interest and abilities of learners and presented for instruction. In other words, pedagogical knowledge is knowledge understanding of the material being taught and how to teach it.

In facing a rapid change in education, teachers are necessary to update their knowledge and skills to improve their professionalism (Richards & Farrell, 2005). They emphasize that teachers need to be able to take part in activities that can help their professionalism betterment such as engaging in self-reflection and assessment, developing teaching skills and knowledge, research involvement in teaching, awareness about their roles and responsibilities, and developing a relationship with others teachers. Related to those statements, pre-service teachers need to deal with the real context of teaching experience to examine their current level of teaching to help them construct their professional identity as a teacher.

Thus, professional identity is an important aspect for pre-service teachers in understanding professional lives and careers. It is because professional identity is a key factor in building motivation, effectiveness and retention (Day,

Kington, & Stobart, 2006; Lasky, 2005). So, through experiencing the real teaching experience, pre-service teachers can start to maintain and arrange better teaching learning activities. It can be said that teaching practicum is an important key to access the door of professionalism by which the pre- service teacher can be considered as a teacher.

Sociocultural and Identity Construction in Indonesian EFL Context

Sociocultural theory belongs to the social nature situated process of learning. According to Eun (2010), it is the concept of learning based on social interaction, cultural interactive of the practicum in teacher education programs. In this term, social interaction fits more likely to encourage dialogic interaction between teachers and students or teacher and teacher in the classroom or school which support and use diverse activities (Eun, 2010). For instance, students who hold theories of learning that are aligned with sociocultural perspectives would participate as active constructors of knowledge rather than as passive receptors of pre-made knowledge. Then, the cultural aspect more likely belongs to the situation of condition of the place, society and policy. For instance, situations in the school or classroom may be different even if they were in the same institution, it is because every individual has their own characteristic to build the situation of their work or places (Lasky, 2005) and due to institutional factors such as national standards and assessment practices (Eun, 2010).

Moreover, Mercer (2002) argues that sociocultural theories are the essential characteristic of processes of learning as being interactive (as cited in Eun, 2010). The interactive nature of the learning process is realized as a teacher and students engage in collaborative activities with shared goals and purposes that are constantly negotiated. The sociocultural perspective recognizes learning as a process rather than a product aimed toward the construction of knowledge. This view essentially defines knowledge as something to be co-created, as situated in a specific cultural context, and developed over time to solve real-life problems that occur within that culture and society.

Furthermore, a sociocultural perspective sees the importance of home and school connection as the best places of pre-service teachers 'professional identity construction. As Eun 's (2010) idea, home and school are the two most prominent locations where social interaction leads to individual development which affects professional identity, and thus bridging these two sites become most important in planning for effective education. For instance, teachers made knowledge of teaching preparations at home and brought them from their homes to the school to enhance student learning in a formal instructional setting.

According to the definition above, professional identity construction in the Indonesian EFL context might be hard. The consideration is because of the context of English Language teaching (ELT) in Indonesia. English is not medium language teaching instruction. Due to this, as cited in Wirza (2018), Alwasilah (2001) argue that ELT in Indonesia faces numerous and serious challenges concerning how teachers' qualifications, students 'motivation, quality of text books, bureaucrats 'attitude, and government policies. Additionally, the prescriptive curricula that ―do not recognize crucial elements of what curriculum means to English teachers, school administrators, teacher educators, and interested stakeholders‖ (Widodo, 2016, p.139). That is why the ideal teacher in the Indonesian educational context is constructed most often as being a classroom leader who can transmit cultural concepts using efficient and effective

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methods and the ideal student is often constructed as a receptive, attentive, and respectful learner who is willing to follow the teacher directions and complete the assigned task to the teachers 'satisfaction.

Furthermore, teaching in the education of Indonesian EFL context can be difficult because the teacher needs to develop and learn new ways to distribute, more symmetrically, authentic roles within the learning endeavor by drawing on the ―Identity‖ of the school context, that is the ―historically accumulated, culturally developed, and socially distributed resources‖ by which, teacher, co-workers and students within an education context define themselves (Brown & Heck, 2018). Consequently, understanding the ―practices, beliefs, knowledge and ideas‖ that people make use of in that context (p.31). Then, the process of forming a professional identity can form properly.

Methods

This study was conducted using a qualitative approach, specifically employing a descriptive case study method. According to Yin (2017), a descriptive case study is useful for describing an intervention or phenomenon within its real-life context. Thus, this research aligns with the descriptive case study design, as it aims to provide a detailed account of how pre-service teachers perceive their professional identity after completing their teaching practicum.
The study took place within a teaching practicum program at a university in Tasikmalaya. The program was designed for 7th-semester undergraduate students enrolled in the faculty of educational sciences and teacher training. During the program, which lasts for three months, participants had the opportunity to gain practical teaching experience. They were assigned to various schools by the department 's committee. Each participant had a mentor, consisting of both a teacher educator at the school and a supervisor from the university department. According to the program guidelines, students were required to create five lesson plans and teach up to two classes. At the conclusion of the practicum, they were evaluated by their mentors.

The participants in this study were 7th-semester students from the teacher education program at a university in Tasikmalaya, all of whom had completed their teaching practicum. The study focused on two participants—Attar and Annisa (pseudonyms)—who were selected based on their diverse cultural backgrounds and their placements at different schools. Attar taught at a Junior High School, while Annisa taught at a vocational high school. This distinction provided further depth to the study. The decision to examine the participants 'historical backgrounds was influenced by the fact that they conducted their practicum in Tasikmalaya, where the local vernacular plays a significant role. This aspect of their experience is expected to influence their identity formation from a sociocultural perspective.

Data for this study were gathered through face-to-face semi-structured interviews, allowing the researcher to obtain rich, in-depth responses to questions, as suggested by Kvale (2005). The interviews followed a flexible framework, promoting focused, two-way communication. The interviews were audio-recorded using a smartphone application. Since qualitative data require interpretative analysis, the process was influenced by the researcher's beliefs, values, and attitudes. According to Wodak (1999), as cited in Widodo (2017), interpretations of data are not fixed, but rather open and dynamic. Nevertheless, analytical tools are necessary to reduce subjectivity. Therefore, Gee's (2011) critical discourse analysis was used to explore the participants' professional identities. For data analysis, Miles and Huberman

's (2014) coding method was applied, and a reduction process was employed to organize and focus on the relevant data that best represented the study 's objectives.

Results and Discussion

Pre-Service Teacher as Pedagogical Expert

As a teacher, it is important to deal with the pedagogical aspect to create the effectiveness of teaching. As it relates to teaching activities, the pedagogical aspect refers to the understanding of teaching horizons, philosophy, strategies and principal processes of teaching (Shulman, 1986). Then, this section discusses about pre-service teacher 's professional identity as pedagogical experts. There are two points related to pre-service teachers 'identity in pedagogical expertise. Those are prior knowledge of teaching and being a teacher; and self-imaging, role and agency.

Pre-service Teachers' Prior Knowledge of Teaching and Being a Teacher

As an educator, the teacher must have an understanding of teaching beliefs. It is necessary in order to make the teaching process run well. The better their understanding of what teaching is, the better the teaching they will carry (Hotaman 2010). It is because their understanding of teaching will affect their actions during teaching activities and make them realize their main goal of teaching. As a result, they will create an effective

teaching environment. As stated in Hargreaves, Shinde, & Karekatti (2012) that beliefs of teaching will influence, though indirectly, on forming effective teaching methods and will bring about the improvement of learners 'learning abilities.

In this case, in the following excerpt, the two pre-service teachers, Atta and Annisa described their prior knowledge in teaching. Both pre-service teachers, Atta and Annisa shared their common beliefs of teaching. In fact, it was known that both of them have different beliefs of teaching, namely the "process of making (Atta)" And "conveying materials (Annisa)".

> Excerpt 1
> —Teaching is a process of making students knowledgeable; make them understood and fluent in English in terms of communication.
> (Atta, April 06, 2020, Author 's Translation)
>
> —Teaching itself is more about conveying appropriate materials regarding with the conditions of the students.
> (Annisa, July 17, 2020, Author 's Translation)

Explicitly, regarding excerpt 1, Atta and Annisa had one main focus object in teaching, namely their students. In line with research findings conducted by Hosgsryr (2012), a good teacher is a teacher who cares and aware of their students. At this point, Atta and Annisa have implemented the path of becoming a good teacher. As shown in the findings, both have the awareness regarding their students.

However, in further explanation, pre-service teachers 'beliefs of teaching can be interpreted as follows. Atta 's assertion about teaching as a "process of making students knowledgeable‖ indicates he realizes that teaching is not only to convey materials but also an intensive process to ensure that students have acquired and understood the knowledge. In this sense, Atta paid more attention to whether the students being taught have understood the material or not. Indirectly, Atta also paid attention to whether the teaching or teaching materials are appropriate or not with the students' needs. As supported by Beijard (2004) that teaching is much more than the transmission of knowledge. A teacher requires such a conception of teaching and concepts of the teacher as a classroom manager and facilitator of learning (Beijard, 2004).

Atta 's belief in teaching was different from Annisa 's. Annisa explained that teaching is more likely "conveying appropriate materials regarding with the conditions of the students". It means, Annisa only cares to whether the teaching or teaching materials she conveys are in accordance with the needs of the student without noticing that student had understood or comprehended the materials.

Theoretically, the beliefs of teaching shared by pre-service teachers were in accordance with a sociocultural theory which sees teaching is situated process of learning through social and cultural interactions (Eun, 2010; Rashidi, 2015). Socioculturally, effective teaching is teaching process which provides intensive processes and a lot of interactions between teacher and students. Furthermore, effective teaching also provides a culture exchange. For instance, the teacher teaches discipline which he always does and wanted his students to imitate it. Consequently, sociocultural and pedagogically, Atta can be categorized as having a deep understanding of the teaching concept rather than Annisa. As explained before, Atta 's words ‖process of making students knowledgeable‖, means Atta was aware that the important thing in teaching is not only conveying materials but also ensuring the students 'understanding.

Furthermore, in another case, regarding the prior knowledge of being a teacher, pre-service teachers shared common beliefs about being a teacher in their professional areas and they considered themselves to be credible teachers. It is shown in the following excerpt.

> Excerpt 2
> ―Teacher is a profession that requires them to educate their students so that they can have a strong character, a strong mentality.
> (Atta, April 06, 2020, Author 's Translation)
>
> ―Teacher is someone who provides information, conveying learning material for students so that they become known from not knows.
> (Annisa, July 17, 2020, Author 's Translation)

Based on the findings, the different philosophies were enacted by pre-service teachers. Their philosophes as a teacher, namely ―profession to educate (Atta)‖, and ―information giver (Annisa)‖ were closely related to and in accordance with their beliefs of teaching (see excerpt 1). It is showed that their beliefs of teaching affect their philosophies as a teacher. As supported by Nykvist & Mukherjee, (2016), beliefs of teaching influences teacher consciousness, teaching

attitude, teaching methods and teaching policies, and finally, learners 'development.

Broadly speaking, the philosophies of two pre-service teachers can be interpreted as follows. The term educate is a facilitated process of knowledge transmission whose explicit goal is to effect an enduring change for the better in the character and the psychological well-being of its recipients (Sarid, 2018). Thus, Atta's teacher philosophy as "profession to educate" can be interpreted as an effort to develop the personal, mental and moral attitude of students. In other words, Atta realized that teaching is not only a process of delivering material but also a process of educating students to have good behavior.

In other cases, Annisa's teacher philosophy as someone who "provides information" or it can say as "Information giver" indicates that she considered that teaching process is to ensure that students have known the presented material. It other words, in this term of information giver, it means Annisa has paid no attention to the needs and differences of students (Mahini, Forushan, & Haghani, 2012). Annisa considered all of them at the same level, for instance, if two of learners are able to answer, the result is that the teaching has been successful.

Furthermore, sociocultural, Atta can be articulated more credible as teacher rather than Annisa. As evidence, the philosophy of Atta as a teacher showed that throughout teaching activities Atta did intensive processes and interaction with his students. It is supported by Eun (2010) that teaching is more likely about the process of learning through the interaction (Eun 2010). However, it does not mean that Atta is better than Annisa. Since each individual has their own views and characteristic toward the teaching and being a teacher (Lasky 2005), their beliefs are neither right nor wrong. But, in terms of concept as a teacher, Atta has a deeper understanding so that he categorized to be more credible.

Self-Imaging, Role and Agency

As a teacher, it is necessary to have understanding such as specific agent and self-image. It is important in order to create effectiveness of teaching (Hargreaves et al., 2012). As it relates to English, self-image refers to self-description towards roles, capabilities, and position in teaching English. Meanwhile agency refers to the role and capacity of people to act purposefully and reflectively on their teaching activities (Kayi-Aydar, 2015). In other word, Agency is one 's capacity to make a personal choice and to act on this choice in a way that makes a difference in one 's life. As supported by expert, these two aspects self-image and agency influence pre-service teachers in making choices, behaving during teaching, what positions and what agents they showed (Widodo, 2016).

In the following data, the pre-service teachers 'self-image was shown in the way of their representation to themselves. It was the pre-service teachers 'view of their roles and position as a teacher in formal institution. Here, the pre-service teachers expressed distinctive voices concerning their self-image as a teacher. Atta considered himself as ―learning teacher‖ while Annisa as ―Flexible teacher‖.

> Excerpt 3
> ―I consider myself a leaner-teacher because I am new, right? How to become a good teacher to become a

professional teacher like the other teachers at the school‖ (Atta, April 06, 2020, Author 's Translation)

—I am a flexible teacher.......seeks to meet heterogeneous student needs......Their needs in comprehended the materials ‖ (Annisa, July 17, 2020, Author 's Translation)

The excerpt 3 showed statements of self-imaging as enacted by pre-service teachers. Generally, Atta's self-imaging of his identity shown as —learner- teacher‖ indicates that Atta considered he is not an expert. It means, he dedicates himself to keep learning and gaining more experiences and knowledge as a teacher (Kwo, 2010). It is essential in order to achieve predicate as Atta hoped, —become a professional teacher‖. In other words, as the way to be a professional teacher, Atta was implementing his knowledge and gaining teaching experiences through the teaching practice (Abongdia, Adu, & Foncha, 2015). Thus, put together, all the experiences and knowledge of Atta were viewed as having the potential to become a professional teacher. As supported by Beauchamp & Thomas (2009), teacher 's professional identity is something to be created through the united of their prior knowledge and experiences.

Meanwhile, in Annisa 's case, Annisa defined her self-imaging of teacher as —flexible teacher‖. Regarding to the excerpt, flexible teacher means Annisa effectively deal with the students from all background (Yoo, et al., 2015). At this point, Annisa has completely been aware that students have different styles of learning. As her statement —Flexible‖, Annisa addressed the students 'differences and made it a point to respond to their different needs. It is supported by her following statements —seeks to meet heterogeneous student needs‖. Thus, during teaching practicum, Annisa considered herself to use different strategies based on students 'needs so that the materials is delivered properly.

Sociocultural, pre-service teachers 'self-imaging during teaching practicum can be interpreted as follows. Atta 's assertion as —learner-teacher‖ indicates himself as teacher who —learns to teach‖ and —learns to learn‖. In other word, he dedicated to keep learning from surroundings at school. At this point, as learner- teacher Atta Atta wanted to be a role model for his students as someone who continues to learn. Meanwhile, Annisa 's assertion as —flexible teacher‖ indicates herself as teacher who —learns about methodology‖. In other word, she learns more about the students to meet their needs. At this point, Annisa wanted her students continually motivated in learning processes. Theoretically, their self-imagines are supported by Mercer (2002) that sociocultural sees identity is something to be created and more likely a process of learning rather than product.

Furthermore, beside self-image, pre-service teacher also shared their agencies during teaching practicum. As stated in the following excerpt, pre-service teachers were both trying to become good teachers. The data can be interpreted that pre-service teachers 'action during their practice shows high engagement between them and the students. For example, Atta asserted his role as —Friend‖ for his students and Annisa delineated her teacher role as "Mediator", "Motivator" and —Evaluator ". In the statement, it showed clearly and proved that the pre-service teachers want to get emotional engagement with their students.

Excerpt.4

I try to be a friend for them and I try to be a good teacher. I want to be a professional teacher, the one who is

responsible and cares about the student‖ (Atta, April 06, 2020, Author 's Translation)

―First, I was the motivator and mediator / facilitator and also an evaluator too. As mediator to convey information or knowledge, as motivators so that students will be enthusiastic in learning continually and pursuing their dreams. As evaluators, because in class we always reflect on what we do‖ (Annisa, July 17, 2020, Author 's Translation)

According to the excerpt 4, pre-service teachers 'agencies reveal namely ―Friend‖, "Mediator", "Motivator" and ―Evaluator" showed their roles in teaching activity. Atta 's agency as a "friend" indicates his role as parent-teacher and moral agent. In other words, Atta consider himself to act as parents for his students. It is in accordance with his statement that he wants to be ―responsible‖ and ―cares‖ towards his students. As supported by expert, the role of teacher as a parent means teacher becomes a sculptor of student's behavior, character, and attitude (Livingston, 2017). In addition, teacher who is responsible, cares, and paid more attention to the students'behaviour, character, and attitude (Campbell, 2012). At this point, Atta 's role as parent-teacher means that Atta wanted he became acceptable by his students so that student would not hesitate to tell stories and express his complaints during studying. Consequently, Atta would be easy to assist and help his student to have good behavior.

Annisa 's agency as "Facilitator", "Motivator" and ―Evaluator" indicate her roles as teacher-leader and social agent. In other word, teacher who takes action and responsibility of all activities while teaching including Motivating, facilitating, and mentoring students (Beijaard, et al., 2015; Cosenza, 2015; Weiner & Lamb, 2020). Hence, Motivator can be interpreted as teacher who gives motivation and spirit to their students that can build the confidence from the students (Thacker & Blanchard, 2004). For instance, teacher will not give punishment if their student made a mistake. But teacher will continue to support and motivates student to repair the mistake. Thus, the term facilitator can be interpreted as teacher who guide the students to be more active in class so that students can develop their creativity and their existing skill (Cheong, et al., 2019). In the last, the term of evaluator means that teacher who always reflect the teaching activity, the learning objective and goal of teaching in order to ensure that teaching activity has been run well (McFadden & Williams, 2020). In sum, the explanations above showed that as a teacher-leader and social agent, Annisa dedicated herself to take the full responsibilities and organized all of teaching activities. Consequently, it was hoped her students would be motivated and and have the social skill in order to be ready for their future career.

Additionally, sociocultural theory depict agency as human being 's ability to act, including the capacity for goal-directed and purposive action (Yang, 2015). Thus, pre-service teachers 'agencies as a moral agent and social agent indicate as their purposive action which always concerns the students 'situation and condition. As moral agent, Atta indicates the learning which emphasizes to the character building, attitude and behaviour changes. In the other case, as a social agent, Annisa indicates the learning which emphasizes social and communication skills. Their action is supported by Campbell 's (2012) that ―teaching is an activity involving a deep awareness of the significance of one 's choices and how those choices influence the development and well-being of others‖ (p. 185). Thus, it can be said that pre-service teachers 'agencies to engage with students in all teaching activities that are compatible with the values was a powerful measurement of his or her agential potential.

Pre-Service Teacher as Subject Matter Expert

As it relates to teaching, knowledge of subject matter is one 's important part of a teacher 's knowledge base. In fact, understanding the knowledge of subject matter is insufficient for being a good teacher. It means, teachers require a deep and full understanding of the subject area. In other words, their understanding that is characterized by knowledge of many concepts and their relationships (Nykvist & Mukherjee, 2016). Then, it is important for teachers to possess this knowledge so that they can change programs, develop elective tasks, explain things at a high-quality level, and diagnose students' understandings and misconceptions adequately.

As described earlier that teacher must require a full understanding of subject matter knowledge. Hence, in the case of pre-service teachers 'subject matter knowledge, both participants reveal their understanding of subject matter knowledge based on their experiences during teaching practicum. As shown in the following excerpts

> Excerpt 5
> ―...viewed from a materials perspective, in my opinion, the curriculum made by the state does not support students' needs. ......Moreover, my students are junior high school students where they are not learning English in elementary school according to the current curriculum. So, from here, as a teacher I must be able to harmonize and see the conditions and situations of students‖ (Atta, April 06, 2020, Author 's Translation)
>
> ―..........the curriculum is made against the circumstances of the students.......For me, Curriculum 13 is too imposing, not in accordance with the condition of the students, because there are still many students who are passive, means that when our students are like that, we have to be active while the student center force students to be active.... As a teacher, I prefer to look at the condition of the students over the curriculum. But still, I don't neglect the curriculum either, I feel dilemma (Annisa, July 17, 2020, Author 's Translation)

Based on the excerpt 6, generally pre-service teachers give the negative reflection to the current curriculum. Their negative evaluation to the current curriculum showed that they were really aware and care to their students. Atta pointed out his negative evaluation to the current curriculum as he considered that the curriculum ―does not support students' needs‖. In other words, Atta considered the current curriculum was not in accordance with the students 'situation and condition. Similarly, Annisa also gave the negative evaluation to the current curriculum. Annisa considered the curriculum was ―too imposing‖ even she said ―against‖ to the students 'real situation and condition.

Afterwards, the care and awareness expressed by pre-service teachers assert themselves as responsible teacher. In this sense, they put their students 'needs as they prioritize in teaching activities. As they stated ―I must be able to harmonize and see the conditions and situations of students (Atta)‖ and ―I prefer to look at the condition of the students over the curriculum (Annisa)‖. At this point, they were thinking how the materials will be acquired by the students easily. In other words, they were set a principle that materials will be given must appropriate with the students 'abilities and levels (Hargreaves et al., 2012). Therefore, the students can reach their set of achievement. As supported by experts that responsible teacher means teacher who responsible toward students' behaviour, achievement and performance (Lauermann & Karabenick, 2013).

Sociocultural, pre-service teachers 'action as a responsible teacher showed their effort to create supportive sense of learning or teaching processes. At this point, their disregard the curriculum in order to give the appropriate materials based on the students 'needs. In other word, their action as a responsible teacher indicates they were aware and care to the students' needs e.g situation, condition, achievement and behaviour. Moreover, through indirectly their action also indicates they have developed their teacher professionalism. In this case, they have been able to create, develop and process material which is customized to the needs of students. It is in line with the opinion of Nykvist & Mukherjee (2016) and Oleson et al., (2018) that an effective teacher is a teacher who has a good relationship with their students and has a concept of how the material will be learned and understood in class.

Pre-Service Teacher as Pedagogical Content Knowledge Expert

As the way to be an effective teacher, pre-service teachers need to identify the importance content knowledge needed for teaching. It includes how that knowledge needs to be understood and how that knowledge is actually learned in the classroom. But this is not enough; the pre-service teachers also needed the ways of presenting and formulating the subject that make it comprehensible to others as well as what makes the concepts easy or difficult for others (Oleson et al., 2018). Thus, pre-service teachers have to understand and have a good knowledge of pedagogical content knowledge in order to ensure the materials are delivered properly. Then, they can be an effective teacher which provides effective teaching. It is because pedagogical content knowledge is knowledge of subject conceptual and procedural, pedagogy, students and curriculum (Ball 2000 as cited in Oleson et al., 2018).

In the following excerpt, pre-service teachers shared how they taught in class. Both of them Atta and Annisa, have the different strategies in delivering materials. Atta tend to use problem solving method as his strategy in teaching activities. Meanwhile Annisa tends to use role-play method as her strategy in teaching. They said:

> Excerpt 6
> ―I often and like to divide my students in to a group or work in groups. Because I think this is the faster way in understanding the lessons with problem solving techniques‖ (Atta, April 06, 2020, Author 's Translation)
>
> ―I 'd love to use role-play. Basically, like role-play. Because, they (students) can explore their own kind of character........ I tend to like to give real situations in teaching so that they will get used to the world of work‖ (Annisa, July 17, 2020, Author 's Translation)

Theoretically, the method was used by Atta in accordance with his teacher philosophy as "profession to educate (see excerpt 1)" and his agent as a moral agent. At this point, the philosophy and agency which was not only emphasize the delivery of material but also emphasizes the character building and behaviour changes. As supported by experts, problem solving method means the teacher provides teaching strategies that will help students strengthen empathy and help them learn more attribution about other intentions (Skeriene   & Juceviciene, 2020). This is based on the fact that in the problem-solving method, students are required to exchange opinions and discuss to solve problems. Consequently, by the method he uses, Atta hopes that his students would have good behavior as he said ―they (student) can have a strong character, a strong mentality‖ (see excerpt 2).

In other case, Annisa tends to use role-play method as the way in presenting the materials. According to the experts, role-plays provide teaching-learning strategies which allow students to take —roles‖ as themselves or other characters in the specific situation (Stevens, 2015). Throughout the role-play method, a teacher can be effective at stimulating student motivations. Also, the teacher can develop students 'communication skills (Baile & Blatner, 2014). By using role-play method as her teaching strategy, Annisa was able to provide information and motivate students to develop their abilities. So, it was hoped that students would be ready to face the world after school. In this case, as well as Atta, the activities or methodology was used by Annisa also in accordance with her teacher philosophy as "information giver" and her agency as "motivator".

Additionally, the methods were used by pre-service teacher designated their sense of purposes during teaching practices. Both of pre-service teachers wanted their students to learn and engage with materials through interaction with others. It is in line with the sociocultural theory which says concept of learning, including a relationship between the teacher and students or students and students based on the social interaction (Connell 2004; Eun, 2010). Thus, throughout problem-solving and role-play method their created and organized learning environment which provide the interactive communication, discussion and sympathetic sense of leaning. Therefore, students tended to be more engage in the learning materials and pre- service teachers 'purpose of teaching can be achieved.

Conclusion

The current study purposively unpacks how pre-service teachers describe and understand their professional identity viewed from a sociocultural perspective. The results of the study, the pre-service teachers, Atta and Annisa shared their professional identities through their understanding of philosophies, beliefs, roles and agencies which were divided into three aspects of knowledge expertise, namely pre-service teachers as pedagogical experts, subject matter experts and pedagogical content experts. Professional identity of pre-service teachers is resulted of social and cultural engagement with the environment of their teaching practice. Therefore, as identity is dynamic processes, their professional identity will always change from time to time depending on the personal interaction with the environment. In other words, different sociocultural places lead different identity of pre-service teachers.

For the future research, the researcher recommended to examine professional identity of pre-service teachers through another perspective. Moreover, it is also recommended to investigate the study focuses on the role of teacher educator or school stakeholders in development of pre-service teachers 'professional identity.

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Hackathon-Based Learning: Equipping New Engineers for Industry Readiness and Success

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Abstract Automotive industry is rapidly evolving into realization of future mobility trends, specifically towards Software- Defined Vehicles (SDVs) and CASE technologies—Connected Autonomous, Shared & Electric systems. This transformation requires Automotive organizations to quickly adapt by upskilling of engineers. This evolution creates skill gap specifically among new engineers due to lack of industry exposure. To address this, Hackathon based learning approach is proposed, aiming to reengineer onboarding and capability development frameworks for young graduate Engineers. Hackathon, a structured design thinking based model is developed with focus on CDIO experiential learning and the ADDIE instructional framework, integrating authentic business challenges and structured project management deliverables including Project Planning, Design, Development, Verification & Validation through Multidisciplinary teams—comprising around 9 teams and 27 engineers from diverse engineering background —collaborated over a 10- 12 weeks cycle mentored by subject matter experts to deliver working functional prototypes aligned to organizational objectives. Skill gap is addressed through guided learning modules assigned based on the projects and on job needs Through Periodic Competency assessments by Subject Matter Experts and Program Manager across functional, behavioural, and project management domains significant improvements in creative problem-solving, technical resilience, interdisciplinary collaboration, and continuous learning were observed across all identified participants of hackathon. Managers reported that the approach had significantly impacted in reduced ramp up time by 50-60 % for role readiness in deployed roles based on feedback from Managers. Our research aimed to develop a structured, design-thinking-based hackathon model for onboarding and upskilling. We assessed its impact on functional skills, project management, and professional behaviors— positioning hackathons as a practical onboarding approach to fast-track engineering readiness and support the transition from learners to launchers

Keywords: Experiential learning, Professional upskilling, Engineering Competency Building, Design thinking, hackathon-based learning, Learning and Development

Introduction

Like many rapidly evolving sectors, the automotive industry is experiencing a significant transformation fueled by the convergence of disruptive trends—Connected, Autonomous, Shared, and Electric (CASE) mobility and the rise of Software-Defined Vehicles (SDVs) (Broo, Kaynak, & Sait, 2022), (Kulmala, Luimula, & Roslöf, 2014). These developments represent not only a technological shift but a redefinition of product architectures, business models, and talent requirements across engineering functions. Traditional engineering roles specifically in Automotive domains are evolving into transdisciplinary functions, integrating software development, data analytics, electrical systems, cybersecurity, and human-centred design within complex vehicular systems (Broo et al., 2022).

This evolution has widened the skills gap for early-career engineers, particularly in areas such as system-level design, agile problem-solving, collaboration across engineering disciplines, and software-centric innovation. Despite their academic preparation, many new engineers are underprepared for the real-world expectations of future mobility roles, where continuous learning, resilience, and interdisciplinary teamwork are as critical as technical knowledge (Coggan & Rennick, 2022) ,(Kulmala et al., 2014).

To bridge this gap, organizations are adopting structured onboarding programs that quickly align new engineers with business and innovation goals. Beyond integration, effective onboarding:

- Builds early engagement and ownership
- Promotes consistent, high-quality development
- Reinforces values and role expectations
- Addresses gaps in skills like communication and systems thinking
- Fosters long-term success through hands-on learning
- Strengthens recruitment by showcasing a growth-driven culture (Zafar & Jones, 2018), (Morgan et al., 2020)

Our study introduces a hackathon-based onboarding framework (See Figure 1.) spanning over 8–12 weeks, teams co-develop functional solutions for real business problems through collaborative Agile sprints and parallel technical learning. The model integrates Design Thinking (Simon, 2015) CDIO (Conceive – Design – Implement – Operate) (Malmqvist, Hugo, & Kjellberg, 2015) with the ADDIE (Peterson, 2003) instructional design framework (Onguko, Jepchumba, & Gaceri, 2013), following a structured flow:

- Self-learning assignment, team formation, buddy allocation
- Business problem scoping and project charter creation
- Work breakdown and project planning
- Architecture design and PoCs/MVP iterations
- Cost-based performance validation
- Weekly mentor reviews and e-learning progress tracking

Like the Capstone Design model, hackathons offer team-based, real-world problem-solving experiences, enabling engineers to apply prior knowledge to open-ended, multidisciplinary challenges (Kulmala, Luimula, & Roslöf,

2014), (Khan, Romkey, Dawe, & Slotta, 2021). Through structured, collaborative project-based learning and regular feedback, participants strengthened both technical and role- related competencies. Beyond technical skills, hackathons also support professional and social development, consistent with findings in curricular and experiential learning research (Rennick, Litster, Hulls, & Hurst, 2020),(Rennick, Hulls, Wright, Milne, Li, & Bedi, 2018). They help early-career engineers:

- Tackle authentic, complex engineering problems (Rennick, Litster, Hulls, & Hurst, 2020).

- Gain hands-on experience with industry-relevant tools (Coggan & Rennick, 2022).

- Practice teamwork, leadership, and communication in real settings (Rennick, Hulls, Wright, Milne, Li, & Bedi, 2018).

- Build lasting peer networks that foster trust and innovation (Uffreduzzi, 2017).
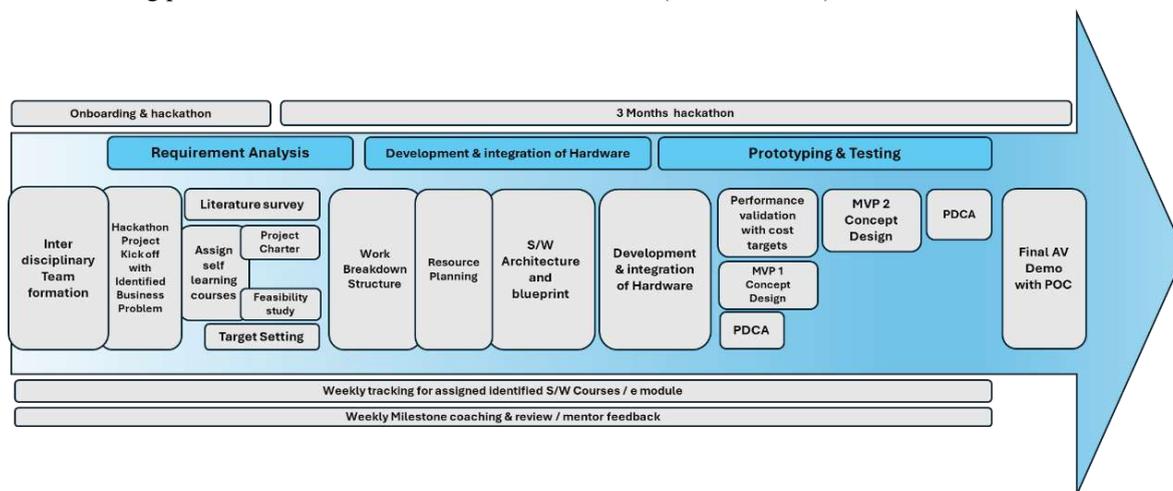
Figure 1. Approach of Immersive 3 Months Hackathon

Literature Review

Theoretical foundations of onboarding

Onboarding has shifted from procedural orientation to a strategic learning experience. The Four C's Compliance, Clarification, Culture, and Connection—promote stronger integration and quicker role readiness (Morgan et al., 2020). Strategic models emphasize mentorship, feedback, and early project exposure, which are especially effective in engineering roles requiring cross-functional collaboration and applied problem-solving (Morgan et al., 2020).

Hackathons as Catalysts for Experiential Professional Growth

Hackathons (Heller, Amir, Waxman, & Maaravi, 2023) foster applied learning through time-bound, multidisciplinary problem solving. As noted by Uffreduzzi (Uffreduzzi, 2017), hackathons simulate innovation environments where engineers formulate challenges and build complete solutions. Two key models exist:

- Curricular Hackathons (Rennick, Rajendran, & Ifeanyi, 2023): Structured for educational skill-building

(teamwork, prototyping) (Rennick, Litster, Hulls, & Hurst, 2020).

- Open hackathons: Industry-driven for rapid ideation and solution acceleration (Key & Akhigbemen, 2017). They enable learners to navigate ambiguous problem spaces and gain exposure to systems-level thinking.

This onboarding model builds on Capstone Design, that emphasizes teamwork, open-ended problem solving, and real-world constraints Kulmala, Luimula, & Roslöf, 2014). Hackathons serve as compressed capstones, supporting ABET [Meah, Hake, & Wilkerson, 2020) outcomes like system design, communication, ethics, and self-directed learning (Coggan & Rennick, 2022), (Kulmala et al., 2014), (Rennick et al., 2018). They also enhance technical fluency, documentation, and stakeholder engagement. Alignment with Industry 5.0

Industry 5.0 demands human-centric, adaptive, and cross-disciplinary education (Broo et al., 2022). Engineers need to blend emerging tech fluency with systems integration, collaboration, and innovation mindsets. Hackathons (Komssi, Pichlis, Raatikainen, Kindström, & Järvinen, 2015), (Rennick, Rajendran, & Ifeanyi, 2023). Support these demands by encouraging autonomy, team-based delivery, and real-world engagement—crucial for CASE and SDV innovation environments spanning across software, hardware, and human-machine interfaces. By navigating open-ended challenges, participants develop not only technical fluency but also crucial professional attributes such as adaptability, stakeholder alignment, and rapid iteration.

Research Methodology

The hackathon-based onboarding program followed a structured 5-steps methodology (see Table 1.) that engaged early-career engineers from cross-functional domains (Electrical, Electronics & Software), in 10 weeks Program Format (see Table 2.), the program followed a structured assessment methodology (see Table 3.).

Table 1. Reference Table: Methodology Snapshot

5 Steps	Condensed Focus
Team Formation	27 Engineers in 9 cross-functional teams simulated CASE collaboration
Program Format	Weeks 1–10 structured onboarding
Design Flow	5-phase model: Scoping → Charter → Design → MVP → Validation
Evaluation Framework	Rubrics + Mentor Evaluations + AV + Self-Learning
AV Reflection	Final storytelling task to present MVP journey, pitch value, and reflect

Table 2. Reference Table: Week wise broad plan

Week(s)	Focus Area
Week 1	Team Formation, Onboarding & Assignment on Self learning
Weeks 2–9	Project Sprints, Iterative Development & Mentorship with guided evaluations
Week 10	Final Evaluation & Showcase

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Hackathon Design Flow

During Week 2-9, Each team tackled a business-aligned challenge using a 5-phase workflow along with guided evaluation by mentors:

1. **Problem Scoping** – Stakeholder need identification
2. **Charter Definition** – Milestones, risks, and roles
3. **Architecture Design** – Unified Modelling Language, modular planning, S/W Design Blueprint
4. **MVP Development** – Two sprint cycles for prototyping
5. **Validation** – Performance and cost benchmarking

Weekly reviews mirrored agile sprints and included technical critiques, peer retrospectives, and project check-ins, reinforcing SDV-aligned development practice (Rennick, Litster, Hulls, & Hurst, 2020).

Evaluation Framework

A structured weighted assessment method (see Table 3.) was applied using a structured rubric (Carless, Bridges, Chan, & Glofcheski, 2016) over 10 weeks to evaluate team and individual performance to track engagement.

Table 3. Reference Table: Assessment Rubrics

Mode of Evaluation	Weightage	Tool	Focus Area / Criteria
Mentor observations, behavioral insights from logs, surveys, and interviews	10	Reflections, field notes, surveys, review scores	Competence, Autonomy, Leadership, Collaboration
Self-paced learning, technical documentation, and project management practices	20	Assigned Certification courses	Technical expertise and project management capabilities
Minimum Viable Product Demonstration	30	15-minute PoCs/MPV Demonstration	Operational Prototype
Audio-Visual Reflection	30	5-minute AV	Storytelling, Value, Reflection

Weighted assessment methodology emphasized mentorship, iterative development, and constructive feedback as the core of learning. Weekly mentor check-ins acted as agile learning checkpoints, driving steady progress without assigning scores till the formal evaluation in Week 10 (see Table 4) for the detailed Week-wise Evaluation Tracker)

Table 4. Week-wise Evaluation Tracker

Week	Type	Focus Area	Evaluation Activity	Evaluator
Week 1	Orientation & Setup	Team formation, role allocation, e-learning module access and baseline knowledge	Attendance, team setup, initial domain alignment and course onboarding	Program Facilitators
Week 2	Feedback & Coaching	Problem identification, stakeholder insights, course progress checkpoint	Feedback on challenge scoping and Week 1 course completion	Mentors, Domain Experts
Week 3	Feedback & Coaching	Charter development, goal clarity, self-learning application in charter	Feedback on deliverable feasibility and Week 2–3 course progress	Mentors, PM Coach
Week 4	Feedback & Coaching	Architecture design, system decomposition, technical knowledge from modules in	Architecture review and self-learning application in tech stack mapping	Mentors, Domain Experts
Week 5	Feedback & Coaching	MVP Sprint 1, early prototype, application of core concepts from learning modules	Sprint demo feedback; course progress review checkpoint	Mentors, Functional Leads
Week 6	Feedback & Coaching	MVP Sprint 2, integration, testing, deepening skill application	Code integration feedback, review of advanced course topics applied	Mentors, Peer Review
Week 7	Feedback & Coaching	System validation, KPIs, user testing, alignment to learned performance metrics	Usability feedback and discussion on insights gained from learning content	Domain Experts, Mentors
Week 8	Feedback & Coaching	Final refinement, course wrap-up reflection, MVP polishing	Final sprint feedback, course completion summary per team	Mentors, Domain Experts
Week 9	Rehearsal & AV Prep	AV content development, technical storytelling using learned terminology	Mock AV run, content clarity, use of domain- specific language from e-learning	Mentors, Communication Coaches
Week 10	Formal Evaluation	Final MVP demo, AV presentation, overall integration of course concepts in delivery	Rubric-based Scoring: 20 % Self-learning & Project Mgmt , 10 % Weekly Review Participation 30% AV Presentation	Final Evaluation Panel- Business leaders

Results

This section presents the outcome of the structured onboarding hackathon across nine teams over two consecutive years, focusing on its performance in three key dimensions: participation, usefulness of output, and innovation impact. A comparative, rubric-driven analysis was conducted using observational data, final product evaluation, and feedback from stakeholders.

Participation and Engagement

All participants (N=27) completed the full 10-week cycle, with a 100% team retention rate. The diverse team composition and inclusion of structured mentoring contributed to sustained motivation and collaborative engagement. Weekly reviews ensured that teams remained aligned to their objectives and deliverables.

Usefulness of Output

Evaluation of proof-of-concepts (PoCs) or MVPs in Week 10 revealed high functional quality:

- 8 out of 9 teams produced MVPs considered viable for further development and integration.
- Managers confirmed that hackathon-trained engineers contributed to live projects within 4–6 weeks,

significantly ahead of the typical 8–10-week readiness timeline under traditional onboarding.

Innovation and Business Impact

A key highlight was the conversion of 8 MVPs into patentable innovations, with patent filings initiated by participating engineers. This not only advanced the organization's innovation portfolio but also boosted morale, confidence, and visibility among early-career talent.

Team Performance Overview

Table 5. Reference Table: Team Performance Overview

Team	Final Score	Strength Highlighted
Team D	97%	MVP excellence, collaboration, innovation
Team B	90%	Strong architectural coherence and product storytelling
Team H	89%	Customer-centric design and business alignment
Team F	84%	Clear technical demonstration and scoped solution

Process Maturity and Feedback

Mentors observed consistent behavioral growth, including:

- Improved communication and ownership.

- Increased confidence during weekly presentations and final AV storytelling.
- Enhanced team synergy and stakeholder awareness.

Weekly mentor reviews served as agile checkpoints, enabling teams to reflect on progress, receive technical guidance, and continuously refine their solutions—without assigning numeric scores. This developmental approach emphasized collaboration, critical thinking, and experiential learning over traditional assessments. It fostered a learning environment where growth was driven by reflection and practice, not just evaluation. *(Refer to Table 6 for detailed Team Performance Overview)*

Table 6. Team Performance Overview

Year	Team	Technical Learning 20%	Weekly Review 10%	AV Present 30%	MVP Demonst 30%	Behavio ral & 10%	Total Score 100%	Remarks
Year 1	Team A	75%	80%	80%	90%	80%	82%	Strong MVP, stable collaboration, AV
	Team B	90%	90%	87%	93%	90%	90%	Highly polished delivery and design
	Team C	85%	80%	93%	83%	90%	87%	Best AV narration; good problem framing; MVP had
	Team D	95%	100%	97%	97%	100%	97%	Outstanding performance in all
	Team E	70%	70%	77%	80%	70%	75%	Functional but limited narrative clarity; great team
Year 2	Team F	80%	80%	83%	87%	90%	84%	Clear demo with relevant use case;
	Team G	75%	90%	87%	83%	80%	83%	Good use of AV tools; balanced team presentation; MVP
	Team H	85%	90%	90%	90%	90%	89%	Business alignment and usability were standout; future
	Team I	80%	70%	80%	87%	80%	81%	Technically sound, needs improvement in AV clarity and

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Discussion

The hackathon-based onboarding model proved significantly more effective than traditional approaches in accelerating engineering readiness and delivering early business value (see Table 5).

Table 5: Hackathon vs. Traditional Onboarding (comparative table)

Theme	Traditional	Hackathon-Based
Onboarding Approach	Task-oriented, policy-driven	Strategic, role-readiness, mentorship-focused
Learning Modality	Passive (lecture/manuals)	Experiential, applied problem-solving
Hackathon Application	Ad hoc events, innovation scouting	Structured pedagogy for skill acceleration
Pedagogical Backbone	Capstone (semester-end design)	Compressed capstone-style sprints in onboarding
ABET Outcome Alignment	Limited or isolated	Integrated through MVP, teamwork, communication
Future skills development	Lacks interdisciplinary integration	Fosters cross-domain adaptability and innovation
Time to contribution	8-10 week (delayed contextual understanding)	4-6 weeks (project ready)
Knowledge retention	Low to moderate (passive learning)	High (applied weekly in real time project)
Innovation potential	Rarely result in IP or innovation contribution	8/9 idea filled for patents, IDF generated
Assessment approach	Minimal or check list driven	Rubric based (technical, managerial, behaviour based)
Recruitment advantage	Neutral often seen as procedural onboarding	High Demonstrates innovation culture to new hires

This study asserts that hackathon-based onboarding accelerates engineering readiness. By blending e-learning, mentorship, and real-world challenges, it builds technical, behavioral, and teamwork skills. Weekly reviews and final evaluations showed measurable growth. The model promotes early ownership and Industry 5.0 relevance, and is scalable across engineering disciplines.

Conclusion

This study presents a hackathon-based onboarding framework that accelerates engineering readiness in SDV and CASE domains. By combining design thinking, applied learning, and guided sprints, the model enhanced technical skills, collaboration, and early project contribution. The approach not only upskilled participants but also delivered business value—8 out of 9 projects reached patentable maturity, reinforcing a culture of innovation and continuous learning. Weekly mentoring, structured interventions, and final evaluations enabled a holistic, outcome-focused experience.

Key Highlights

- Reduced ramp-up time by 40–50%
- Enabled early IP creation and project ownership
- Built confidence and system-level thinking in new engineers

Scalability and Future Work

Patent guidance helped teams align ideas with organizational needs, resulting in multiple patent submissions from all sample cohorts. This model can extend to wide application under CASE offering a scalable and high- impact alternative to traditional onboarding. Future research may explore long-term tracking, hybrid delivery formats, and AI-enhanced mentoring to scale its benefits across technical ecosystems.

Recommendations

This study recommends implementing hackathon-based onboarding to fast-track engineering readiness in Organizations. The model blends self-learning, mentor-led sprints, and real-world challenges to build technical and collaborative skills. The approach is extendable across domains, including hardware and cybersecurity, and scalable via digital/hybrid formats. Organizations are encouraged to institutionalize this model to align early talent with business and innovation goals.

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A Positive Education-Based Tutoring Program for Enhancing Student Well-Being: An Action Research Proposal with Elementary School Children

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Abstract: Positive education is a pedagogical approach that integrates principles of positive psychology to promote students' holistic well-being. It encompasses the development and evaluation of self-esteem, self-knowledge, and interpersonal relationships. The objective of this research was to design and validate a tutorial intervention program for elementary school students based on the principles of positive education. To this end, a qualitative action research design was employed, involving the participation of 18 second-grade students from a private school in Lima, Peru. The main findings demonstrate that the intervention program facilitated the development of self-knowledge, supported the maintenance of high self-esteem, and promoted the strengthening of interpersonal relationships, contributing to their socioemotional well-being. Based on this research, it can be concluded that a positive education program can play a significant role in the socioemotional development of elementary school students. Future research could focus on implementing similar programs in diverse contexts, such as public and rural institutions, to explore the approach's effectiveness in varying socioeconomic and cultural settings.

Keywords: Positive Education, Tutoring, Primary Education, Intervention, Action Research.

Introduction

Contextualization and Justification of the Topic

Education in the 21st century faces challenges arising from both the implementation of various innovations to the

profound social and cultural transformations shaping contemporary societies. In Peru, these challenges are evident in the accelerated incorporation of technological advancements into students' daily lives, as well as in shifting cultural perceptions of personal identity, success, and happiness. These changes directly impact educational practices, making it essential for educators to move beyond the mere transmission of academic knowledge and rather focus on the holistic development of students, equipping them with essential tools to navigate an increasingly complex and evolving society.

The adoption of new pedagogical paradigms and innovative educational approaches has been driven by the growing importance of digital competencies and socio-emotional skills (Pozo et al., 2023). In Peru, as in other parts of Latin America and Europe, these shifts have led to the development and implementation of active pedagogies—teaching methodologies that not only enhance academic skills but also cultivate gratitude and strengths-based activities, ultimately contributing to both student well-being and academic performance (Leow et al., 2024). In this context, the Peruvian Ministry of Education (MINEDU) has been working to improve educational quality and address issues such as academic stress and low self-esteem at different levels. Positive education can be a valuable tool to promote a more holistic and human-centered approach to learning, which could be beneficial in the Peruvian context by fostering a healthier sense of happiness among students.

Thus, it is imperative to examine the profound and meaningful impact that positive education and the promotion of well-being can have on students' overall emotional development. The contemporary notion of positive education has gained significant relevance in academic and psychological communities. As described by Cabanas and Gonzales (2021), it represents a fundamental shift in the educational purpose toward the pursuit of happiness, acquiring both practical and formative significance in the Peruvian school system. This trend underscores the importance of education as a key indicator of student growth, quality, success, and well-being.

According to Wang et al. (2021), by supporting the pillars of positive psychology—individuals, experiences, and institutional support—students are encouraged to achieve personal fulfillment, flourishing, and resilience. This approach, which strengthens both academic performance and socio-emotional development, aligns with current educational policies in Peru that aim to create more inclusive and emotionally safe learning environments. The focus on well-being and happiness as core educational principles not only enhances students' academic performance but also fosters their socio-emotional growth, helping them build greater confidence and adaptability within the Peruvian context (Kongo et al., 2024). Furthermore, this approach equips students with the necessary tools to become balanced, mature individuals capable of facing the challenges of contemporary society.

This research acknowledges the significance of each of the aforementioned aspects and, consequently, seeks to contribute to the existing knowledge and practice in the field of positive education and the promotion of happiness for student well-being within the country's educational landscape. To achieve this objective, empirical evidence on the effectiveness of active methodologies aimed at fostering student well-being and success was explored. The findings of this study align with educational policies that advocate for integrating emotional and social well-being into the school curriculum, providing clear guidelines for the implementation of active methodologies that benefit all stakeholders in the educational process.

This study posed the following research question: Is it feasible to adapt a positive education program for tutorial sessions with primary school children? This inquiry emerged from the consideration of integrating the principles of positive education, which focus on promoting emotional well-being, happiness, and interpersonal relationships. Thus, the primary objective of the research is to assess the feasibility of such an adaptation by analyzing both its potential benefits and the challenges it may entail. In this regard, the proposed action research approach allows for a continuous and flexible evaluation of the program's adaptation, fostering active participation from both teachers and students throughout the process. Through the phases of planning, action, observation, and reflection, action research facilitates the implementation and continuous improvement of educational practices.

Theoretical Framework

Interpersonal Relationships and Positive Education

In the academic field, the positive pedagogical approach is defined as a student-centered framework aimed at strengthening individual capacities, fostering positive emotions, and developing resilience (Adler, 2017). Professor Martin Seligman of the University of Pennsylvania laid the foundations of positive education in the late 1990s (Shilko et al., 2022), conceptualizing it as an effective means to promote well-being and happiness. In Peru, where issues related to school coexistence and emotional management have been identified in some educational institutions, fostering interpersonal relationships based on respect, empathy, and collaboration is essential for creating an optimal and equitable learning environment. This perspective emphasizes that learning should not be confined to the acquisition of academic knowledge alone but should also support the development of socio-emotional skills and the strengthening of students' character.

Within the context of positive education, enhancing interpersonal relationships among students is crucial for fostering a learning environment that correlates with academic success. This approach seeks to reinforce mutual respect, empathy, and collaboration, thereby reducing conflicts within Peruvian classrooms, regardless of whether the school is in a rural or urban setting, or whether it is public or private (Deng, 2024). By cultivating essential social skills such as conflict resolution and teamwork, positive education contributes to a school climate where students interact respectfully and effectively (Lim & Min, 2024). This environment, in turn, facilitates academic development while supporting students' overall well-being and emotional growth, aligning with the broader goal of providing a holistic and equitable education.

Self-Awareness for Happiness

Shilko et al. (2022) emphasizes that positive education places crucial importance on the development of positive emotions, optimism, and life satisfaction, considering them essential elements for fostering children's happiness. This perspective aligns with Palomera (2017), who argues that happiness should not only be an educational goal but also a fundamental component in creating an environment that supports meaningful learning. To achieve this, it is essential to establish dedicated learning spaces and allocate time for reflection and relaxation, thereby fostering the generation of positive emotions, which play a key role in promoting happiness within the educational setting (Wu, 2022). This approach involves cultivating positive attitudes and skills, fostering upward emotional spirals, and promoting a

climate of healthy and positive relationships. Chan (2024) examines how positive education enhances students' emotions, such as happiness, joy, and gratitude, highlighting the significance of positive student-teacher relationships in fostering a supportive community that boosts motivation, engagement, and academic success. Through activities that help students identify and reflect on their character strengths and their influence on daily actions and decisions, students can develop a deeper sense of self-awareness. This approach underscores the importance of understanding one's identity, core values, and how personal strengths can be leveraged to set meaningful goals, enhancing both academic achievement and personal fulfillment (Heintzelman et al., 2023). By fostering self-awareness, positive education not only supports children's personal development but also provides them with a strong foundation for making informed decisions and cultivating continuous growth.

Emotional Wellbeing and Self Esteem

Kumplulainen (2014) argues that child well-being is closely linked to positive education, as it focuses on creating educational environments that foster self-esteem, resilience, and the holistic development of children. Parra (2022) supports this perspective, emphasizing that positive education enhances students' emotional, social, and academic well-being by significantly contributing to their happiness and overall quality of life in school settings. On one hand, studies such as that of Gür and Eser (2022) have demonstrated that implementing positive thinking education in preschoolers positively impacts children's well-being, highlighting the necessity of early interventions that promote happiness and well-being from early childhood. On the other hand, Shilko et al. (2022) assert that positive education has the potential to improve students' mental health and psychological well-being. Strengthening students' self-esteem is essential to their overall development, as it shapes their motivation, academic outcomes, and social interactions. It also plays a crucial role in healthy childhood development, directly impacting motivation, academic success, and peer interactions (Burger & Mortimer, 2023). For instance, Sır and Lök (2024) developed a program that significantly improved students' self-esteem and reduced peer bullying, resulting in better academic outcomes. Given its connection to motivation, research indicates that students with higher self-esteem exhibit greater resilience and optimism—critical factors for academic success (Shrotriya, 2023). Therefore, by fostering an environment that values and celebrates student achievements, positive education aims to empower children to face challenges with a positive and resilient mindset.

Selected Studies on Positive Education

Alam (2021) underscores the need for educational reform that prioritizes sustainability and happiness as central objectives. He emphasizes that educational systems play a crucial role in fostering happiness at both individual and collective levels, particularly in the face of contemporary social, technological, cultural, and environmental challenges. This perspective aligns with that of Waters (2020), who advocates for the implementation of well-being practices and the creation of supportive school environments, highlighting the importance of a pedagogy grounded in positive education. In this context, well-being practices encompass implicit strategies to cultivate student well-being, establish conducive learning environments, and equip teachers with the necessary skills to promote student flourishing.

As described in various studies, positive education complements traditional educational approaches by prioritizing the promotion of happiness, well-being, and the principles of positive psychology (Kanashvili, 2022). Agrawal et al. (2021) propose that the emotional and psychological development of students should be a central objective, extending beyond purely academic achievement to enhance life satisfaction, engagement, optimism, and positive emotions. Positive education programs focus on teaching concepts such as well-being, resilience, and life purpose, employing evidence-based methods to improve students' mental health and psychological well-being (Wibowo et al., 2021). Additionally, a study conducted in an Indian school highlighted student well-being as a critical domain, emphasizing the significance of fostering enriching educational experiences and understanding the multifaceted aspects of meaningful engagement in school activities (Wairagade & Mukherjee, 2024). This research underscores the importance and necessity of applying a methodology based on positive education, demonstrating its potential benefits for all members of the school community.

Methodology

The action research methodology (Yang, 2024) is well-suited for this study as it seeks to practically integrate principles of positive psychology into primary education. The foundation of this approach lies in the idea that educational improvement requires a dynamic and participatory process in which the researcher becomes an agent of change within the educational environment. Within this framework, action research enables a comprehensive examination of how character strengths can positively influence students' well-being and motivation. This study is guided by *See the Good*, a scientifically validated approach that fosters the development of positive emotions and the recognition of personal and interpersonal strengths (See the Good, 2018). These cards serve as educational tools designed to help students identify and cultivate their character strengths through reflective activities and discussions. Each card highlights a specific strength, encouraging students to recognize and apply these qualities in their daily lives. By integrating these cards into tutoring sessions and student well-being activities, this study aimed to evaluate their impact on motivation and emotional development.

Planning	Action	Observation	Reflection
Identify the research question.	Program implementation in context and with participants.	Collection of observed data.	Sustainability of the intervention.
Design objectives, criteria and indicators.	Adaptations and translation of materials.	Analyze the data presented in a qualitative method.	Lessons learned from the research.
Ethical considerations of program and participants.	Action documentation.		Reflections from the teachers and researchers.

Figure 1. Phases of Action Research Methodology

The research was conducted over three weeks, during which students were introduced to the principles of character strengths and student well-being activities in tutoring sessions. Action research methodology was employed, structuring the study into four key phases: planning, action, observation, and reflection, as illustrated in Figure 1.

Context and Participants

The intervention was conducted at a private school in La Molina, Lima, Peru, a district characterized by a high socioeconomic status. The participants were second-grade primary school students from upper-middle and upper-class families. This group, consisting of 21 students between the ages of seven and eight, demonstrated significant challenges in developing empathy and teamwork, often leading to peer conflicts, difficulties in cooperative learning, and struggles with emotional regulation within the school environment. Given that character strengths-based strategies emphasize self-awareness, emotional intelligence, and positive interpersonal relationships, this group was particularly suitable for investigating how such interventions could enhance their social interactions and overall emotional well-being.

In alignment with this goal, the school follows a British-Peruvian curriculum, implementing an educational methodology centered on a transdisciplinary inquiry-based approach grounded in conceptual learning, aligned with the principles of the International Baccalaureate. Second-grade students from a high socioeconomic background typically experience emotional and psychological development shaped by the advantages and comforts of their context. Emotionally, they tend to feel secure and confident, although they may exhibit lower frustration tolerance due to limited exposure to significant challenges. Psychologically, their self-esteem is often built on external achievements and social recognition, which may hinder their self-awareness and self-regulation. In terms of interpersonal relationships, they may lean more toward competition than collaboration, making empathy and effective conflict resolution more challenging, ultimately affecting their socio-emotional development within the school setting. Recognizing these developmental factors, the study specifically selected 18 students (11 girls and 7 boys) between the ages of 7 and 8 who participated, all enrolled in second grade at the private school in La Molina. The selection process was intentional, aiming to ensure maximum variation among participants within the same school, considering factors such as different levels of academic performance, motivation, and gender. This approach sought to enhance the validity of the findings within a specific educational context. Additionally, the choice of this age group was driven by the need to assess the impact of the program during a critical stage of development, in which students begin to develop greater self-awareness and a deeper understanding of their social interactions. By focusing on this period, the study aimed to evaluate the effectiveness of character strengths-based interventions in fostering positive behavioral and emotional outcomes.

Phase 1: Planning
Techniques, instruments and data processing

The planning phase in the action research process was crucial, as it laid the foundation for the entire investigative process. General and specific objectives were established in alignment with the implementation of a mentoring program based on the principles of positive education. These objectives aimed to strengthen students' self-esteem,

self-awareness, and interpersonal relationships through activities designed to foster the development and recognition of their character strengths.

This phase also included the definition of data validation methods, such as triangulation and peer review, to ensure the reliability and validity of the findings. Table 1 outlines the key aspects considered in the development of the tools used to demonstrate the results. Throughout the study, three main techniques were employed: systematic observations, analysis of students' work through curated materials, and reflections derived from focus groups. The focus groups followed a structured question guide to facilitate a final reflection on the program's implementation. The dimensions evaluated included self-awareness, interpersonal relationships, and self-esteem.

Table 1: Data Collection Techniques for the Action Investigation Process

Technique	Tools (Instruments)	Validation
Systematic Observations	Checklist: Structured list with specific criteria to evaluate behaviors or skills observed in relation to self-knowledge, self-esteem and interpersonal relationships.	Confirmation with Participants: Review observation results with participants to ensure accuracy and avoid misinterpretation.
	Teacher Anecdotal Record: Detailed record of significant events, behaviors, and situations observed during the sessions over the 3 weeks.	Triangulation: Compare data obtained with document analysis to ensure consistency and reliability.
Analysis of Student Work Products	Portfolio of Work: Compilation of work done by students reflecting prior knowledge of concepts related to character strengths.	Review by Advisors: Other teachers or specialists review the work products to ensure consistency in interpretation.
Focus Groups	Reflective Discussion Guide: Questions and topics for group discussion to explore students' experiences and perceptions of their self-knowledge, self-esteem, and interpersonal relationships using character strengths to explain and give examples.	Transcripts: Use a graphic organizer of discussions for detailed analysis and to ensure that important details are not missed.

These strategies were designed to evaluate the impact of the program, as shown in Table 2, ensuring that the methods were appropriate for a second-grade student cohort. Instruments such as an initial diagnostic assessment conducted before the study, and a post-test were developed to assess the program's effectiveness. Additionally, checklists, observation sheets, and a teacher's anecdotal record were employed to document direct observations of student

behavior. Qualitative rubrics were also utilized to analyze students' work products in alignment with the targeted dimensions.

Table 2. Indicators and Evaluation Criteria

Dimension	Criteria	Evaluation Strategy
Self-awareness	Students will be able to identify at least three of their own character strengths and explain how these influence their daily behavior and decisions.	- Direct observation during activities. - Reflective journal entries for each student. - Reflective group discussions in groups. - Pre-test (initial diagnosis) - Post-Test (final diagnosis)
	Students will be able to set a simple goal related to character strength.	- Observation of students' ability to define a simple goal (e.g., "be nicer" or "help a friend"). - Tracking and recording progress in achieving the goal. - Post-Test (final diagnostic)
Self-esteem	Increased frequency of positive self-statements in tutoring activities and increased willingness to take on challenges in the classroom.	- Comparison of student work samples before and after the program. - Post-Test (final assessment)
	Students will be able to express, in a simple way, something they like about themselves or their work.	- Observation during activities to identify moments when students express something they like about themselves through a drawing. - Pre-test (initial diagnosis)
Interpersonal Relationships	Students will be able to participate in group activities demonstrating respect for the ideas of their peers by identifying the use of two strengths cards.	- Observation during group activities to identify times when students listen to their peers and offer help. - Pre-Test (initial diagnostic) - Post-Test (final diagnosis)

During this phase, a review of existing literature was conducted to provide a theoretical framework for the intervention. Additionally, the necessary resources and materials were identified, and an activity schedule was designed to structure the implementation over the planned three-week period. Figure 2 illustrates the approach used to design materials for collecting student outcome data. Each week was assigned a primary objective, along with specific session goals, to ensure progressive development in the students' learning and personal growth.
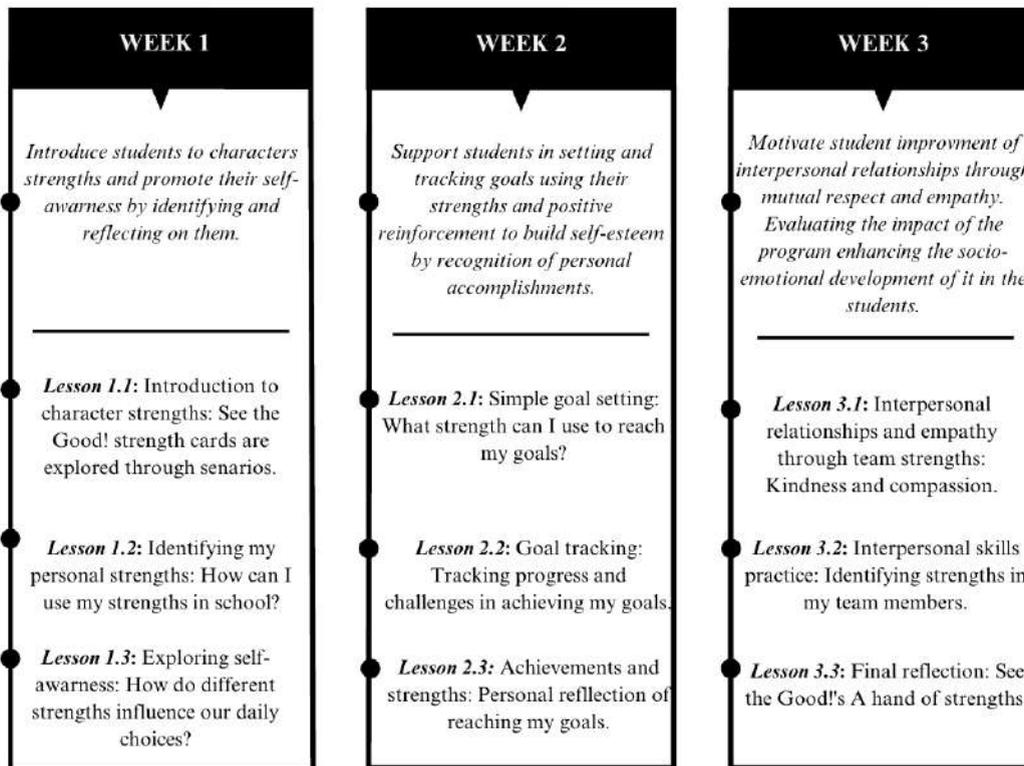
Figure 2. Second Grade Lesson Scheme

Validation Criteria and Ethical Considerations

From an ethical perspective, rigorous measures were implemented to ensure the confidentiality and respect of all participants. A confidentiality agreement was signed with both the educational institution and the students' parents to protect the identity of the students and the school in all research-related reports. Additionally, a specific agreement was established for use of materials from See the Good! (2018), ensuring that they were exclusively used for this study and, upon completion, securely returned to the See the Good team with all necessary security measures.

Phase 2: Action

During the action phase, the intervention was conducted in a second-grade classroom, integrating the *See the Good!* character strength cards into tutoring sessions. The intervention included group activities where students discussed examples of character strengths they had observed in their peers and shared personal stories reflecting the use of these strengths in their daily lives. For instance, one activity involved students selecting a card and explaining how they could apply that strength in their everyday behavior, fostering empathy and teamwork. The implementation schedule spanned three weeks, with sessions conducted twice per week, each lasting approximately thirty minutes. An adaptive approach was employed to ensure all students felt included and that their emotional needs were effectively addressed. This approach allowed for adjustments in teaching strategies and emotional support based on students' responses and observed progress. The overarching goal was to create a flexible and responsive learning environment that acknowledged individual differences and promoted meaningful personal development.

The intervention process was enriched using diverse resources and materials. The *See the Good!* character strength cards served as the central component of the activities, complemented by visual resources such as illustrations depicting different character strengths. A total of twenty-six cards were selected, each featuring a description of a specific strength alongside an image representing it. Each card outlined how the strength could be applied effectively and how its misuse—either through excess or deficiency—could impact behavior. This resource was integrated into the planning phase to help students recognize how strengths contribute to specific situations, goal-setting, and personal reflection. Additionally, physical tools such as structured worksheets were employed, allowing students to document their reflections and share their insights with peers. Participants completed a total of nine worksheets, following a structured three-week plan designed to monitor the program's implementation and assess its impact. The intervention followed a detailed three-week schedule, with sessions lasting approximately thirty minutes, divided into three distinct phases: introduction, development, and closure.

Week 1: Self-Awareness and Strength Identification

The primary objective of the first week was to introduce students to character strengths and promote self-awareness through the identification and reflection of their personal strengths. Before the program's implementation, each student completed an initial questionnaire designed to gather demographic and psychological insights into the participant group. The questionnaire included questions aimed at assessing students' self-awareness, self-esteem, and interpersonal relationships at the start of the study. Each session lasted approximately 30 minutes and concluded with a worksheet activity that encouraged students to identify, connect, or reflect on the strengths they explored.

Week 2: Goal-Setting and Personal Growth

The second week focused on supporting students in setting and tracking personal goals, leveraging their strengths and positive reinforcement to foster self-esteem through the recognition of their achievements. Activities centered on helping students understand how character strengths could be used to establish both individual and collective goals within the school environment. Each student was tasked with identifying a strength they wished to improve upon throughout the week. They wrote this goal on a card, which remained visible on their desk as a daily reminder. The key objectives for this phase were to encourage students to identify, apply, articulate, and reflect on their strength learning.

Week 3: Interpersonal Relationships and Conflict Resolution

The final week aimed to enhance students' interpersonal relationships by fostering mutual respect and empathy, ultimately assessing the program's positive impact on their socio-emotional development. During this phase, students were encouraged to apply what they had learned to real-life problem-solving situations commonly encountered in the school environment. By engaging in reflective discussions and structured activities, students had the opportunity to demonstrate their understanding of character strengths in practical contexts, reinforcing their ability to navigate social interactions more effectively.

Phase 3: Observation

During the observation phase, systematic evaluations were conducted to assess students' behaviors and skills in relation to self-awareness, self-esteem, and interpersonal relationships. A checklist was employed, allowing teachers to systematically observe students' behaviors and competencies using specific criteria. This checklist was structured according to the three key areas of the study: self-awareness, self-esteem, and interpersonal relationships, enabling precise documentation of how these skills manifested in different classroom contexts.

Teachers supplemented these observations by maintaining a detailed anecdotal record, documenting significant events, notable behaviors, and relevant situations observed throughout the three-week period. This qualitative data was later discussed with students as part of a confirmation process to ensure the accuracy of observations and minimize misinterpretations. Additionally, an analysis of students' work products was conducted. Student portfolios were collected, each containing a selection of nine assignments designed to reflect their individual understanding of character strengths. These portfolios served as tangible evidence of students' learning progress and their ability to apply the concepts explored during the intervention.

To assess the outcomes of the intervention, multiple evaluation methods were employed at both the beginning and end of the three-week study. The implementation of a pre-test and post-test was essential in measuring second-grade students' knowledge and understanding of self-esteem, self-awareness, and interpersonal relationships. The pre-test provided insights into students' initial levels in these areas, offering a baseline to determine their existing understanding and application of these skills in daily life. The post-test, conducted at the conclusion of the intervention, facilitated a comparative analysis that highlighted the progress made, allowing for an assessment of the program's impact within this short-term study. This approach not only enabled the identification of changes in students' conceptual knowledge but also in their practical application of these skills, revealing improvements in self-perception and the quality of peer interactions.

Phase 4: Reflection

The reflection phase involved a critical review conducted by both the teacher and the researchers, aiming to compare and evaluate the results obtained before and after the intervention. This phase focused on assessing the effectiveness of the tutoring program, which was based on the principles of positive education, and analyzing the extent to which the specific objectives related to students' self-awareness, self-esteem, and interpersonal relationships were achieved. The evaluation incorporated both the indicators established during the planning phase and direct classroom observations. An adaptive approach was employed throughout the intervention, allowing for continuous adjustments to the strategies to ensure that all students felt included and that their emotional needs were effectively addressed. This approach facilitated real-time modifications, enabling the program to respond to students' varying learning needs and paces. As a result, the teaching and learning process was enriched, fostering a more equitable and participatory classroom environment.

Throughout the implementation, the teacher observed that the program effectively encouraged students to identify

and express their emotions more openly, fostering a climate of trust. On multiple occasions, it was noted that positive interactions among students improved as the tutoring sessions progressed, particularly during activities requiring group reflection and mutual support. These changes were especially evident in students who initially struggled to recognize their strengths and had demonstrated a low level of identification and application of the targeted dimensions in the pre-test. However, as the program advanced, these students gradually became more engaged in both group and individual activities.

Additionally, the teacher noted that the continuous adaptation of strategies allowed for an effective adjustment of task difficulty levels, which led to increased self-confidence among students and greater willingness to take on personal challenges. This was particularly evident during the second week of the program's implementation when students actively applied a personal goal aligned with a strength they aimed to improve. Overall, the teacher observed that the personalization of activities through the use of See the Good cards fostered a learning environment in which students became increasingly willing to participate and explore their own capabilities. This individualized approach enabled strategy adjustments to meet students' specific needs while promoting a space where each student could progress at their own pace and meaningfully develop their socio-emotional skills. Furthermore, the program's flexibility provided valuable insights into the role of positive education as a dynamic and adaptable approach, facilitating both students' personal development and the growth of the broader school community.

Results and Discussion

The action phase commenced with the administration of a pre-test designed to assess students' initial levels of self-awareness, self-esteem, and interpersonal relationships. This pre-test served as a baseline for measuring the identification and application of character strengths prior to the intervention. The results provided a clear reference point, highlighting both students' strengths and areas for improvement. This initial assessment enabled the teacher and researchers to tailor pedagogical strategies effectively from the outset of the program. Adjustments and modifications were made throughout the implementation based on observed student needs, fostering an environment conducive to the development of socio-emotional skills. At the conclusion of the program, a post-test was administered using the same format and evaluation criteria as the pre-test. This allowed for a direct comparison of progress across the proposed indicators.

Figure 3 presents an initial demonstration of students' identification and application of the targeted dimensions before the implementation of the positive education-based tutoring program. The results of the pre-test illustrate the progress achieved in the areas of self-awareness, self-esteem, and interpersonal relationships.

The qualitative analysis of the pre-test results reveals a positive trend in the categories of interpersonal relationships, self-awareness, and self-esteem among second-grade students. Most students demonstrate high level interpersonal skills, as evidenced by their ability to interact effectively with peers and collaborate well in team settings. Regarding self-awareness and self-esteem, the findings indicate that students generally exhibit a positive self-perception and a high level of self-worth.
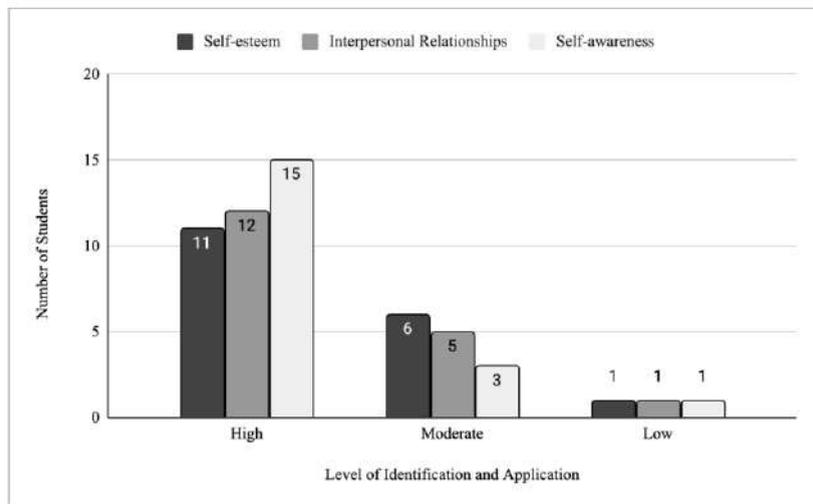
Figure 3. Bar Chart: Pre-Test Results
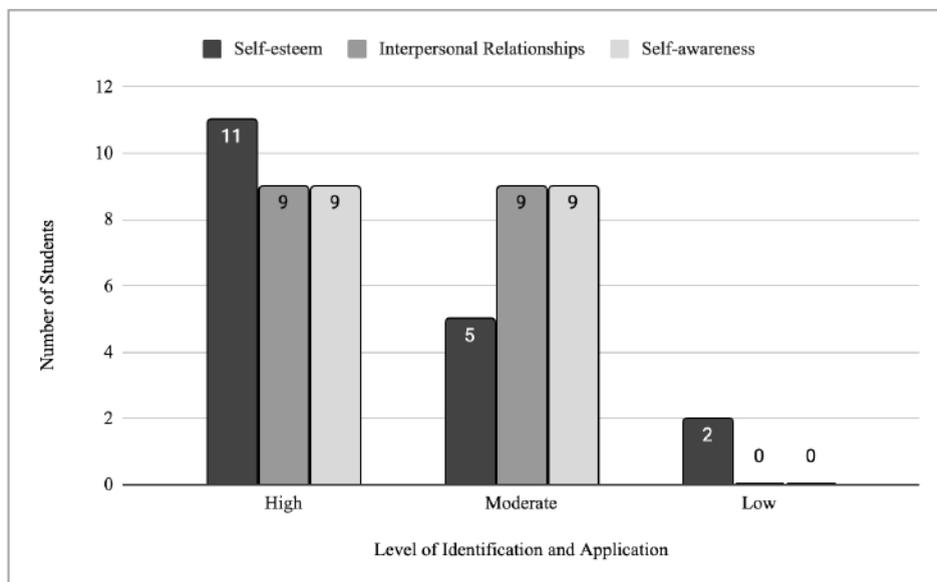
Figure 4. Bar Chart: Post-Test Results

The analysis of this table highlights the impact of the intervention and provides a deeper interpretation of the changes observed throughout the implementation. The results indicate a positive progression in the dimensions of self-awareness, self-esteem, and interpersonal relationships. Furthermore, the data suggest that students have strengthened their capacity for introspection, enhanced their self-perception, and improved their interpersonal skills. A higher number of students demonstrate a high level of self-awareness, which may indicate a greater consolidation in this particular area.

Self-Awareness

The results obtained by the intervention program indicated that students achieved a moderate understanding of their character strengths, as well as an increased ability to reflect on how these strengths influence their daily decisions. Eighty percent of the students were able to identify at least three personal strengths. Some of these students successfully connected how their strengths could help them reflect on different situations, while others demonstrated

how they could apply these strengths in their daily lives.

> I have the strength of kindness when I am kind to my friends. I am creative when I think of new ideas. I can demonstrate a love of learning when I participate in math. (Female student, 8 years old)
> I have the strength of love of learning when I am working on math problems. I am kind when I am with my friends. I can demonstrate creativity when I have new ideas. (Male student, 7 years old).
> At school, I can be grateful when someone gives me something; I show gratitude. When we work as a team, I am collaborating. If a friend hurts me, I can show forgiveness. (Male student, 8 years old)

These findings align with previous research demonstrating that self-awareness enhances a sense of purpose and improves informed decision-making. Hägglund et al. (2019) suggests that participating in self-reflection exercises enables students to develop a clearer understanding of both their strengths and areas for growth, which in turn fosters greater self-awareness and supports emotional well-being. Learners who engage in reflective practices frequently experience higher levels of confidence and personal satisfaction throughout their educational process, underscoring the important relationship between self-awareness and positive emotional development.

The pre-test and post-test results indicated that at the beginning of the intervention, 15 students exhibited a high level of self-awareness. After the three-week intervention, the post-test results showed that 9 students maintained a high level, while another 9 achieved a moderate level of self-awareness. Regarding the effectiveness of structured interventions, Kim (2023) demonstrates that well-designed short-term programs can lead to significant improvements in self-awareness, challenging the notion that only long-term interventions generate profound changes. Similarly, Zhai et al. (2023) emphasize that self-reflection interventions positively impact academic performance, suggesting the effectiveness of brief programs. Additionally, studies such as that Zhang (2024) demonstrates that a focus on self-concept can enhance confidence and subjective well-being, underscoring the importance of these approaches in students' personal development.

Although structured interventions have proven effective in strengthening self-awareness, some studies suggest that their impact depends on program design and duration, highlighting the need to optimize these approaches to maximize their benefits.

Self-Esteem

The program successfully maintained a high level of self-esteem among 11 students, who demonstrated increased confidence in their abilities and a greater willingness to participate in academic and social activities. An improvement in their perception of personal value was observed in both academic and social contexts. This was confirmed through an activity in which students set personal goals to be worked on over a week, with the teacher observing their progress throughout the process. This positive shift in self-esteem was reflected in greater engagement and openness to new challenges.

> My goal is to complete 14 pages of my Early Finishers booklet. In this goal, I will work on my love of

learning strength. This is important to me because it will help me improve in math. To achieve this goal, I will use perseverance and patience to complete as much as I can. (Female Student, 7 years old).

My goal is to complete all my classwork during lessons. The strength I will work on is self-control. To achieve this goal, I will follow a plan to avoid talking when I shouldn't, be brave enough to ask for help, and stay persistent when I get distracted so I can refocus on my work. (Female Student, 8 years old).

Kim and Dhammasaccakarn (2024) argue that self-esteem is fundamental to emotional well-being, and the findings from this program align with their theory. The results showed that the intervention had a positive impact on students' self-perception. Additionally, Kim (2023) emphasizes that self-acceptance is key to personal growth, which aligns with the observations from this study, where students demonstrated improved confidence and readiness to face challenges. Amelia et al. (2024) further reinforce the connection between self-esteem and emotional regulation, which was evident in the students' behavioral changes.

Although some studies suggest that self-esteem programs require a prolonged period to produce lasting changes, the results of this program indicate that even short-term interventions can be effective. Programs such as the 9-week CBT-based primary care intervention and Girls on the Move! have shown significant improvements in self-esteem through interactive approaches (Beattie & Beattie, 2017). Moreover, a school-based intervention maintained its effects for up to 12 months, highlighting the potential of short-term educational strategies (Caldwell et al., 2019). These findings suggest that experience-based learning approaches can optimize the impact of brief interventions, though continuous reinforcement is recommended to ensure long-term sustainability.

Interpersonal Relationships

Twelve students showed significant improvement, demonstrating a high level of interpersonal relationships following the intervention. They exhibited greater empathy, conflict resolution skills, and a more collaborative attitude both inside and outside the classroom. These changes were documented through applied activities and qualitative observations by teachers, who reported a more respectful and cooperative classroom environment.

At first, group activities were difficult for us, but then we set a goal to achieve, and it became easier to work together. Sometimes we just want to finish quickly and don't communicate, but we understood that talking is important for teamwork. We can use our strengths and support each other. (Male Student, 7 years old; Female Student, 8 years old).

We already know each other well because we sit at the same table group. So, working together on the tower-building activity and group games was easier because we understand each other's strengths and weaknesses. We were able to help one another, and even when it got difficult, we knew that by talking, we could reach an agreement and achieve our goal. (Group E: Female Student, 8 years old; Female Student, 7 years old; Male Student, 8 years old; Male Student, 8 years old).

The findings of this study align with previous research highlighting the importance of emotional intelligence (EI) in developing interpersonal skills. Tika et al. (2024) assert that EI is essential for fostering empathy and conflict

resolution, while Mutongi et al. (2023) report that programs focused on this area improve social interactions and reduce conflicts. Regarding the classroom environment, Martínez and Gómez (2024) document positive changes in group dynamics following the implementation of social-emotional learning (SEL) programs, which resulted in increased student cooperation—an outcome also observed in this study (Lim & Min, 2024). These findings support the idea that integrating EI into educational curricula not only promotes personal development but also enhances social cohesion and teamwork (Black et al., 2019) However, some experts caution that an excessive focus on emotional competencies might overshadow cognitive skill development, highlighting the need for a balanced educational approach.

Conclusion

Several factors influenced both the implementation and the outcomes of this study. First, given the complexity of character strengths within the framework of positive education and socio-emotional well-being, effectively introducing these concepts to students within a short timeframe proved challenging. The brevity of the intervention period limited the depth with which self-awareness, self-esteem, and interpersonal relationships could be explored, potentially affecting students' understanding and assimilation of these concepts.

Additionally, logistical delays at the beginning of the research led to a more condensed and accelerated implementation of the program. This impacted both planning and follow-up, as some sessions had to be conducted at a faster pace, compromising the quality of activities and student reflection. Consequently, the results were somewhat scattered, making it difficult to identify clear patterns of improvement in the evaluated areas.

A key recommendation for future action research is to extend the intervention period to 27 weeks. This approach would allow for a gradual introduction in the first week, followed by 26 weeks dedicated to exploring each character strength individually. Such a structure would provide students with more time to internalize and reflect on each strength, facilitating a deeper development of their self-awareness, self-esteem, and interpersonal relationships.

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Key Factors for Teaching German to Spanish-Speaking Children: A Qualitative and Structural Analysis

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Abstract: Learning a foreign language early enhances students' linguistic, cognitive, and emotional development. This research aimed to determine the essential factors in teaching German to Spanish-speaking children. Using a qualitative, exploratory design, five pedagogy experts conducted a structural analysis with the MICMAC (Impact Matrix Cross- Reference Multiplication Applied to a Classification) tool to examine German teaching processes. Key factors emerged, including reading children's books in German, using visual materials, and immersing students in the language. Immersion, in particular, was more influential than other factors like interacting with native speakers or repeating vocabulary. The study also highlighted the importance of teaching resources and tools over traditional strategies. Based on these findings, it is recommended that German teachers incorporate children's book reading and innovative visual aids to create an immersive classroom environment, potentially enhancing the language learning experience for students.

Keywords: Language teaching, German, Spanish-speaking children, Early education, Structural analysis.

Introduction

Learning a foreign language such as German from an early age is essential, as it has a positive impact on children's brains by stimulating cognitive skills such as memory, attention, and creativity. Various studies have shown that bilingual children develop enhanced key skills and adaptability, which help them face contemporary challenges. In

fact, learning another language has a significant impact on a child's overall development, both cognitively and emotionally, enriching their learning process and fostering meaningful personal growth (Fioretto, 2018).

In an interconnected world, being bilingual offers a range of cognitive and cultural benefits. Thus, early learning of a foreign language such as German not only expands linguistic skills but also opens academic and professional opportunities, even in Spanish-speaking environments. To foster this early learning, it is important to consider principles such as input, the principle of variable repetition, the principle of play, the principle of movement, the principle of integration, and the principle of progression (Roattino & Wilke, 2023). These principles involve exposing children to linguistic stimuli they can see and hear in their surroundings, engaging them with new vocabulary, allowing them to experience learning through play due to their natural need for movement, and integrating language learning, which ultimately enhances their receptive and productive skills.

Learning a foreign language from an early age fosters cultural awareness, contributing to the formation of global citizens capable of navigating diverse contexts. However, a widespread discourse persists regarding the perceived difficulty of learning German. It is commonly assumed that, for a native Spanish speaker, German presents a significant challenge, as learning it requires immersion in a completely different linguistic family (Vilar, 2014). Therefore, it is crucial to develop interactive and playful teaching methods that make learning this language an engaging experience capable of capturing students' attention. The reality is that the number of students interested in learning German has increased as a result of Europe's economic and political context. Within this framework, the teaching and learning of German is justified by its ability to develop communicative skills and create opportunities in business, science, and technology (Corella, 2018).

However, research on teaching German to Spanish-speaking children remains scarce, highlighting the need to bridge this gap to ensure accessible and effective learning in this context. Therefore, this study aimed to analyze research on the teaching of German to Spanish-speaking children, focusing on language acquisition, pedagogical strategies, and the use of technological resources.

Theoretical and Conceptual Foundations of Foreign Language Learning

To comprehensively understand the topic addressed in this research, it is essential to explore three key aspects: theories of foreign language learning in childhood, the characteristics of the German language, and methodologies and strategies for teaching foreign languages to children.

Theories of foreign language learning in childhood encompass various approaches to understanding how students acquire and develop skills in a foreign language during this stage. Likewise, the characteristics of the German language—such as its phonology, morphology, syntax, and lexicon—play a crucial role in how it is taught and learned, presenting specific challenges for students. Understanding these characteristics is fundamental to designing effective strategies for teaching German to children.

In turn, methodologies and strategies for teaching foreign languages are essential to ensuring effective learning, as they encompass a variety of techniques and make use of didactic resources. The integration of these elements provides a comprehensive perspective on the teaching and learning processes of German, allowing for a more effective approach to challenges and, consequently, the maximization of opportunities in early childhood education.

Theories of Foreign Language Learning in Childhood

Learning a foreign language is a complex process aimed at developing students' linguistic competencies necessary to communicate in another language, understand different cultures, and adopt a broader perspective of the world. This process highlights the importance of analyzing the various principles essential for understanding how to develop an effective learning process. In this regard, learning theories play a fundamental role. González and Brouard (1996) state that foreign language learning theories constitute a central aspect of the learning process and—when properly implemented—hold significant importance. Examples of these include Krashen's model, Ellis's model, interlanguage theory, and linguistic universals theories.

Krashen's model, known as the Monitor Theory, is one of the most influential theories in foreign language acquisition. Its relevance lies in its hypotheses, which explain how to improve the teaching-learning process of a foreign language effectively, making it applicable to different languages, including German. This model proposes five main hypotheses: the acquisition-learning hypothesis, the natural order hypothesis, the monitor hypothesis, the input hypothesis, and the affective filter hypothesis (Krashen & Terrell, 1983, as cited in Martínez, 2014, p.10). The acquisition-learning hypothesis distinguishes between subconscious language acquisition, similar to how children acquire their native language, and conscious learning, which focuses on grammatical rules and vocabulary (Cerdas & Ramírez, 2015).

The natural order hypothesis suggests that there is an innate order in the acquisition of grammatical structures in a language. The input hypothesis emphasizes the importance of comprehensible and meaningful input in the language acquisition process. Meanwhile, Martínez (2014) points out that the affective filter hypothesis highlights the presence of affective variables in all learners, which are directly related to the success of second or foreign language acquisition. Factors such as motivation, self-confidence, and anxiety influence this process, as a receptive disposition fosters a positive attitude toward language learning and increases linguistic input for knowledge acquisition.

Ellis (1990), known as the Integrated Theory, seeks to combine cognitive and linguistic aspects to provide a comprehensive explanation of how learners acquire and use their knowledge of a second language in different contexts and tasks (González & Brouard, 1996). This model recognizes the importance of mental processes such as attention and memory, allowing for a more complete understanding of second language acquisition. Additionally, it highlights the strategies students use to apply grammatical rules and their relationship with motivation, attitude, and prior experience in understanding the complexity of second language acquisition. Consequently, this theory offers valuable guidelines for designing effective teaching programs that consider students' individual differences by integrating cognitive and linguistic aspects.

The interlanguage theory, proposed by Selinker (1969) from a psycholinguistic perspective, argues that second language learners develop an autonomous linguistic system distinct from both their native language and the target language. This system evolves as learners gain greater proficiency in the second language. The theory is used to

identify developmental stages in second language learning, conceptualizing it as the result of five central cognitive processes: language transfer, training transfer, learned second-language learning strategies, second-language communication strategies, and overgeneralization of second-language linguistic material. Furthermore, interlanguage development may differ from native language development due to a phenomenon known as fossilization. This means that most second-language learners do not achieve full competence, and this limitation cannot be overcome through additional instruction.

The theories of linguistic universals focus on internal factors and the acquisition of the formal properties of language through an innate and universal linguistic component. Two major approaches stand out within these theories: the Universal Typological Approach to Language, represented by Greenberg and Comrie, and Chomsky's Universal Grammar. On the one hand, Greenberg (1974) and Comrie (1981) describe their approach as inductive, studying the surface characteristics of various language families to determine variations and the underlying principles governing them. This approach seeks to constrain second language learning through typological and universal principles regarding the structure of natural languages.

On the other hand, Chomsky (1980) proposes the existence of an innate mechanism in the human mind that facilitates language acquisition. He argues that human beings are born with a biological predisposition to learn language, which influences how individuals acquire a second language. Moreover, he suggests that universal linguistic principles, such as grammar, underlie all human languages. These principles affect how second-language learners internalize grammatical rules and linguistic structures, either facilitating or hindering the learning process.

Characteristics of the German Language

The German language is a Germanic language belonging to the Indo-European language family, possessing a set of unique linguistic features that differentiate it from other languages such as English or Spanish. Grammatically, Castell (2014) identifies that in German, all nouns have their own definite article, regardless of whether they refer to people, animals, objects, or abstract concepts: *der* for masculine, *die* for feminine, and *das* for neuter. When conjugating verbs, their forms depend on the grammatical person to which they refer. For example, in the first person, the suffix -e is added to the verb, in the third-person singular the suffix -t, and in the first-person plural the suffix -en. In the plural, the definite article is always *die*. Personal pronouns refer to people and objects. While *ich* is used to refer to oneself, *er* refers to a male person, *sie* to a female person, and *wir* to two or more people, among others.

Castell (2014) points out that nouns can adopt different grammatical roles in sentences depending on whether they are the subject or the direct object of an action. To indicate this, grammatical cases are distinguished: nominative for the subject, accusative for the direct object, and dative for the indirect object. For example, for the masculine article der, in the nominative case, it remains the same, in the accusative case, it changes to den, and in the dative case, it changes to dem.

Similarly, Pineda (2008) explains that certain verbs determine the grammatical case of the component that accompanies them. For example, the verbs that govern the nominative case are bleiben, heißen, scheinen, sein, and werden. Verbs that govern the accusative case are numerous and varied; if they have the following prefixes, they usually require the presence of an accusative: an–, be–, durch–, er–, hinter–, über–, um–, ver–. Examples of these

verbs include anrufen, erzählen, lesen, and essen. Finally, in the case of verbs that govern the dative case, a similar pattern to the previous one occurs. The following prefixes should be considered: auf–, bei–, ein–, ent–, entgegen–, ge–, nach–, unter–, vor–, wider–, zu–, and zuvor–. Examples of these verbs include auffallen, nachgeben, danken, gefallen, and zuhören.

Phonetically, German has an alphabet consisting of 30 letters, among which four special letters stand out: ß (es-tset or scharfes s), ä (a-Umlaut), ö (o-Umlaut), and ü (u-Umlaut). Its vowels include the letters a, e, i, o, u, y, ä, ö, and ü, while the remaining 21 letters are consonants. Additionally, tonic vowels can be long or short. They are long when they appear in an open tonic syllable or in a tonic syllable closed by a single consonant, as in bad [ba:t], and short when they are in a tonic syllable closed by two or more consonants, as in alt [alt]. Regarding the pronunciation of consonants, they are divided into several groups (Ruppert and Otto, 1999):

> Plosives, which are subdivided into voiceless plosives (p, t, k) and voiced plosives (b, d, g). The b is pronounced like the Spanish b in words such as Biene [ˈbiːnə] or Liebe [ˈliːbə], but at the end of a word or syllable, it is pronounced as a relaxed and weak p, as in siebzehn [ˈziːptseːn]. The t is pronounced with aspiration in words like Teller [ˈtɛlɐ], Theater [teˈaːtɐ], or retten [ˈʁɛtən]. However, in words of Latin origin where t is followed by the vowel i, it is pronounced as [ts], for example, Nation [naˈtsjo].

> Fricatives consist of the letters f and v, which share the same sound, as in Feuer [ˈfɔɪɐ] and Vater [ˈfaːtɐ]. The s can be voiceless or voiced. It is voiceless if it appears in the final position of a word, written as s, ß, or ss, as well as in the groups st and sp if they are not at the beginning of a word, for example, fast [fast], heißen [ˈhaɪsən], or Fluss [flus]. It is voiced when it is initial and followed by a vowel or in an intervocalic position, for example, Zusage [ˈtsuːzaːɡə] or Sonne [ˈzɔnə].

> Affricates, consonants with a complex consonantal sound that begins with a plosive sound, usually p or t, followed by an air release through a fricative sound like f, s, or sch. The three main ones in German are: [ts] (written as z, tz, or ts) in words like Zaun [tsaʊn], [pf] (written as pf) in words like Pferd [ˈpfeːɐt], and [tʃ] (written as tsch) in words like Botschaft [ˈboːtʃaft].

Additionally, there are three more categories that consist of a single consonant: vibrants, which include the consonant r, pronounced [ʁ], as in reden [ˈʁeːdən] or fahren [ˈfaːɐn]; laterals, which include the consonant l, with the same sound as in Spanish; and nasals, which include the consonants m and n, pronounced the same as in Spanish.

When comparing German and Spanish in terms of linguistic structure, Moreno (2002) points out that some graphemes used in Spanish also exist in German, but in this language, they represent different sounds, which could cause interference when interpreting them while learning the language. Additionally, vowel sounds such as [ai] and [au] may cause pronunciation difficulties due to differences in their graphic and phonetic representation between both languages. The author also identifies four types of discrepancies in consonant sounds between Spanish and German. These differences include the presence of sounds in one language that do not exist in the other, the use of the same sound with different graphic representations, the assignment of the same graphemes to different sounds, and variations in the pronunciation of the same sound in each language. Finally, at the morphosyntactic level, emphasis is placed on

the differences in adjective-noun agreement between both languages, as well as on the placement of elements within sentences.

Mediavilla (2017) finds that Spanish-speaking students face difficulties in learning German in several key areas: pronunciation and intonation, as certain sounds in German do not exist in Spanish, and the differences in intonation and accent in German can make oral communication challenging; grammar and syntax, since German grammar, with its declensions, grammatical genders, and complex sentence structures, presents a challenge for Spanish speakers accustomed to the simpler grammar of Spanish; and from a cultural perspective, learning a foreign language also involves becoming familiar with the culture and customs of the country where the language is spoken, adding an additional layer of adaptation for Spanish speakers.

Methodologies and Strategies for Teaching Foreign Languages to Children

When it comes to methodologies for teaching non-native languages, it is essential to emphasize strategies and cognitive skills related to oral and written comprehension in language learning. Methodologies encompass the ways of teaching, learning, and connecting both processes, which together constitute the core of language didactics (Casariego et al., 2023). In this sense, the goal is to promote the interrelation and use of the language to develop communicative competence and linguistic skills. To achieve this objective, methodologies have evolved over time. Some authors have conducted a thorough analysis of the historical evolution of second language teaching methodologies, describing them through six fundamental approaches.

The Grammar-Translation Method is a traditional approach that emphasizes the explicit teaching of grammatical rules and the translation of literary texts, aiming to develop reading and writing skills. In contrast, the Direct Method encourages language learning through oral communication, avoiding the use of the mother tongue and prioritizing vocabulary acquisition in everyday contexts. On the other hand, the Audiolingual Method focuses on repetition and intensive practice to strengthen oral expression and listening comprehension, influenced by structural linguistics and behaviorist psychology (Larsen-Freeman & Anderson, 2013).

Starting in the 1970s, the Communicative Approach emerged, focusing on language learning through communication, prioritizing oral interaction, communicative task resolution, and the contextualized use of language. The Task-Based Approach, derived from the Communicative Approach, centered on performing meaningful and authentic tasks that required language use in real situations, emphasizing active learning and problem-solving. Additionally, Content and Language Integrated Learning (CLIL) combined foreign language teaching with academic content, integrating language learning with the acquisition of knowledge in other fields (Sánchez, 2009).

When designing didactic strategies for teaching a foreign language, it is essential to consider various aspects that influence the learning process. Among these are the adaptability of teaching scenarios to different age groups, linguistic proficiency levels, and learning objectives (Powers et al., 2008). However, focusing on the oral domain, Akcan (2005) highlights the implementation of strategies centered on developing oral skills to strengthen children's linguistic foundation. These strategies not only enhance vocabulary and language comprehension but also encourage students' participation in activities related to learning German.

Ibaibarriaga (2015) uses storytelling as a didactic resource in teaching German in Early Childhood Education. The use of storytelling provides a meaningful context and encourages children's active participation in their own learning. This approach positively contributes to the learning process by stimulating interest in the language and facilitating the acquisition of linguistic skills. Additionally, it enables the integrated and contextualized teaching of various language aspects, such as vocabulary, grammar, oral, and written expression.

Ruiz de Azúa (2019) highlights the use of playful activities in teaching German as a foreign language, emphasizing their ability to increase students' motivation and engagement. These activities, which include games or songs, not only facilitate more effective language acquisition but also promote the development of linguistic skills such as listening comprehension, oral expression, writing, and reading. Furthermore, they encourage student interaction, enhancing collaboration and teamwork through group activities. Additionally, they allow for personalized learning, as they can be adapted to each student's interests and needs, thereby increasing their relevance and effectiveness in the teaching process.

Chaves (2019) points out that gamified activities have a positive impact on German language teaching, providing significant benefits. These include improved motivation, student engagement, and increased linguistic competence. Gamification in the school context fosters interaction and active participation, promoting a more dynamic learning experience. Moreover, Chaves also highlights that these activities contribute to reducing stress and anxiety by creating a more relaxed and enjoyable learning environment, which is crucial in the process of learning a foreign language. This reduction in anxiety and stress associated with learning German helps students feel more comfortable and confident when practicing the language, fostering a positive attitude toward learning. Additionally, these activities encourage an acceptance of errors as a natural part of the learning process.

Regarding motivation and interest in language learning during childhood, Ramajo (2009) argues that these are key factors in the learning process. Motivation not only influences students' self-efficacy—understood as their confidence in successfully completing a specific task or achieving a goal—but also impacts their academic performance and ability to face challenges in language learning. Additionally, an adequate level of motivation strengthens students' self-esteem, making them feel more confident and more willing to actively participate in the learning process. For example, Ferrando (2023) emphasizes that motivation in second language learning is a fundamental aspect that teachers must foster through enthusiasm, commitment, and the creation of a positive learning environment. This principle also applies to German, as it is a foreign language less present in the everyday environment of Spanish-speaking children, requiring sustained high motivation to facilitate immersion and maintain students' interest.

Furthermore, Pérez and Hernández (2022) highlight that both intrinsic and extrinsic motivation play a fundamental role in learning a foreign language, as they serve as a driving force that guides students toward their linguistic goals. They also stress the importance of teachers identifying the factors that motivate students in their daily lives, which allows them to make informed decisions in the teaching process and select appropriate didactic strategies. Additionally, Pérez and Hernández (2022) note that socio-affective motivation plays an important role in foreign language learning, as it involves the expression of emotions and the creation of environments that reduce anxiety and fear.

Some Studies on Teaching Strategies, Acquisition, and Use of Technology in Learning German as a Foreign Language

The literature provides relevant evidence on the factors influencing the learning of a foreign language in Spanish-speaking children, emphasizing the importance of early exposure and specific methodologies in instructed teaching contexts.

Milla et al. (2020) highlight the multiplicity of elements necessary for the effective acquisition of a foreign language in childhood, suggesting that a comprehensive approach considering cognitive, contextual, and pedagogical variables is essential. This perspective reinforces the need to design educational programs that incorporate diversified strategies tailored to the specific characteristics of each student group. Schulz et al. (2023), in turn, demonstrate that increasing the number of words included in the curriculum fosters second-language development in monolingual children in instructed teaching environments. This raises the need to evaluate not only the amount of language exposure but also the effectiveness of the methodologies employed to optimize learning.

Finally, Pfenninger (2020) highlights the impact of CLIL (Content and Language Integrated Learning) programs on bilingualism acquisition, indicating that intensive linguistic immersion can enhance both oral and written proficiency in the second language. However, it is worth questioning to what extent this methodology is equally effective in different educational contexts and populations with varying levels of contact with the target language. Additionally, it is crucial to consider institutional conditions and teacher training required for the proper implementation of these programs.

Regarding the introduction of German language learning, these studies provide complementary perspectives, addressing aspects ranging from the feasibility of immersion programs to the cognitive factors influencing literacy and linguistic competence development in children with different levels of language exposure.

Güntensperger and Asali-van der Wal (2024) examine the implementation of summer linguistic immersion programs for students with no prior knowledge of German, based on Swiss educational models. While this approach may be effective in initiating language learning, it is crucial to assess its long-term impact, especially in comparison to continuous instruction strategies. Moreover, it is essential to consider whether the intensity of immersion over a short period compensates for the lack of sustained language contact. On the other hand, Wealer et al. (2022) analyze how phonological awareness in Luxembourgish and knowledge of the alphabetic principle influence the acquisition of German as an additional language in preschool children. This study highlights the importance of metalinguistic skills in learning a new language, suggesting that the transfer of phonological abilities from the native language may facilitate literacy development in German. However, further research is needed to understand how these relationships may vary depending on the linguistic distance between the native and target languages.

Visser (2023) expands the discussion on learning German by examining the relationship between reading and spelling performance in native and non-native German-speaking children in the federal states of Hesse and Bavaria. Identifying

differences in structural invariance between these groups allows for a better understanding of the specific difficulties faced by second-language learners and the pedagogical adaptations needed to ensure equitable instruction.

Finally, Schwab et al. (2014) address reading, spelling, and language competence in children learning German as a first or second language, providing relevant data on the specific challenges that may arise in each case. Their findings emphasize the need to adapt teaching strategies to the particularities of the learner group, ensuring that both native and non-native speakers receive adequate support in their language acquisition process.

Regarding the acquisition of the German language, these studies offer a multidimensional analysis, covering aspects from linguistic development in monolingual children to the factors influencing language learning among refugees and immigrants in Germany and Austria.

The study by Zaretsky et al. (2022) focuses on assessing linguistic competence in monolingual four-year-old children, addressing language comprehension, vocabulary, grammar, and word repetition. Such research is key to establishing reference parameters for early linguistic development and identifying potential learning difficulties. On the other hand, Fischer (2016) delves into the challenges faced by refugees and immigrants in Germany and Austria, highlighting German language proficiency as an essential factor for integration. While this study emphasizes the relevance of language as a tool for social inclusion, it is also necessary to consider how educational policies and German language teaching programs for foreigners can facilitate this process and minimize linguistic and cultural barriers.

Seuring and Will (2022) complement this perspective by examining German language acquisition in refugee children, identifying motivation, efficiency, and language exposure as key factors in developing their linguistic competence. This study suggests that immersion in rich and diverse communicative contexts can foster language acquisition, underscoring the need to design pedagogical strategies that encourage meaningful interactions for non-native speakers. In summary, the importance of creating environments that promote effective linguistic immersion for non-native speakers is emphasized.

Regarding teaching strategies, these studies offer a broad perspective, highlighting the importance of word meaning, the use of digital resources, and experiential learning as key approaches to improving language acquisition. Sekiziyivu and Mugimu (2017) analyze teaching strategies employed in Uganda, emphasizing the value of word meaning in developing linguistic skills. This approach, centered on understanding and contextual use of language, suggests that foreign language learning should not focus solely on grammar and syntax but also on constructing meaning through interaction with the language.

Wijayati et al. (2022), in turn, explore the integration of Open Educational Resources (OER) in teaching German at levels A1-B1. Their study highlights how the use of digital materials and teacher collaboration can democratize access to learning resources and enrich language instruction. Despite its benefits, the use of OER also presents challenges, such as the need for teacher training in digital tools and the adaptation of materials to different learning styles.

Finally, Cancelas and Hurtado (2020) present a proposal based on Service-Learning for teaching German in real-life contexts outside the classroom. This innovative approach seeks to create meaningful learning opportunities through student participation in practical activities that foster language development in authentic situations. Their study highlights the relevance of connecting learning with real-world experiences, which can increase student motivation and communicative competence.

Regarding the use of technological tools in teaching German, these studies demonstrate their positive impact, emphasizing their ability to improve pronunciation, literacy, and vocabulary acquisition in various educational contexts. Künzl-Snodgras et al. (2022) explore the use of applications and multimedia technologies in learning German, emphasizing how these tools can facilitate the identification of common words and expressions while fostering familiarity with pronunciation at the phonological level. This approach highlights the role of technology in language teaching, not only as a complementary resource but as a pedagogical strategy that optimizes auditory exposure and phonetic recognition.

Márkus (2023), on the other hand, analyzes the use of dictionaries in teaching German and English as foreign languages in Hungary, highlighting their function in searching for unknown words and understanding grammatical and phonological aspects. While dictionaries represent a traditional tool in language learning, their effectiveness may depend on the student's level of autonomy and ability to integrate information into a real communicative context.

Konerding et al. (2020) investigate the effects of a computerized training program on literacy and vocabulary acquisition in immigrant children learning German as a second language. Findings show significant improvements in phonological awareness, spelling, and vocabulary knowledge, underscoring the importance of developing basic literacy skills in children with limited proficiency in the language of instruction. This study reinforces the need to design technological interventions adapted to the linguistic and cognitive particularities of learners.

Finally, Matassoni et al. (2018) examine transfer learning and the use of acoustic and linguistic models for speech recognition in non-native children. Their research demonstrates that these techniques can compensate for pronunciation differences between native and non-native speakers, optimizing the construction of a more general representation of the phonetic space. Additionally, this finding has significant implications for designing teaching programs incorporating advanced technologies in oral competence development.

Method

Structural analysis is a methodological approach applicable across various disciplines, used to understand the organization and composition of a system as a whole. This technique fosters collective reflection, allowing for the identification of key variables within a complex system and the possible influences among them through a matrix that relates all its constituent elements (Godet, 2007).

In this research, the structural analysis technique was employed to identify the key factors that enable an understanding of how German is taught to Spanish-speaking children. According to Lorenzo et al. (2015), key factors are considered

fundamental components for achieving success in a management process and must be taken into account when making informed decisions. These factors facilitate the evaluation of both theoretical and practical competencies, which may or may not influence a specific investment environment.

The study system in which structural analysis was applied was the process of teaching German to Spanish-speaking children. This process consists of interconnected factors, whose analysis allows for the identification of relationships and dependencies between elements. In this way, the aim is to generate a more significant impact and understand how each factor influences the others, leading to a deeper and more structured comprehension of the research. To effectively apply this technique, several phases were established to structure the research and analysis process; these phases were designed to facilitate the understanding of potential factors involved in the structural analysis of the study.

Phase 1: Identification of Categories and Factors

This phase involves listing the categories and factors that impact the teaching of German to Spanish-speaking children. To identify as many factors as possible, a document review was conducted using databases such as Scopus and Scielo. Additionally, a matrix was developed containing the relevant categories and factors within this field of study. The document review was carried out in the Scopus database. Various search criteria were used to select relevant articles addressing foreign language teaching, particularly German. Furthermore, each category was divided into a group of factors. Two categories were defined: Learning Strategies and Resources and Tools.

The categories and factors were validated by five specialists in teaching German as a foreign language, with academic backgrounds in Literature, Humanities, and Education, as well as teaching experience in Spanish-speaking contexts and training in German educational institutions. During validation, their contributions were essential in compiling the 15 factors, which were divided into the two previously mentioned categories. Table 1 provides a brief description of each factor to facilitate comprehension.

Table 1. Factors Involved in Teaching German to Spanish-Speaking Children

Category: Learning Strategies	
Factor	Description (Scope)
F1: Teachers' Academic Training in Teaching Methodologies	Specialized training for teachers in effective methodologies for teaching German to Spanish-speaking children, ensuring an appropriate and up-to-date pedagogical approach.
F2: Contextualization of the Language in an Immersive Environment	Creation of a learning environment where German is used in most daily activities, simulating a full linguistic immersion.
F3: Interaction with Native Speakers	Direct interaction of students with native German speakers to enhance language acquisition.

F4: Introduction of Daily Routines in German	Establishment of daily routines, such as greetings and common activities, conducted in German to promote familiarity with useful expressions.
F5: Constant Exposure to German through Songs	Implementation of German songs during teaching sessions to facilitate vocabulary acquisition, pronunciation, and basic grammatical structures.
F6: Vocabulary Repetition	Use of repetitive techniques, such as daily practice of key vocabulary and new words, to ensure retention..
F7: Application of Project-Based Learning	Development of thematic projects in which students must use German to research, create, and present their work, applying the language in real-life situations.
F8: Promotion of Playful Activities and Games	Integration of games specifically designed to reinforce vocabulary learning and grammatical structures.
Category: Resources and Tools	
Factor	Scope
F9: Teacher's Experience in Teaching	Teacher training in the use and selection of specific didactic resources for teaching German, including educational technologies, printed and audiovisual materials, and board games.
F10: Teaching Basic Grammatical Structures	Detailed and progressive instruction on the fundamental grammatical rules of German, using examples and exercises to build a solid foundation for sentence construction and accurate communication.
F11: Introduction to the Context of German Culture	Presentation of German cultural elements, such as festivities, traditions, and customs, to contextualize language use.
F12: Use of Educational Videos	Screening of educational videos in German that depict everyday situations, aiming to enhance listening comprehension and familiarize students with natural accents and intonations.
F13: Use of Board Games	Implementation of board games created in Germany that require the use of the language, encouraging the practice of German.
F14: German Children's Literature	Selection of children's books that progressively introduce vocabulary and basic grammatical structures, facilitating comprehension and enjoyment of reading in German.
F15: Audiovisual Resources	Development and regular use of visual materials designed to practice and reinforce the learning of key vocabulary and phrases.

Phase 2: Identification of Categories and Factors

In this stage, five experts in methodology and pedagogical teaching of the German language were consulted regarding the level of influence and dependence among all the factors of the studied system. As a structural analysis tool, the

Multiplication Applied to a Classification based on Matrices (MICMAC) was used. Table 2 presents the general profiles of these experts, who were selected through a non-probabilistic and intentional sampling process.

Table 2: Profile of the Experts Consulted

Códe	General Profile
E1	Bachelor's degree in Literature and Humanities, native German speaker with 22 years of experience teaching German.
E2	Bachelor's degree in Early Childhood Education, completed university studies in Germany. Lived in Germany for nine years, acquiring in-depth knowledge of the German language.
E3	Native German teacher with nine years of experience teaching German to Spanish-speaking children in Peru.
E4	Teacher and expert in the German language with academic training in Germany.
E5	Teacher with a strong command of the German language and more than 10 years of experience teaching the language.

To conduct structural analysis using the MICMAC tool, a series of specific steps must be followed. First, the list of structural factors identified through a documentary review of reliable data sources is introduced. Second, a rating is assigned to determine the degree of influence that each of the previously listed factors has on the next one. For instance, if 15 factors are identified, the influence of the first factor must be rated in relation to the remaining 14, and so on. This information is gathered by providing a matrix, identical to the one used by the MICMAC software, to a group of experts in the research field, who must reach a consensus on the scale of influence or dependence that, in their opinion, exists among the factors. Third, once the influence ratings for each factor on the others have been entered, a direct relationship map is generated. This map illustrates how the variables interact with each other, with the second quadrant highlighting the key variables that the analysis aimed to identify. Additionally, to quantify the influence of each factor, experts were provided with a classification scale ranging from 0 to 4, where each score reflects the level of dependence that one factor exerts over the others. This classification was based on the scale presented in Table 3.

Table 3. Scale of Degree of Influence or Dependence

Degree of Influence or Dependence	Rating
Strong (very high influence)	4
Potential (possible future influence)	3
Moderate (moderate influence)	2
Weak (low influence)	1
Null (no influence)	0

Finally, a matrix of direct influences was generated using the MICMAC software, allowing for the identification of key factors in the system's evolution. In particular, the aim was to highlight the most dependent and influential factors in the teaching of German to Spanish-speaking children. In an interconnected world, being bilingual offers a range of cognitive and cultural benefits.

Phase 3: Identification of Key Factors

In the final phase, the structural analysis was completed through two successive rounds until a consensus was reached with the participating experts. Each expert assessed the levels of influence and dependence of the 15 factors identified in the first stage. To conduct the analysis of a Direct Impact Matrix (DIM), it is crucial to detail the quadrants of the resulting plane to identify the position of key variables in terms of influence and dependence. Figure 1, presented below, displays the plane of a direct impact matrix, where each of its quadrants is named and described.
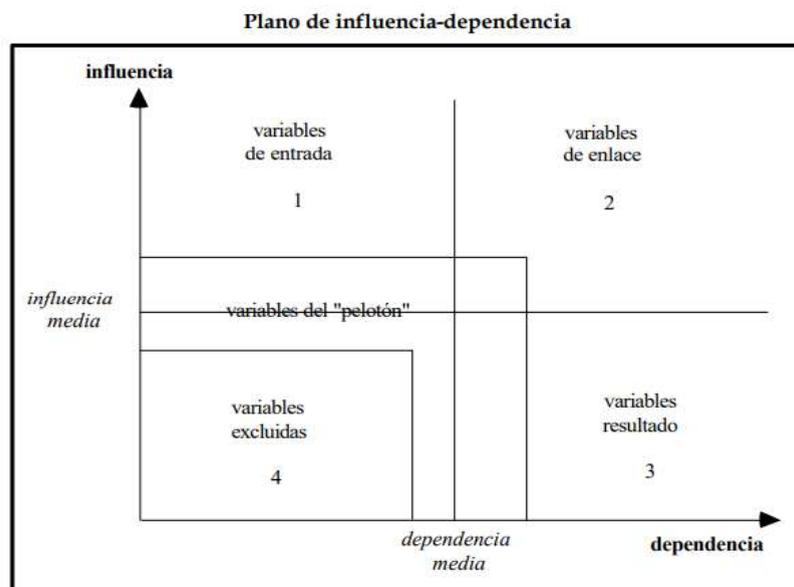
Figure 1. Layout of the Direct Impact Matrix with Detailed Quadrants.

According to Godet (2000), variables are distributed into different categories based on their influence and dependence within the system. Input variables are located in the upper left quadrant of the plane; they have high influence but low dependence, making them the driving or inhibiting forces of the system. Linkage variables, or key variables, are in the upper right quadrant and are crucial since they are connected to the system's challenges and drive its evolution toward an optimal state. In the lower right quadrant are the outcome variables, which have low influence but high dependence; these variables reflect the system's evolution and can only be addressed indirectly. On the other hand, excluded variables are positioned in the lower left quadrant, showing both low influence and dependence, making them irrelevant to the system's future. Finally, the cluster variables have medium influence and dependence, playing a supporting role in the system's functioning and facilitating progress toward key objectives.

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Results

Figure 2 presents the direct impact matrix, in which the 15 variables analyzed for the system are projected, taking into account the direct relationships between them. Based on the results obtained, a system with a certain degree of variability was identified, as evidenced by a distribution of points concentrated around the upper part of the main diagonal. This pattern suggests that most variables exhibit a similar level of motricity and dependence. Consequently, in this type of system, any modification in one variable generates effects across the entire system and, in turn, impacts the original variable (Godet, 2007).
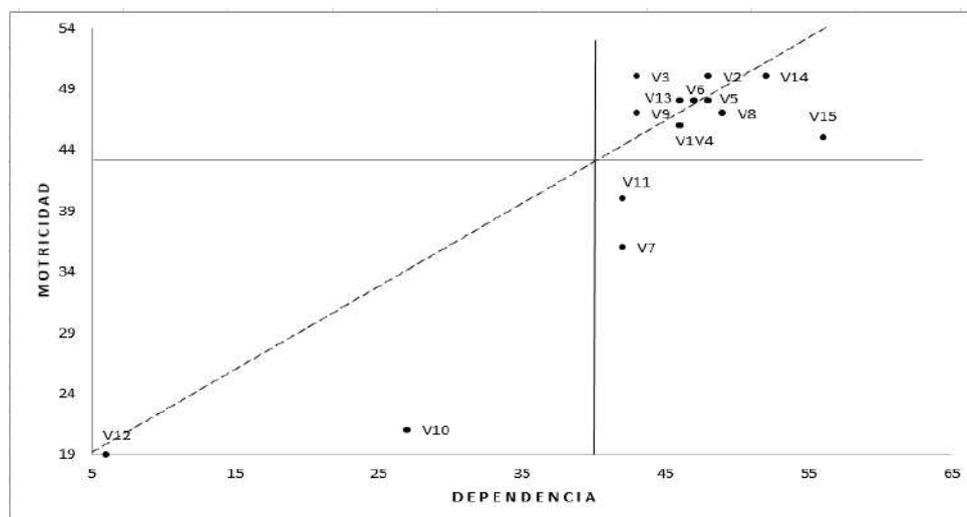
Figure 2. Projection of the variables on the Cartesian plane with direct impacts

The most determinant factors identified were F2 (contextualization of the language in an immersive environment), F14 (german children's literature), and F15 (audiovisual resources), in that order from highest to lowest impact within the system. The participants indicated that these factors have a strong relationship with teaching German to Spanish-speaking children. Factor F2 was especially valued because it reflects receptive learning on the part of the students, who need an environment where they can use German authentically. Teachers emphasized that an immersive environment allows children to feel motivated to use the language spontaneously and naturally. Additionally, this factor showed a higher degree of influence in relation to other factors, such as interaction with native speakers, introduction of daily routines in German, constant exposure to German through songs, vocabulary repetition, etc.

For its part, factor F14 is relevant because children's books offer a variety of stories that capture children's attention. According to the feedback received from the participating teachers, during German reading time, children are not only exposed to new information but also contextualize words previously covered in class alongside new vocabulary. This process of listening and relating previously learned concepts to new words significantly improves language comprehension. Factor F15 is essential for facilitating the learning of Spanish-speaking children, as teachers noted that the use of images, videos, and visual tools not only makes lessons more engaging but also helps reduce language barriers by providing a clear and direct reference.

The least influential factors were F12 (use of educational videos) and F10 (teaching basic grammatical structures). These variables are located in the excluded variables quadrant, indicating that they exhibit both low influence and low dependence within the system. Among the comments received from the participating teachers, it was noted that while students may occasionally enjoy watching a TV program, as has been done at times in school, it is not considered a key factor in learning German. Likewise, teachers mentioned that while teaching grammatical structure is a fundamental part of learning a new language, they prefer to first promote language practice through linguistic immersion. Therefore, based on the evidence, its role is considered irrelevant to the system's evolution.

Discussion

The results obtained align with previous research on German language teaching. The use of German children's literature, identified as a key factor in the system, reflects the current preference for utilizing resources and tools in language instruction. Schwab et al. (2014) emphasize the inclusion of children's book reading as a fundamental tool in the learning process, both for children acquiring German as their first language and for those learning it as a second language. Similarly, Akcan (2005) highlights the relevance of using books related to the weekly theme in immersion classrooms, where read-aloud sessions are conducted, and discussions are encouraged before, during, and after reading to strengthen language learning by enhancing comprehension and expanding students' vocabulary. Additionally, the author structures the class using German visual materials, such as reference posters, calendars, images, and lists of new vocabulary, to support the language acquisition process. This reinforces the premise that the combined use of these two resources constitutes a key factor in the learning of German by Spanish-speaking children.

On the other hand, the use of audiovisual resources, belonging to the same category of resources and tools, also emerges as a key variable. According to Schulz et al. (2023), visual contexts play a significant role in vocabulary teaching and comprehension in language learning, including German. Likewise, Ehri et al. (2001) emphasize the relevance of phonological awareness and how the use of visual materials, such as images and picture books, facilitates reading acquisition in children learning German. This is particularly relevant when considering that the author identifies picture books as fundamental elements in German language learning, thus highlighting the importance of these two variables within the system.

Meanwhile, the contextualization of the language in an immersive environment stands out as a key factor based on the Immersion Method, which is used in German schools located in Spanish-speaking countries. This approach allows students to learn the language naturally at an early age through interaction and real-life language use. Language immersion takes place in the classroom, where only the target language is used throughout the lesson in a controlled environment, facilitated by interactive activities in real-life contexts, promoting listening and reading and enabling students to absorb the new language naturally (Chau, 2023). These spaces are predominant in German language teaching, where, according to Powers et al. (2008), mixed-reality environments can significantly enhance language learning, including German, by providing immersive contexts that enrich the educational experience.

The visualization of educational videos can contribute to the development of activities and routines by familiarizing children with the language through images and listening. However, the use of videos in childhood remains an issue

that should be approached critically, particularly concerning the behavior and learning outcomes of children. Unlike television, which can expose children to long periods without adult supervision—potentially having significant consequences on their development and behavior—educational videos can become a valuable tool if they follow a structured and guided teaching approach (Criado et al., 2018). While videos are a powerful tool that enables both visual and auditory immersion in a foreign language like German, this resource requires systematic instruction that integrates the four communicative skills (speaking, listening, reading, and writing) into the language learning process.

Teachers prefer using videos as an educational resource for language instruction, as they facilitate content comprehension by integrating moving images and sound, using narratives to convey stories that capture students' attention (Jiménez, 2019). Videos serve as a tool that can enrich the teaching of a language like German, but it is essential to ensure that the video content has a clear purpose and is adapted to the specific needs of the classroom. Teaching grammatical structure, while essential for language learning, can be challenging due to the complexity of grammar rules in both writing and speaking, which can be difficult for students to grasp. Grammar learning requires students to engage in activities that foster communicative competence and enhance linguistic awareness (Rubio et al., 2023). However, applying grammatical rules can be complex, and students may struggle to use them effectively in real-world contexts.

Conclusion

The evidence obtained allowed for the identification and analysis of the most determining factors in the process of teaching German to Spanish-speaking children. Notably, two of the most critical factors for the system belong to the category of resources and tools. Factor F2 is particularly relevant, as it comes from a different category, learning strategies, and shows a considerable influence in relation to other factors such as interaction with native speakers or the introduction of daily routines in German, all within the same category.

Another significant finding lies in how these factors highlight the importance of the resources and tools used by teachers in teaching German, surpassing in relevance didactic strategies, which, although fundamental to the system's development, are based on the contextualization of the language in an immersive environment. This immersive approach serves as a starting point for implementing other learning strategies.

Finally, the structural analysis conducted aimed to identify the relationships and dependencies among key factors to observe their impact on the system and how each factor influenced the others. The study concludes that identifying these factors provides a range of didactic possibilities for German teachers working with Spanish-speaking children.

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Vocational Motivations in Male Students for the Teaching Profession: Breaking into a Traditionally Female-Dominated Field

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Abstract: The feminization of education careers, particularly at the early childhood and primary levels, has created barriers to male participation due to gender stereotypes that associate childcare with female roles. In Peru, the predominance of women reinforces the perception that these professions are more suitable for them. This research employs a qualitative approach and semi-structured interviews to examine eleven male students' vocational motivations and experiences in the final cycles of Early Childhood and Primary Education programs at universities in Lima. The findings reveal that family influences and personal experiences are key in their career choice. However, they face stereotypes that question their suitability and limit physical contact with students. Despite these challenges, the participants demonstrate satisfaction and commitment to teaching. Therefore, this study leads us to ask ourselves: What is the role of inclusive policies and awareness programs in advancing gender equity in education? It also suggests conducting further research in other regions to validate the applicability of these findings.

Keywords: Vocational motivations, Gender stereotypes, Male teaching, Teacher training, Early childhood education.

Introduction

Early Childhood Education serves as a gateway to an extensive flow of stimuli that generate learning, transitioning from sensory to cognitive experiences. It is divided into two stages: early childhood education, which covers the ages of 0 to 3 years, and preschool education, referring to the period from 4 to 6 years (López, 2016). Following this,

primary education continues, reinforcing a crucial stage that strengthens and complements the knowledge acquired in early childhood education.

According to the Ministry of Education from Peru (2016), regular basic education (EBR) is divided into 7 cycles, the first 5 of which are part of the initial and primary levels. In the initial education level, Cycle I span ages 0 to 2 years, followed by Cycle II, which covers ages 3 to 5. In primary education, Cycle II includes the first and second grades; Cycle IV encompasses the third and fourth grades; and finally, Cycle V covers the fifth and sixth grades, respectively. Research into the motivations and career choices of male students in early childhood and primary education is of fundamental importance in the socio-cultural analysis of contemporary pedagogical phenomena.

According to Davids and Waghid (2020), there is a notable gender disparity in the educational field, with a significant predominance of women in teaching roles. In addition, the INEI (2020) shows that 58.0% of teachers in Peru are women and 42.0% are men. In the initial education level, 98.4% of teachers are women and only 1.6% are men; whereas in primary education, 61.4% and 38.6% are women and men, respectively. The importance of an education career for young people, regardless of gender, lies in its influence on the formation of future generations. Brown (2019) asserts that educators play a crucial role in students' cognitive, emotional, and social development, emphasizing the need to diversify gender representation in this field.

Regarding education at a global level, the Millennium Development Goals (United Nations, 2005) establish that access to quality education is a fundamental right for all children, youth, adults, and women. However, the question arises: What do we understand by quality education? This concept is closely linked to the term "inclusion." According to Echeita and Ainscow (2011), in some countries, inclusion is still conceived as a strategy aimed solely at individuals with disabilities in educational settings. However, UNESCO (2005) expands this approach by stating that inclusion should be understood as a way to embrace and support diversity in all its forms, including aspects such as gender, economic, or social status.

Gender inequality manifests in higher education in various ways. One area where this inequality is most evident is in career choices, a process influenced by factors such as social and family expectations, vocation, values, and cultural traditions, among others (García, 2021). Furthermore, academic disciplines are also marked by gender biases, which contribute to the "feminization" of certain professions (Connell, 2007). This phenomenon is not alien to the educational field, which leads us to question: Why do men rarely opt for careers related to education, especially in early or primary levels?

In this regard, block et al. (2018) offer a possible explanation, suggesting that educational careers are perceived as "feminine" and lack prestige due to their association with caregiving, community, and low salaries. This scenario invites reflection: How would the teaching profession look without the socially imposed feminization? Would more men be willing to pursue a teaching career? And most importantly, can we truly talk about inclusion and gender equality when men interested in studying education are limited by social prejudices? Therefore, quality education and inclusion must be understood broadly, considering both gender aspects and diversity in all its forms. Without a critical

reflection on the social and cultural norms that influence academic decisions, it will not be possible to achieve true equality of opportunity in education.

For this reason, understanding the motivations and decisions of young people, especially men, is essential to advancing quality and equity in education. It is crucial to know the perspectives of the protagonists, those who face gender-related prejudices daily. Additionally, according to Rodríguez-Esteban and Carretero-Serrano (2022), recognizing the importance of gender equity in education makes it possible to work toward overcoming the stereotypes and barriers that may discourage men from entering this field. This will not only benefit the students themselves but also contribute to building a more egalitarian and just society in the future. Therefore, it is necessary to promote greater diversity in the teaching profession, not only in terms of gender but also with respect to cultural backgrounds and personal experiences, in order to enrich teaching and learning at all educational levels.

On the other hand, the research topic seeks to contribute to a deeper understanding of a relevant aspect of the educational field. By analyzing the motivations and career choices of men in education, the aim is to fill a gap in the academic literature in the region and provide valuable information for designing policies and programs that promote greater male representation in this profession. Furthermore, by addressing the social and cultural dimensions of this phenomenon, it offers a comprehensive perspective that could generate a positive impact on the promotion of equal opportunities and diversity in education (Pescosolido et al., 2019).

Given the relevance and impact of the research in today's educational world, and based on the aforementioned, this work formulates the research question centered on which theories and previous studies explain the motivations and career choices of men in education. The aim of this study was to explore the motivations and factors influencing men's decisions to pursue careers in early childhood and primary education, as reported in the literature. Furthermore, it seeks to understand the implications of these vocational choices in terms of gender diversity in the educational field.

Theoretical Framework

Extrinsic and Intrinsic Motivation

According to Carillo et al. (2009), motivation—derived from the Latin word motivus (related to movement)—is that which drives or has the power to move; in other words, it is the engine of human behavior. Similarly, interest arises from a need; thus, whenever a need emerges, it disrupts the state of balance in the organism, producing a state of tension and dissatisfaction that drives the individual to develop behavior or actions to release the tension. Therefore, in certain situations, motivation determines the level of energy and the direction in which we act.

Regarding extrinsic motivation, Soriano (2001) defines it as that which is provoked from the outside, either by other people or the environment. It is based on the main concepts of reward, which is an attractive object given at the end of an action; punishment, which is an unattractive object given at the end of a behavior to prevent its repetition; and finally, incentive, which is an environmental object that can attract or repel the individual performing the behavior. Classical and operant conditioning are associated with this type of motivation.

Intrinsic motivation, according to Hernández and Cordero (2021), is that which an individual carries with them, independent of external factors, which drives them to perform activities simply for the enjoyment of doing them. This type of motivation originates within the individual and is linked to personal interest, satisfaction, and the enjoyment derived from carrying out an activity. Unlike extrinsic motivation, which depends on external factors such as rewards or punishments, intrinsic motivation is connected to a sense of autonomy and self-actualization. According to Hernández and Cordero (2021), this form of motivation is fundamental to personal and professional development and is an important element to consider when analyzing learning. This is because intrinsic motivation fosters creativity, learning, and long-term commitment to personal goals. It also contributes to emotional well-being, as individuals driven by intrinsic motivation tend to experience higher levels of satisfaction and happiness.

Vocational Guidance and Career Choice

Vocational calling, according to Del Pino and Alonso (2019), is a form of service that brings lasting personal fulfillment, involving the execution of an activity that holds significant social value, allowing individuals to not only achieve deep personal knowledge but also discover innate qualities and skills that can be put to service for society. In this sense, vocational calling is not merely an inclination or preference but a call to actively contribute to the common good, creating a positive impact in the environment.

On the other hand, Rojas et al. (2018) argue that vocational calling enables an individual to develop a range of skills, attitudes, and interests, leading to self-actualization. This development is closely linked to the context in which the person finds themselves, as well as their personal and psychological aspects. In this way, vocational calling acts as a catalyst that drives the holistic growth of the human being, facilitating not only professional success but also a deep and sustained personal satisfaction over time. For this reason, vocational calling becomes a bridge between individual abilities and societal needs, promoting a balance between personal development and contribution to the common good.

Regarding vocational guidance, Erazo and Rosero (2021) define it as a formative and informational need for students. It is a continuous and dynamically active process that evolves alongside the interests and capabilities of students, adapting to their changing needs over time. Similarly, vocational guidance helps to consolidate commitments, values, and feelings that accompany the exercise of a profession, supported by educational stakeholders to reaffirm the students' vocational inclination toward a university career.

Gender Stereotypes and Professional Careers

Gender stereotypes are widely shared beliefs about the characteristics and roles deemed appropriate for men and women in a specific society. According to Marcano and Suárez (2022), these stereotypes are linked to prejudices that limit an individual's professional, labor, and social development. They are associated with erroneous ideas that disrupt stability and simplify reality. Moreover, gender stereotypes are a problem that interferes with career perception and choice, as well as academic and professional performance.

Gender stereotypes continue to play a crucial role in professional decisions, affecting the career aspirations and trajectories of both men and women. According to Santana and Ruiz (2018), these stereotypes influence how skills and competencies associated with certain professional roles are perceived, perpetuating the idea that some professions are more suitable for one gender than another.

Regarding gender stereotypes in career choices, Cruz (2020) indicates that these arise when a person believes that the career they are studying is dominated by the opposite gender, activating negative thoughts toward their own gender. In the case of early childhood education, men who choose this career may face prejudice and questioning about their motivations, which could discourage them from entering and remaining in this field, traditionally dominated by women (Wagner, 2021). Similarly, Thorpe (2016) mentions that many male teachers in the educational field experience constant surveillance, especially during physical interactions with children or situations related to caregiving, due to the fear of being falsely accused of sexual abuse.

On the other hand, gender-based occupational segregation is a persistent phenomenon that begins to influence individuals from childhood. Recent studies, such as that by Block et al. (2018), show that cultural and social expectations about gender roles affect the professional aspirations of children from an early age. For men interested in early childhood education, these stereotypes can create a discouraging and unsupported environment, hindering their integration and professional development in a traditionally feminized field (Monteiro & Altmann, 2014). This not only limits career options for men but also reinforces the feminization of the sector, perpetuating existing gender stereotypes. For example, Maldonado et al. (2022) mentions that parents would withdraw their children from an educational institution if they had male teachers. As a result, school administrators prefer to hire female staff, due to doubts about the maternal instincts required for early childhood education and the fear of men because of abuse and pedophilia cases. Consequently, many male teachers are forced to work in administrative areas.

Other Studies on Male Vocational Choices and Education Careers

In contemporary education, particularly in higher education, male students' vocational choices toward teaching careers have generated growing academic interest. However, there remains a gap in research addressing the various factors influencing men's decisions to enter professions related to early childhood education. Current research primarily focuses on the social and cultural barriers that discourage men from choosing education as a career, as well as the influence of gender stereotypes and the lack of male role models in educational settings, which are critical factors in this process.

On the other hand, a study conducted by the Public University in Northampton (England) focused on exploring the aspirations of early childhood students and how these aspirations align with employability skills, related to the uncertainty about their professional trajectory. The findings of the study indicated that students present various motivations, such as family influences, previous educational experiences, and personal circumstances. Additionally, it was observed that students' aspirations were influenced by both internal and external factors (Richardson & Lumsden, 2023).

Regarding gender stereotypes, it is evident that male students face deep-rooted gender stereotypes in society that associate early childhood education with femininity (Alba et al., 2021). These stereotypes not only affect the social perception of men who choose this career but also influence their self-image and professional confidence. Furthermore, the literature suggests that these prejudices can lead to a less inclusive educational environment for men. The lack of social acceptance and the fear of being judged can cause many men to avoid this profession, despite having a genuine interest in early childhood education. This, in turn, reinforces the perception of early childhood education as a predominantly female career.

In addition, Fernández et al. (2020) mention that there is an idea that educators may have homosexual preferences. García (2022) points out that there is a homophobic depreciation that generates this issue, among others. The author argues that this is due to the impact on the masculinity of men who decide to study careers like education, as they are stigmatized as "deviants" in traditionally feminine professions. Maldonado et al. (2022) states that society is the one that has stigmatized men who decide to study education. Moreover, sexual preference or gender is erroneously associated with the "maternal" instinct that is thought to be necessary for a career in education. This stigma, deeply rooted in social prejudices, not only discourages men from pursuing careers in early childhood education but also creates an environment of discrimination and harassment. The perpetuation of these stereotypes negatively affects both trainee teachers and active professionals. Additionally, the lack of male representation in this field may reinforce these erroneous perceptions. Therefore, it is essential for educational institutions to implement awareness and support programs to counter these stigmas and foster a more inclusive and respectful environment. The research also suggests that increasing the diversity of the teaching body could help challenge and change these perceptions.

On the other hand, Calderón and Carrera (2022) report that the feminization of early childhood education is a complex phenomenon produced by economic, historical, social, and cultural factors. Moura (2016) argues that this phenomenon, which persists as a sexual division in teaching labor, has resulted from a historical process influenced by the evolution of social roles over time. Similarly, Hirata and Kergoat (2007) state that this division stems from social relations between genders, where women are assigned roles in the social and reproductive spheres, while men are assigned higher-value social functions, such as politics, religion, and the military career, among others.

This phenomenon has led to the perception of education as a profession more suited for women, thus affecting the vocational choices of men. This information is confirmed by Davids and Waghid (2020), as they highlight the predominance of women in teaching, especially at the primary school level. Therefore, both studies agree that the feminization of education is a phenomenon rooted in various social and cultural dynamics, which has shaped the perception of the teaching profession as a more appropriate domain for women, thereby contributing to the low male representation in this field.

Finally, Stanislav (2022) analyzed the self-perception of gender stereotypes among teacher education students, identifying that the most valued characteristics by future educators include understanding, creativity, and imagination. These findings highlight the need to examine how gender stereotypes influence teacher training, with the aim of promoting equity in the teaching profession.

Method

The methodology of this research adopted a qualitative approach with a non-experimental design, which, according to Valle Taiman (2022), is based on the understanding of reality as a social construct that posits that reality is perceived in different ways by each individual. Furthermore, this approach focuses on capturing the perspectives and meanings that subjects attribute to their experiences, which is essential for the objectives of this study. As Koh and Owen (2000) point out, the qualitative approach is concerned with how situations occur, focusing on attitudes, beliefs, and the ways in which people interpret the world around them.

Regarding the phenomenological paradigm, Fuster (2019) describes this method as a means for describing and interpreting the essence of the experiences lived by the subjects. This paradigm is particularly relevant in fields such as pedagogy, psychology, and sociology, where a deep understanding of individual experiences is crucial. The phenomenological-hermeneutic method requires a reflective attitude, a constant openness to experience, and a sensitivity to language.

Participants

The participants in this research were eleven male students, aged between 20 and 25 years, who are enrolled in the final cycles of the Early Childhood and Primary Education programs at both public and private universities in Lima, Peru. All participants are currently completing their pre-professional internships at both public and private institutions, which allows them to provide a comprehensive perspective on their formative and vocational experiences in a field traditionally dominated by women.

The selection of participants was carried out intentionally to ensure equitable representation from various institutional and socio-economic backgrounds, thereby guaranteeing the diversity and richness of the study's findings. Below, Table 1 presents the list of interviewees and their relevant characteristics for the development of the interviews.

Table 1. Interviewed Participants

Interviewee	Age	Semester of studies	University		Currently doing professional internships	
			Public	Private	Yes	No
Interviewee 1	23 years	8th		X	X	
Interviewee 2	20 years	6th		X	X	
Interviewee 3	21 years	6th		X	X	
Interviewee 4	23 years	8th		X	X	
Interviewee 5	20 years	6th		X	X	
Interviewee 6	23 years	Graduate	X		X	
Interviewee 7	23 years	10th	X		X	
Interviewee 8	25 years	10th		X	X	

Interviewee 9	23 years	Graduate	X	X
Interviewee 10	23 years	Graduate	X	X
Interviewee 11	25 years	Graduate	X	X

Note. The table displays demographic and academic characteristics of 11 interviewees, including age, semester of studies, type of university (public or private), and whether they are currently participating in professional internships. Most participants were 23 years old and enrolled in private universities. A majority of the interviewees were not currently doing professional internships at the time of data collection.

Instrument

In this study, a semi-structured interview guide was used as the primary instrument for data collection. This type of interview is characterized by its flexibility, a feature that allows for the acquisition of in-depth and detailed information. According to Lopezosa (2020), such interviews are based on a set of pre-designed questions but allow respondents to answer openly, without being confined to predetermined options.

This openness enables interviewees to freely express their thoughts and experiences, providing them with the opportunity to offer cross-cutting insights that may not have been initially anticipated in the interview questions. Although this approach may result in less systematic data, the information gathered is considerably richer thanks to well-formulated questions and the respondents' willingness to share their perspectives. This level of depth is essential for a comprehensive understanding of the phenomena under study, particularly within a qualitative and phenomenological framework. The following table 2 presents the 7 questions that were used in our interviews. These were divided into three categories: vocational motivations, challenges and difficulties, and satisfaction and professional future.

Table 2. Categories, Scope, and Interview Questions

Category	Objective	Question
Vocational Motivations	Aimed at understanding students' vocational motivations and their decision-making process when choosing the education career. It also explores the role their environment played during this process.	What led you to choose the education career? What influence did your environment (family, friends, etc.) have on your decision to study education?
Challenges and Difficulties	Seeks to understand the challenges and difficulties related to stereotypes or prejudices faced by men during their academic training and in their workplace, either during the application process or in their daily work.	How have you experienced stereotypes or prejudices for being a man while studying education? Explain. How have you experienced stereotypes or prejudices for being a man when applying for a job? Explain.
Satisfaction and Professional Future	Oriented towards exploring the influence of stereotypes and prejudices that the	If you could go back in time, what would you change about your decision?

participant may have experienced in their decision to study education. It also aims to investigate their reflections on the topic and how they see themselves in the future.

What advice would you give to a man who wants to study education?

What are your plans for your professional career after graduation?

Note. The table presents categories, objectives, and questions used to explore male students' motivations, challenges, and professional futures in choosing an education career, with a focus on stereotypes and their impact on decision-making and future plans.

All the interviews were conversational in nature, semi-structured, and lasted approximately 30 to 40 minutes. They were recorded via the Zoom platform with the prior consent of the interviewees. Despite the virtual setting, a climate of trust and closeness was established, allowing participants to express themselves with fluency and depth. The interviewees' familiarity with digital environments helped minimize potential communication limitations and facilitated the development of the interviews in a dynamic and participatory context.

Subsequently, the recordings were transcribed, and minor adjustments were made to optimize clarity and facilitate content analysis. The approach adopted in the research was constructivist, which, according to Sánchez-Suricalday et al. (2022), is based on the experience, decisions, and interpretations of the researcher during the analysis of qualitative studies. This approach not only encourages deep reflection on the collected data but also on the role of the researcher and their influence in the research process. Finally, to validate the data collection instruments, the research team collaborated with two expert psychologists, who reviewed and provided feedback on the interview guide to ensure its relevance and clarity. Furthermore, rigorous ethical criteria were applied to safeguard the confidentiality and well-being of the participants.

Results

The results are presented in three key categories, aiming to provide a detailed and coherent analysis. Each category addresses essential aspects such as the internal and external motivations that influence career choice, the gender stereotypes and prejudices encountered during their training, and their perspectives on future professional prospects. These categories were selected based on the relevance of the factors that impact men's vocational choice to study education, the challenges associated with gender stereotypes, and their reflections on their long-term vision in this profession. This analytical structure allowed for the identification of the main challenges and the highlighting of opportunities to promote greater gender equity within the educational field.

The Influence of Family and Personal Experience on Career Choices in Education: Exploring Vocational Motivations and Decision-Making Processes

The process of choosing a career in Education is significantly linked to the vocational motivation of students. A majority of the interviewees stated that the main reason influencing their decision to pursue this career was related to

family factors. In the interviews, the students showed a willingness to reflect on and share their personal experiences regarding the influence of family on their professional choice.

> "In my family, in one way or another, we have always been quite motivated toward education. My mom was an educator, her grandmother was too, and her great-aunt was an educator. Education has always been close to my mom." (Interviewee 3, 21 years old)

One interviewee shared that he had received significant family influence, highlighting that, with relatives dedicated to teaching, he had the opportunity to experience his vocation before completing secondary education. This experience directly influenced his decision to choose a career in Education at university. This early immersion not only shaped his view of education as a vocation but also allowed him to experience the impact of teaching on students and communities. By observing his relatives' roles as mentors and guides, he developed a strong sense of purpose, which made education feel like a natural path for him. The influence of his family gave him the confidence and clarity to choose this career, knowing that it was not just an academic pursuit but a calling aligned with his values and passions. On the other hand, five of the interviewees shared that their decision-making process took longer, as they initially explored various career options before ultimately choosing Education. During this period of exploration, they considered different fields, unsure of where their true passions lay. However, through this journey of self-discovery, they eventually realized that teaching was the profession they were most passionate about. This prolonged decision-making process allowed them to better understand their personal interests, values, and strengths, ultimately leading them to the conclusion that a career in education was the right fit. Their experiences highlight the importance of exploration and self-reflection in finding a career that aligns with one's true calling. Similarly, one interviewee mentioned that despite having a clear vocation for teaching, he did not have his parents' approval, which led him to opt for a different career, which he eventually abandoned due to personal dissatisfaction.

> "I always knew I wanted to study Education; that's been clear to me since I was 14. This conversation about studying Education was recurrent for about five years, always getting a negative response. When I started studying Marketing, there were three clear moments in that year and a half. I talked to them about changing my career. The first two were a no, but the third, I just told my parents I was changing my career, that I had already started the process and was waiting for their support... it was a bit risky on my part." (Interviewee 10, 23 years old)

Additionally, one interviewee expressed that his previous and direct experience in the educational field was decisive in confirming that Education was the career most aligned with his professional interests. He also stated that his connection with sports played a key role in his decision-making process, as this practice allowed him to integrate his sports interests with his pedagogical vocation, thus consolidating his commitment to teaching as a life choice.

Gender Stereotypes and Their Impact on Professional Experience in Education: Navigating Challenges and Workplace Difficulties

In the category of challenges and difficulties, most of the interviewees mentioned having encountered gender-related

stereotypes in the Education career, both during their academic training and, primarily, in their work environment. These difficulties were evident in the restrictions regarding physical contact with students, as advised by their colleagues and superiors.

> "The instruction I received was to be careful with physical contact, and it's really complicated. When a girl comes up and wants to hug me, I tell her no, no, no, don't hug me, or when I have to help a girl because she's crying, I can't approach her." (Interviewee 3, 21 years old)

> "In my second year of internship, I had a conversation with two of my coordinators. They called me one day, and more than a reprimand, I saw it as a coaching moment, 'We're aware of you, we know you don't have any bad intentions, but we think it's time to be aware of this point... You need to be more careful, more conscious of your body language and how you return a hug when a student gives you one'." (Interviewee 9, 23 years old)

Additionally, they discussed the recommendation not to be alone with the children in a classroom or to always have a third-party present. This recommendation is primarily driven by concerns over safeguarding and preventing potential allegations of inappropriate behavior. This precaution is especially emphasized for male teachers due to gender stereotypes and societal anxieties about their role in caregiving professions. While these guidelines are intended to protect both students and teachers, they can create challenges in building trust and rapport with students, potentially limiting the emotional support educators can offer. Additionally, the presence of a third party may alter the natural dynamic in the classroom, causing frustration for teachers who want to provide more personalized care. Ultimately, this recommendation reflects a tension between ensuring safety and maintaining meaningful, supportive relationships in the educational environment.

Several interviewees expressed concern about how gender stereotypes affect their professional performance, noting that these biases restrict their ability to work freely and often force them into specific age groups, typically with older students. The pressure to conform to these stereotypes can limit their teaching flexibility and create a sense of confinement in their roles, as they may feel compelled to avoid working with younger children to prevent any misinterpretation of their intentions. This situation not only restricts their professional growth but also impacts their overall job satisfaction, as it undermines their ability to work with a diverse range of students and fully engage with their teaching vocation.

> "I prefer third and fourth grade because taking first and second grade is more difficult, also because I feel that you can be judged if, for example, they need to go to the bathroom, you have to accompany them. So, I prefer to maintain some distance to avoid any problem, and that's why I prefer third or fourth, fifth and sixth grade as well." (Interviewee 5, 20 years old)

Regarding academic training, some interviewees mentioned that their student center had few or no male Education students. Despite the university's efforts to combat these stereotypes, there were still students who reproduced them. Finally, some found it difficult to integrate into a group where almost all students were of the opposite gender.

"In one class, the professor asked, 'Why are there so few men studying Education?' and a classmate mentioned that it was because there were many cases of abuse. For me, it was thinking that I would also be attributed that stereotype." (Interviewee 5, 20 years old)

Furthermore, other interviewees discussed the influence of cultural stereotypes, particularly the maternal perception of teaching, and how it affected their experiences during their training. One interviewee explained that women are often seen as the natural caregivers for children, perceived as kinder and gentler, while men are frequently stereotyped as rough or even harsh. This cultural bias, they noted, played a significant role in shaping how they were viewed by others in the educational environment. The perception that teaching is a profession better suited for women made it challenging for some male educators to establish their identities within the field, as they had to contend with these stereotypes both from peers and the broader society. This experience highlighted the limitations imposed by traditional gender roles, which often confined men in education to less nurturing or more authoritative roles, affecting their interactions with students and their sense of belonging in the profession.

On the other hand, one interviewee shared that gender stereotypes often lead him to maintain a more distant attitude with children, which inadvertently reinforces the perception of men as cold or emotionally detached. Despite not wanting to project this image, he explained that he prefers to act with caution in his interactions to protect both his personal integrity and the well-being of the children. This careful approach, he noted, stems from a desire to avoid misinterpretations or the potential for accusations, as societal expectations of male teachers can sometimes make them overly cautious in their interactions with students. While this behavior is motivated by a sense of responsibility, it also highlights the emotional burden that stereotypes place on male educators, limiting their ability to engage more naturally with their students.

Satisfaction, Reflection, and Future Aspirations in the Education Career: Personal Insights and Professional Recommendations

Regarding this category, all interviewees stated that they were satisfied with their decision to study Education.

"I have classmates who may have advanced faster than I did, even having a master's degree, but along the way, many times they doubted their vocation. That's not something that happened to me; I've always been sure about my decision, and if I had to go back in time, I'd choose the same without thinking twice." (Interviewee 11, 25 years old)

However, some participants expressed that they would have liked to have made certain decisions differently. For example, choosing Education as their first option, waiting a few years before starting their studies, or choosing a different specialty.

On one hand, the interviewees offered several recommendations for men considering a career in Education, emphasizing the importance of being mindful of the social environment and avoiding entering the field with preconceived stereotypes. They stressed that it is crucial for male educators to challenge societal expectations and

stereotypes about their roles in the classroom, particularly those related to caregiving and emotional engagement. By doing so, they can foster a more inclusive and supportive learning environment, both for themselves and their students. The interviewees encouraged future male educators to embrace the nurturing aspects of teaching and to be confident in their ability to make meaningful contributions to the educational field, regardless of gender-based expectations.

Finally, one interviewee shared his aspiration to continue gaining hands-on experience in the classroom, emphasizing the importance of learning directly from his interactions with students. He expressed a desire to eventually expand his knowledge and apply his expertise to educational management, aiming to have a broader impact on the educational system. By first solidifying his practical teaching experience, he believes he can better understand the challenges faced by educators, which will inform his future role in shaping educational policies and management strategies. This progression reflects his commitment to both personal growth and contributing to the improvement of education at a larger scale.

Discussion

The choice of a career in Education among the male students interviewed reflects a vocational motivation influenced by various factors, with family influences standing out. A majority of the interviewees mentioned that their decision to pursue teaching was shaped by the educational legacy within their families, indicating that the transmission of values and experiences related to teaching can strengthen the inclination toward this profession. This is because family environments where education is a central focus not only generate greater exposure to teaching but also reinforce its value as a legitimate and fulfilling career option.

This situation aligns with what Richardson and Lumsden (2023) state, who indicate that prior family experiences play a significant role in deciding to choose a career focused on teaching. However, not all families offer the same conditions to foster this vocation. Factors such as the educational level of the parents, the social value of teaching within the home, and the presence of role models influence how students perceive the profession. In this regard, the interviewees spoke about their interest in self-fulfillment, as mentioned by Rojas et al. (2018), asserting that vocation develops based on context and personal aspects, facilitating integral growth and personal satisfaction. These findings reinforce the idea that, for some men, following the family tradition in teaching can be a form of self-realization, despite the challenges associated with gender stereotypes mentioned by González et al. (2021).

Another important aspect in the vocational choice was the exploration of different career options before deciding on teaching, something mentioned by several of the interviewees. This search reflects a process of self-discovery and the consolidation of an intrinsic motivation that strengthens over time, driving students to find a clearer purpose in their professional choice. In this regard, García (2007) highlights that students intrinsically motivated toward their career have a more favorable attitude toward it, thus reinforcing their long-term commitment to teaching.

Similarly, Merino et al. (2015) emphasize that intrinsic motivations predominate among men who opt for teaching, highlighting vocation as a key element in their decision. This idea is reflected in the testimony of one of the interviewees, who, despite facing family doubts, expressed the desire to teach. Hernández and Cordero (2021)

describe this intrinsic motivation as the driving force that pushes people to act for the pleasure of doing so, which translates into genuine commitment to teaching, aligning with the results indicating that this desire to make a difference is fundamental to their career choice.

Moreover, influences from previous personal experiences and the integration of individual interests, such as sports, were observed in the vocational choice process. One interviewee shared that his participation in sports activities was crucial for deciding to study Physical Education, thus merging his personal interests with his vocation. This aligns with the findings of Siera and Siera (2011), who state that choosing teaching is not only about the desire to teach but also about the opportunity to share personal interests, which can strengthen the connection between vocation and profession. However, Palencia (2000) warns about the tensions that men may face in a field dominated by gender stereotypes, which could affect their work experiences and perceptions of competence. This dynamic is particularly relevant for men in early childhood education, as González et al. (2021) note, who indicate that stereotypes associated with teaching hinder the acceptance of men in a traditionally female-dominated environment.

On the other hand, the evidence shows that, although men are present in the educational sector, their numbers are very low, and stereotypes persist that restrict their functions in the workplace, particularly regarding physical contact with students. García (1999) argues that physical contact is important because, for the teacher, it is a way to show interest in the student, improving their performance in school. Fernández et al. (2020) add that these stereotypes related to physical contact are fueled by the mass media's dissemination of cases of harassment and sexual violence in the media and social networks. Many teachers also express a level of anxiety due to the fear of being accused of certain types of physical contact with their students.

Moreover, González et al. (2021) note that the feminization of education is a reality that affects both the self-perception and perception of the teaching profession. This is because, according to Ottaviano and Persico (2018), the education career is associated with the "maternal" aspect, and providing this service challenges concepts of masculinity and femininity. Many male teachers face challenges that lead them to decide to work in other sectors of the educational world, such as project management.

In relation to this, there is also evidence of a predominance of male teachers in higher primary grades. Zapata and Cruz (2019) mention that stereotypes inevitably influence the preference for female teachers at the early educational levels. Monteiro and Altmann (2014) add that there are difficulties and tensions in the integration of men into early childhood education, marked by gender perceptions, masculinity stereotypes, and attempts at segregation. Finally, Marcano and Suárez (2022) affirm that most male students in Education are aware of the limited job opportunities for them at the early childhood education level.

Finally, it is observed that most of the interviewee's express satisfaction with their decision to pursue a career in Education, which is a positive indicator of the level of vocation and commitment present in these students. This is confirmed by Rojas et al. (2018), who mention that most education students report being satisfied with their career choice, with the fundamental reason being working with children. This is extremely important, as Selamat and Nordin

(2014) assert that teacher commitment has been recognized as one of the key factors for the future success of education and educational institutions.

Similarly, Galaz (2011) maintains that commitment acts as a strong magnet that facilitates the connection with teaching in the process of constructing professional identity. These identification processes gather biographical or personal differentiation elements that highlight teaching as the core of identity, defining and shaping what it means to be and how one is as a teacher. This can be observed in the satisfaction responses of the interviewees. On the other hand, having a safe environment with supportive people is extremely important for a man in the Education career. Larraín (2005) points out that symbolic interaction with others implies a dual perspective in constructing identity. On one hand, there is identification as a unifying element, based on the reference models the teacher has and with whom they seek to identify. This process is also deeply influenced by components related to commitment, which acts as a central axis in identifying with the teaching profession.

To support the claim about the vocational gratification of teachers and its correlation with job satisfaction, Cantón Mayo and Tellez (2017) indicate that high levels of satisfaction, particularly those associated with the daily execution of their activities and their personal commitment, are framed within a vocational dimension.

In this context, the gratification derived from teaching eclipses secondary concerns. Moreover, teachers' professional satisfaction includes not only personal achievement but also the possibility of advancing to leadership positions. Anaya (2014) asserts that educational quality generates benefits at both individual and organizational levels, which, in turn, contributes to enhancing the reputation of educational institutions. This reality suggests that teachers with defined goals, such as the aspiration to manage their own school, have additional motivation that reinforces their job satisfaction.

Conclusion

The study reveals a varied trend regarding the vocational motivations of male Education students. However, it also uncovers a unique attitude toward the gender stereotypes the participants have experienced throughout their academic and professional lives. The motivations of male students who choose to study Education are diverse and complex, often influenced by family and personal experiences.

It is evident that, although some students receive support and encouragement from their environment, others face significant barriers due to gender stereotypes that associate education, especially at the early levels, with a role traditionally associated with women. These perceptions affect the formative experience and job opportunities of male students, as they are restricted in their professional practice, especially in physical contact with students and the possibility of working in lower grades.

Additionally, the research highlights that despite the difficulties, most participants feel a high level of satisfaction and commitment to their career choice, which reinforces the importance of their intrinsic vocation. Men in education demonstrate a strong will to overcome and adapt, continually seeking ways to contribute meaningfully to the

educational development of their students, challenging stereotypes, and showing resilience in the face of cultural and social limitations in their environment.

Finally, this work not only expands the understanding of the barriers and stereotypes that affect men in the educational field but also provides a framework for developing policies and programs that promote greater gender diversity in the teaching profession. Despite progress in gender equity in other fields, teaching remains a highly feminized profession, reinforcing stereotypes and limiting male participation in early childhood and primary education.

In this regard, the research findings highlight that the social perception of male teachers not only affects their insertion into the educational field but also their professional development and job satisfaction. The persistence of prejudices associated with masculinity and teaching impacts their employment opportunities and the conditions in which they perform their work. Therefore, it is essential to implement awareness strategies and promote equity in teacher training, as well as create spaces for dialogue to demystify beliefs about the suitability of men in teaching.

Based on these findings, new lines of research are opened, which could focus on comparing the experiences of men at different educational levels and in various regions to assess the replicability of the results and the influence of contextual factors.

Acknowledgements

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Teachers' Perceptions in High-Socioeconomic Schools in Lima on the Implications of AI use in Early Childhood and Primary Education

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Abstract: Artificial Intelligence (AI) has become a key ally for educators in recent years, facilitating various tasks and contributing to educational quality. This research explores the perceptions of teachers from high socioeconomic status schools in Lima regarding the use of AI in early childhood and primary education. Using a non-experimental design with a qualitative approach, a group of teachers was interviewed through a non-probabilistic, purposive sampling method with maximum variation. Findings reveal the teachers' acceptance of AI, highlighting its potential to provide quality education. However, the findings also reflect concerns about possible technology dependency and the dehumanization of teaching at such early ages. Lastly, the study emphasizes the need to provide teachers with continuous training, particularly in digital skills related to the effective use of AI in the classroom. This research opens new lines of inquiry focused on developing teacher training programs for the use of AI in educational settings. Additionally, it suggests exploring pedagogical approaches where technological implementation is alternated with human interaction in teaching. Replicating this study could provide insights into adapting AI to different educational contexts, considering essential factors to ensure ethical integration into the teaching-learning process.

Keywords: Artificial Intelligence, Technology, Early Childhood Education, Primary Education, Teacher Perceptions.

Introduction

Contextualization and Justification of the Topic

The integration of artificial intelligence (AI) in the education of children in kindergarten and primary school is significantly transforming pedagogical practices. According to Kamruzzaman et al. (2023), AI can personalize learning experiences for students and provide valuable data on their performance, which in turn informs instruction and improves learning outcomes. Likewise, AI, being a technology that has advanced rapidly with the development of machine learning and deep learning, plays a crucial role in the development of systems such as conversational chatbots that can intelligently interact with students, providing personalized feedback and learning support (Han & Lee, 2024). These developments have led to increased interest in the education sector, as they facilitate attention to the particular needs of students and improve teaching methods.

However, AI adoption also poses challenges. Frutos et al. (2024) highlight the need for educators and AI system designers to work together to develop tools and strategies that promote academic integrity and mitigate the risks of plagiarism and cheating. Therefore, while AI offers numerous advantages for personalizing and improving education, it is crucial to address its potential risks to ensure ethical and effective use in the educational context.

The efficiency of Artificial Intelligence (AI) in teaching preschool and primary school children is justified by its potential to transform education and improve the teaching and learning process (Ayala-Pazmiño, 2023). This tool offers potential benefits, including improved personalized learning, task automation, and effectiveness of educational processes (Risang, 2023). AI has the ability to track students' progress, identifying difficulties and personalizing information (Kuhail et al., 2023). In addition, it has the capacity to facilitate various educational tasks, providing access to resources and adapting learning according to the needs of students (Frutos et al., 2024). Han and Lee (2024) add that it also offers access to various programs as alternatives to overcome the gaps that may exist for learning a new language.

Martínez-Comesaña et al. (2023) point out that Artificial Intelligence (AI) allows individual needs to be adapted, offering a student-centered approach that allows learning to be fruitful. Other authors state that artificial intelligence improves educational planning, based on the needs of students to generate effective planning (Celik et al., 2022; Zulkarnain & Yunus, 2023). For his part, Mertala (2017) points out that, without the use of AI in education, the changing needs of students cannot be met, as they are largely caused by technological evolution. Finally, Dieterle et al. (2022), adds that AI leads to improved learning outcomes and academic achievement due to its great potential for adaptation; however, it requires a deep understanding of teachers' perspectives for such improvement to be guaranteed. This work aimed to explore the perceptions about teachers and the implications of the use of Artificial Intelligence in early and primary education in Peru. To this end, the importance and impact that AI can have on the new generations trained in Lima's schools was considered, as well as the use that teachers give it within the classroom.

Theoretical Framework

In this section, we talk about technological education, delving into the definition of Artificial Intelligence (AI) applied

to the educational field. Technological education contains a series of fundamental knowledge and skills for development in a globalized world, ranging from the use of technological tools to the understanding of complex concepts such as AI. Given the advancement of technologies and their integration into various aspects of daily and professional life, it is crucial to understand not only how these tools work, but also their impact and potential on education. In addition, it discusses the ways in which AI can transform pedagogical practices, facilitating the personalization of learning, optimizing assessment processes, and offering new opportunities for teaching and learning. Therefore, it is considered important to delve into both terms to provide a solid basis for understanding the current and future dynamics of education in an increasingly technological environment.

Technological education

Technological education is an educational approach focused on learning concepts such as Artificial Intelligence (AI) through practice, as well as the development of concrete technological solutions, i.e., the use of smart devices, robotics, and the internet (Bellas et al., 2023). Gulliver et al. (2015) reinforce this idea, adding that they are interventions that use technological devices such as computers, the internet, and telephones. For their part, Hamal et al. (2022) define technological education as a field of study that focuses on integrating technologies into educational processes, seeking innovation and creativity in order to improve the teaching and learning process. Hübner et al. (2018) point out that it is an active process of construction of the educational space at a personal level, taking into account individual needs and characteristics.

Kaur (2012) adds that technological education is the study of human innovation, providing students with the opportunity to apply and manage knowledge related to the globalized world. Scanlon et al. (2015) report that it is the design, implementation, and evaluation of learning experiences based on and driven by contemporary technological advances. On the other hand, Yusuf et al. (2024) point out that it is the educational process that integrates a wide variety of specialized technologies for teaching. From another perspective, Zawacki-Richter (2019) mentions that it is a field that encompasses pedagogical, social, cultural, ethical, and economic dimensions. Finally, Mertala (2019) defines it as the acquisition of knowledge, competencies, and skills related to the use and integration of technologies in the educational context.

Artificial Intelligence in education

The definition of Artificial Intelligence (AI) encompasses a variety of approaches and perspectives according to various studies. Hamal et al. (2022) highlight that AI is the ability of non-human systems to mimic cognitive functions typically associated with human attributes, such as learning, speech, and problem-solving. Sheng et al., (2022) add that it is a branch of computer science that aims to provide human-like intelligence to machines, allowing them to perform tasks as if they were people. Gomez (2023) defines it as the ability of machines to potentiate areas such as data processing, decision-making, process automation, and interaction with human beings. Therefore, Sahin et al. (2013), describe it as a technical term that means learning to execute a task related to human beings through reasoning and interaction with the environment.

Artificial intelligence represents a transformative tool in education, with the potential to revolutionize both teaching and learning. According to Alshehri et al. (2023), this technology is also understood as one that allows machines to perform tasks that require human intelligence, such as interacting with students through chatbots, providing personalized feedback and learning support. It is essential to develop educational policies that promote an equitable and accessible use of AI, ensuring that all students can benefit from its advantages (Bellas et al., 2023). Ultimately, according to Gómez (2023), AI is also used to create educational resources that increase motivation, develop problem-solving skills, and foster creativity in the teaching-learning process. This allows the personalization of learning, creating inclusive materials that respond to the needs of the students.

Artificial Intelligence contributes to inclusive, equitable and quality education, preparing them as digital citizens. Artificial Intelligence redefines the role of teachers, seeing them as a companion in the development of technological skills and the creation of resources (del Puerto & Esteban, 2022). According to Padilla (2019), the impact of artificial intelligence (AI) on education stands out, from its evolution from fiction to its ubiquity in daily life. It highlights the need for solid ethics in its implementation to avoid human impersonation. It emphasizes the importance of digital literacy and the development of technological and scientific competences to harness AI as an educational tool, along with the promotion of pedagogical and digital skills. In conclusion, it advocates for a balanced integration of AI in education, maximizing its benefits and mitigating its risks (Peña et al., 2020)

Previous Studies

The literature reports that teachers know very little about new technologies; In this sense, evidence indicates that there is a great need for educators to increase their digital skills by receiving appropriate training that helps to enhance their knowledge and motivation. All of this is important for the success of its application (Polak et al., 2022).

In a study conducted in Sweden, it was reported that teachers have misconceptions about Artificial Intelligence (AI), as well as challenges in the acquisition of technological and pedagogical knowledge, underlining the importance of addressing this to improve teacher training in the field, promoting solid literacy on the subject (Velander et al., 2024). Educational technology can contribute to the development of different digital skills that are basic and that help to improve digital literacy. However, it is necessary to train teachers so that they can use it properly and provide a good education (Sánchez, 2024).

In addition to this, it was found that teacher satisfaction with the usefulness and ease of use of AI has a great impact on its application within the students' teaching process. The results of an intervention work prepared by Zulkarnain and Yunis (2023) show that teachers' perceptions and the intention to continue using AI in teaching have a very strong and significant correlation. For the intervention, a Pearson correlation coefficient was used, a statistical measure that assesses the strength of the relationship between two quantitative variables. In this sense, teachers' perceptions of the usefulness and ease of use of artificial intelligence directly influences the intention of use they give it in the classroom, since they are the ones who make the final decisions in that context (Kizilcec, 2023).

However, in a study developed by Celik et al. (2022), it was found that the use of AI not only depends on educators'

perceptions, but also on their knowledge of the technological, pedagogical, and content framework. This framework, known as TPACK, refers to the effective integration of technology, pedagogy and content in the educational process, highlighting the importance of mixing these elements to generate quality learning. According to the authors, it is essential that for this knowledge to be enhanced, multiple stakeholders participate, such as technology developers, experts in the field, teachers and students. This not only enriches knowledge about the use of AI in education, but also facilitates its effective integration within the teaching and learning process.

Artificial Intelligence (AI) is effective in the educational field; therefore, teachers should explore the use of various technological tools with current trends that help address learning problems, providing personalized classes adapted to the needs of students (Han & Lee, 2024). Alam et al. (2024) confirm this information, arguing that AI is an effective tool for teaching with the capacity to meet different needs.

In a study conducted by Allehyani and Algamdi (2023) where teacher perceptions were collected, it was found that they recognize the effectiveness of AI, indicating that, if used responsibly, it can be effective for learning. However, they also point out that it brings with it challenges and risks. In this sense, Sanabria et al. (2023) mention that AI is an effective tool. However, its poor application could prevent the development of knowledge, professional competencies, skills, critical thinking and vital elements for future professionals from being adequately materialized. AI in education offers a wide range of benefits that positively impact the teaching work and the learning experience of students. In a study developed by Frutos et al. (2024), it was found that teachers recognize the ability of AI to adapt content and learning strategies, especially in primary education, where attractive resources and the automation of tasks are valued to reduce workload, while Celik et al. (2022) highlight how AI-based systems, By efficiently matching tutors between peers, they allow teachers to optimize their time and personalize their teaching.

Likewise, the results of research conducted by Ayala-Pazmiño (2023) highlighted several benefits of AI in education, including the personalization of learning experiences for students and the ability to provide valuable data on their performance, which can inform instruction and improve academic outcomes. Tlili et al. (2023) demonstrated that Chat GPT increases the odds of educational success by providing basic knowledge and reducing the teaching workload through immediate feedback. Likewise, Allehyani and Algamdi (2023) observed that early childhood teachers perceive significant benefits after the initial adoption of Chat GPT, which facilitates the acceptance of innovative technologies. In addition, Dwivedi et al. (2021) noted that AI improves teacher effectiveness and student engagement through intelligent and personalized learning environments.

However, the integration of AI into education also poses a number of challenges and risks that need to be addressed with caution. Celik et al. (2022) highlight the need to enrich AI systems with different types of data to better understand teaching and learning processes, which could help teachers plan more effective interventions and provide timely feedback. On the other hand, Frutos et al. (2024) underscore teachers' perception of the risk of undue reliance on AI, which could result in the lack of development of critical skills in students, such as critical thinking and problem-solving.

Allehyani and Algamdi (2023) warn of the need for continuous monitoring and evaluation of student learning

outcomes when applying Chat GPT in the classroom, due to the risk of producing biased or inappropriate content. Finally, an intervention by Dwivedi et al. (2021) noted that AI in education could raise concerns about fairness and impartiality, as well as limit the development of critical and creative skills if it is relied on too much. The results of research by Tlili et al. (2023) highlighted concerns about the use of chatbots in education, underscoring the need for clear guidelines for their safe and effective use, including competencies for teachers and students in their management, as well as ethical and privacy considerations.

The rapid adoption of artificial intelligence in education has raised significant concerns among teachers. Some express concerns about the dishonesty, plagiarism, and ineffectiveness of many of their regular tasks (Alam et al., 2024). They highlight that students can generate school papers and essays in a matter of minutes, difficult to distinguish from those created by humans. The findings of a research paper conducted by Sánchez (2024) evidenced the growing concern about AI plagiarism in education. Teachers are concerned about the plagiarism problems that may arise, highlighting the importance of addressing this issue from an ethical and pedagogical perspective, and promoting the development of basic digital competences among teachers.

The integration of AI into student assessment and feedback raises important ethical and technical considerations. One of the main risks is that students use AI tools to cheat on assessments or circumvent the learning process, as these technologies can generate work or complete academic tasks, undermining the educational value of such activities (Ayala-Pazmiño, 2023). Faced with this challenge, the need for educators and AI system designers to work together to develop tools and strategies that promote academic integrity and mitigate the risk of plagiarism and cheating is highlighted (Frutos et al., 2024).

Method

The research used a qualitative approach of descriptive scope, with a non-experimental design. This approach was chosen because it allows us to explore in depth the perceptions of teachers about the use of Artificial Intelligence in early childhood and primary education in Lima, Peru. Being an open-ended approach, it provides the opportunity for participants to express their experiences and concerns in detail, providing a rich and nuanced understanding of an emerging and complex topic. This approach is particularly suitable for investigating how teachers are integrating AI into their classrooms and how they perceive its implications in the training of new generations. Qualitative research stands out for prioritizing understanding participants' perspectives or experiences through interviews, focus groups, and observations to collect detailed descriptive data (Smith et al., 2022). In addition, it focuses on the importance of context, recognizing findings related to social, cultural, and environmental environments. The adaptability of this type of research is essential to explore current issues such as the use of AI in education, highlighting the lived experiences of teachers (Michel et al., 2023).

Context and participants

The study was carried out in schools of high socioeconomic level in Metropolitan Lima, educational institutions that are characterized by offering quality academic training, based on modern infrastructure, various technological

resources, bilingual or international educational programs and highly qualified teachers in different areas. They also seek to promote the integral development of the student through the strengthening of different skills, whether socio-emotional, academic or civic. These schools usually serve students from families with a high purchasing power, which is reflected in the tuition and board fees, which are well above the national average. According to data from the Peruvian Ministry of Education, schools at this level serve a segment of the population with socioeconomic advantages, which allows them to have access to education with greater opportunities and resources (Minedu, 2021). The participants in the research were twenty-two teachers of early childhood and primary education, aged between 22 and 60 years, of which the majority (approximately 70%) are women. These teachers, who work in schools of high socioeconomic status, are exposed to an educational environment that gives them access to pedagogical innovations, such as the integration of Artificial Intelligence in their educational practices. This particular context can influence their experiences and perceptions of the use of AI, given that they have the resources and institutional support to experiment with new technologies in the classroom. Table 1 shows the detailed list of the teachers interviewed. Their selection was due to a non-probabilistic sampling of an intentional type. This sampling refers to a collection method that does not involve random selection, which facilitates a collection of more detailed information on the topic to be investigated (Foster, 2000).

Table 1: Persons interviewed

Interviewee (No.)	Sex		Age	Time working as a teacher	Level of teaching		Time spent working at your last school
	F	M			Initial	Primary	
Interviewee 1	x		55 y/o	30 years	x		10 years
Interviewee 2	x		50 y/o	25 years	x		15 years
Interviewee 3	x		47 y/o	20 years	x		18 years
Interviewee 4	x		22 y/o	3 years	x		3 years
Interviewee 5		x	29 y/o	7 years	x		6 years
Interviewee 6	x		23 y/o	2 years	x		2 years
Interviewee 7		x	33 y/o	10 years	x		6 years
Interviewee 8	x		29 y/o	8 years	x		8 years
Interviewee 9	x		45 y/o	12 years	x		8 years
Interviewee 10	x		30 y/o	10 years		x	5 years
Interviewee 11	x		28 y/o	9 years		x	3 years
Interviewee 12		x	40 y/o	15 years		x	10 years
Interviewee 13	x		23 y/o	3 years		x	3 years
Interviewee 14	x		25 y/o	5 years	x		2 years
Interviewee 15	x		55 y/o	33 years	x		15 years
Interviewee 16		x	27 y/o	7 years	x		5 years

Interviewee 17	x	28 y/o	5 years	x		5 years
Interviewee 18	x	20 y/o	1 year	x		1 year
Interviewee 19	x	32 y/o	4 years		x	2 years
Interviewee 20	x	47 y/o	25 years		x	20 years
Interviewee 21	x	51 y/o	22 years		x	22 years
Interviewee 22	x	48 y/o	24 years		x	10 years

Source: Author's own elaboration.

Technique, instrument and data processing.

A semi-structured interview guide was used for data collection. This is a qualitative research tool used to conduct interviews that combine a basic question structure with the flexibility to explore the interviewee's answers in depth. As Lopezosa et al. (2022) explain, these interviews are based on a set of predefined questions, but allow participants to respond openly, avoiding the rigidity of structured interviews. This type of guide is mainly used in qualitative studies where it is essential to capture the subjective perspective of the interviewees and explore complex phenomena in greater depth (Puga & García, 2022). The use of a semi-structured guide allows not only a greater adaptation by the researcher to the answers obtained, but also the possibility of making cross-sectional assessments and obtaining varied data. This flexible approach is especially valuable for generating spaces for dialogue that reveal detailed and nuanced information, overcoming the limitations of the most rigid methods (Lopezosa, 2020). Based on the research objectives, five categories of analysis and ten questions were posed, which are shown in Table 2.

Table 2. Categories, scopes and questions for the interview.

Categories	Reaches	Questions
Introduction and Context	Aimed at exploring the teacher's previous experience and their knowledge or perception of the use of Artificial Intelligence (AI) in education.	How would you describe your overall experience with initial/primary education?
		What do you know or have heard about the use of AI in education?
Perceptions of AI in Education	It seeks to identify teachers' perceptions of the integration of AI in the classroom.	What are your initial perceptions about integrating AI into your classroom?
		Can you give me an example of a situation where you think AI could be beneficial in your daily teaching?
Experiences and Expectations	This category aims to inquire about the previous experiences and expectations that teachers have about the adoption of AI.	Have you used any AI tools in your teaching? If so, what has your experience been like?
		What are your expectations regarding the use of AI in education in the next five years?

Challenges and Opportunities	It seeks to identify the challenges perceived by teachers when trying to integrate AI within their classes.	What challenges do you anticipate when integrating AI into primary education?
		What opportunities do you think AI can offer students and teachers?
Reflection and Future	This category is aimed at exploring the teacher's vision of the future of education with the integration of AI.	How do you envision the classroom of the future with the integration of AI?
		What kind of support or training would you need to use AI effectively in your teaching?

Source: Author's own elaboration.

The data collected through the semi-structured interviews were processed using the grounded theory approach, which allows an inductive analysis of the responses. This qualitative method facilitates the identification of patterns and the generation of categories from the data obtained, rather than from predefined hypotheses. According to Blosser (2014), grounded theory begins with an open coding process, in which the researcher reviews the transcripts of the interviews in detail, analyzing each line and using short sentences to describe the content of what is expressed. This approach allowed for the development of a deep and nuanced understanding of teachers' perceptions, experiences, and expectations regarding the use of AI in education, ensuring that conclusions emerged directly from the analysis of the data.

Therefore, the constructivist approach of grounded theory with generative AI was used to code the interviews. This method began with reviewing the respondents' responses to use the short sentences that characterize what they are saying about the topic. Then, the teachers' answers were compared and contrasted, separating them into five categories, for this, generative AI was used to help in the grouping of the answers to proceed with the convergences and divergences following the criteria of this theory.

Validation criteria and procedural ethics

Before applying the guide, it was validated. To this end, the review of two experts on the subject was requested. The first expert is a coordinator of a high-cost private school located in Lima, with a master's degree in technology and extensive experience in the educational field. The second expert is a professor from a school of the same category and from an elite university, with master's degrees and specializations in the subject. According to Martínez and Selva (2019), reliability and validation are fundamental virtues that ensure the tenacity and precision of research, allowing the results obtained to accurately reflect the content and the specific domain that is intended to be measured. One of the most effective strategies for validating documents is expert judgment, a method that, as Juarez-Hernández and Tobón (2018) point out, allows detailed information and accurate evaluations to be obtained from people with extensive experience and recognition in the area of study. This validation process not only ensures that the instrument is suitable for the purpose of the research, but also strengthens the reliability of the results.

In addition, rigorous ethical criteria were followed during the process. Both experts and participants were informed about the purpose of the study and assured of confidentiality in their responses. Likewise, an informed consent was

given to participate in the interviews, respecting their autonomy and ensuring that participation was free and voluntary. This is consistent with the premise that the practice of qualitative research involves an ethical and moral dimension that, at times, exceeds simple technical requirements, with people's well-being prevailing over academic and scientific purposes (Noreña et al., 2012).

Before applying the interview, a pilot test was carried out with five teachers from the schools participating in the study. This allowed the interview guide to be evaluated and minor adjustments to be made over time to improve the flow of interviews. Subsequently, messages were sent to teachers from two high-cost schools in Lima, providing a brief description of the research and requesting their collaboration in conducting the interviews. Thus, schedules and locations were coordinated for the interviews.

The interviews were semi-structured and conversational, lasting between 12 and 15 minutes. All were audio-recorded and transcribed with some minor edits in the quotes to improve clarity. The confidentiality of the data of the participants, the school and the information collected was respected. The recordings were reviewed several times to ensure that the data collection process is reliable. Likewise, the number of interviewees was also due to criteria of redundancy and saturation in the information obtained. Finally, to confirm the answers obtained, a focus group was organized with 10 of the interviewees. In this final stage, the same questions were asked in order to know a little more in depth what the interviewees thought about the preliminary results obtained.

Results

This research explored the perceptions and experiences on the use of AI in education from the perspective of 22 teachers from schools of high socioeconomic status located in the city of Lima. In this section, the results obtained are presented, organized into five categories to facilitate their analysis and understanding. Each category addresses different aspects, providing a structured view of the findings and allowing the identification of benefits, risks, opportunities and needs on the implementation of artificial intelligence in education.

Introduction and Context

Most of the interviewees mentioned that being a teacher is having a strong commitment and love for teaching. Likewise, many of them pointed out that they feel satisfaction in the growth and development of their students since they enjoy seeing how they acquire new skills and grow over time. As an example, one of the interviewees mentioned that her overall experience has been truly rewarding allowing her to transform the lives of her students.

> In these 25 years of career, my overall experience with early teaching has been incredibly rewarding and transformative. From day one, I realized that teaching is not just a profession, but a vocation that allows you to impact lives in a meaningful way. Initial teaching is particularly special because it is where the first seeds of knowledge and curiosity are sown. Seeing how students begin to discover the world through the concepts I present to them is one of the greatest joys of my professional life. I have learned as much from my students as they have from me, and every interaction has contributed to my personal and professional growth. In

addition, teaching has given me the opportunity to develop deep empathy, creativity, and patience. I would not change this experience for anything in the world, and I feel deeply grateful to have been able to contribute to the formation of so many young minds (Interviewee No. 2, 50 years old).

In addition, a large part of the interviewees emphasized the importance of an education that promotes the integral development of the student, valuing both traditional methods and new technologies and pedagogical approaches that are being given today. While it is true, the teachers pointed out that this is arduous and challenging since it is a challenge to update, however they are committed to improving their education to create new learning opportunities.

Although I have only been in this profession for two years, I have learned a lot and have seen the positive impact that a well-designed education can have on children. I am very committed to integrating modern methods and technology in the classroom to enrich the learning experience of my students (Interviewee No. 6, 23 years old).

With several years of experience, I have learned that education is an ever-evolving process. I have had the privilege of guiding many students in their academic and personal development, and I have always looked for new ways to improve my teaching practice to provide them with the best education possible and I am committed to continue learning (Interviewee No. 10, 30 years old).

On the other hand, one of the interviewees specifically mentioned the integration of Artificial Intelligence within teaching, highlighting the potential it has to transform education and simplify the work of teachers. This was not shared by all the testimonies since some of them do not mention technology or showed preferences for teaching with traditional methods.

I have been in the classroom for 20 years and AI has simplified my work in time and resources. Always with professionalism, reviewing and diversifying the reality of my classroom (Interviewee No. 1, 55 years old).

Interviewees also reflected on what they had heard about artificial intelligence. The answers reflect a clear convergence in the usefulness of AI in education. They recognize it as a powerful tool that can enhance learning and support teachers. However, they also agree that the use of this must be measured, responsible and complementary, preventing classes from being robotized. Likewise, some of them showed great concern as education becomes increasingly technological and they fear that human interaction will be replaced.

AI is revolutionizing education in multiple ways, bringing tools and resources that transform both teaching and learning. The key is to use AI as a complementary tool, which enhances human skills in teaching, without replacing them. As a teacher with extensive experience, it's exciting to think about how these technologies can help amplify the positive impact you're already having on your students (Interviewee No. 3, age 47).

I've heard about artificial intelligence in education, but I have to admit that I don't know much about how it actually works. What I know is that it is increasingly present in the classroom, and that causes me some concern, since I am not sure how it will affect teachers and their role in teaching (Interviewee No. 15, 55 years old).

Perceptions of AI in Education

Perceptions of artificial intelligence (AI) in education range from enthusiasm to skepticism. On the one hand, many teachers highlight that AI facilitates tasks, that is, it helps in lesson planning, development of materials and creation of efficient and personalized approaches according to the needs of the group. In the interviews, the educators showed their optimism about how it can enrich the teaching and learning process, offering new experiences, diversifying and adapting to different contexts.

> My initial perceptions are positive and optimistic, albeit with a clear awareness that effective AI implementation will require reflection, preparation, and a student-centered approach. I am excited to explore how AI can enrich my teaching and, ultimately, my students' learning (Interviewee No. 3, 47 years old).
> While the idea of integrating AI into the classroom is a little intimidating at first, I'm committed to learning and adapting. I see the potential of AI to enrich learning and improve the quality of education I offer, and I am willing to explore how it can be used effectively in my teaching (Interviewee No. 17, 28 years old).
> A clear example would be the use of AI to assess student progress in real-time. You could use an AI tool that analyzes how children are responding to reading activities, quickly identifying if any of them need more support in certain areas, and suggesting specific activities to reinforce those concepts (Interviewee No. 19, 32 years old).

From another point of view, significant concerns were found about the risk of technology replacing human interaction and the teacher-student connection, which are fundamental in teaching, especially in the early levels of education.

> The idea of integrating AI into my classroom is a bit intimidating, mainly because I'm not used to relying on technology. However, I also recognize that it could be an opportunity to improve my students' learning and make some tasks easier. I am concerned that he may lose the human contact so necessary in early education (Interviewee No. 7, 33 years old).

Likewise, one of the interviewees commented on the care that must be taken with artificial intelligence, since although it can help to facilitate different tasks, it can also generate conformism in teachers, making laziness stand out and the quality of learning is lowered.

> I'm skeptical about integrating AI into the classroom. I worry that instead of encouraging independent thinking and effort, it can promote laziness by doing everything with a single click. I believe there is inherent value in the process of learning through trial and error, and I fear that AI may diminish this experience (Interviewee 15, 55 years old).

Experiences and Expectations

Teachers' experiences and expectations regarding artificial intelligence in education reflect a wide range of attitudes. Among educators who have already integrated AI tools into their teaching, the majority report positive experiences.

It highlights how AI has facilitated content creation and lesson planning, as well as improved student engagement and tracking.

> I have used AI tools such as ChatPDF, Chat GPT, and others, both to generate content and to search for data. I believe that the development will be enormous and I hope that a code of ethics can be established for its use (Interviewee No. 6, 23 years old).
>
> I've used a few AI tools, mainly adaptive learning platforms and virtual assistants to plan lessons. My experience has been very positive; these tools have not only saved me time, but have also improved student engagement by tailoring activities to their interests and skill levels (Interviewee No. 12, age 40).

On the other hand, expectations about the future role of AI in education are also mostly optimistic. Enthusiasm is expressed for the potential of AI, a long-term vision of the tool through personalized and accessible education.

> The idea of using AI is something I'm really excited about, especially because of its ability to personalize learning and offer more focused support to each student. I am open to exploring and experimenting with these tools in the near future, as I believe they could be a great addition to my current pedagogical methods (Interviewee No. 3, 20 years old).
>
> I hope that in the next five years AI will be an essential tool in education, not only complementing but enhancing the teaching work and improving the learning experience for all students (Interviewee No. 18, 20 years old).
>
> I hope that in the next five years AI will become an integral part of education, facilitating more personalized and accessible learning for all (Interviewee No. 12, 40 years old).

However, there are also concerns about the impact of AI on the teaching profession and on the quality of education. It reflects great fear about the possible dehumanization of education and the risk of excessive dependence on technology.

> My fear is that, if not handled correctly, AI could lead to a situation where teachers are seen as less necessary (Interviewee No. 14, 25 years old).
>
> While the idea of integrating AI into my classroom is a little intimidating at first, I'm committed to learning and adapting. I see the potential of AI to enrich learning and improve the quality of education I offer, and I am willing to explore how it can be used effectively in my teaching (Interviewee No. 17, 28 years old).

Challenges and Opportunities

The integration of artificial intelligence into teaching presents a number of significant challenges that need to be carefully addressed to maximize its positive impact. Among the most cited challenges is the risk of over-reliance on technology, which could dehumanize the educational process and limit direct interaction between teachers and students.

One of the biggest challenges would be to prevent students from becoming overly reliant on technology. I also anticipate that it could be difficult to keep learners engaged in activities that require more effort if AI offers quick and easy solutions (Interviewee No. 13, 23 years old).

In addition, another teacher highlights the concern for data privacy and security, stresses the need for meticulous planning and proper training to ensure that AI is effectively and ethically integrated into the educational environment.

Ensuring that all students have access to the same technologies and ensuring the privacy and security of AI data are crucial challenges (Interviewee No. 6, 23 years old).

Despite these challenges, AI offers valuable opportunities that can transform teaching and learning. Among the opportunities highlighted are the personalization of learning and the improvement in the efficiency of administrative tasks. Enabling increasingly student-centered teaching.

AI offers opportunities such as personalized learning and access to resources 24/7 for students, and time optimization and data analysis for teachers (Interviewee No. 3, 47 years old).

AI offers the opportunity to personalize learning, allowing each student to progress at their own pace and receive the support they need (Interviewee No. 15, 55 years old).

AI can help identify and address gaps in learning more quickly and efficiently (Interviewee No. 19, 32 years old).

Reflection and Future

The classroom of the future with the integration of artificial intelligence is envisioned as an environment where technology plays a key role in supporting both teachers and students, while maintaining the value of human interaction and the development of essential skills. Several interviewees imagine a more dynamic and personalized classroom, where AI allows teaching and learning to be optimized. The importance of balancing technology with human intervention is highlighted.

The classroom of the future with AI would be a dynamic and personalized environment, where technology enhances learning and allows teachers to focus on what matters most, inspire and guide their students (Interviewee No. 4, 22 years old).

I imagine a classroom where AI could be present, but not dominating the teaching process. I hope that traditional methods will continue to be the basis of learning, with AI simply supporting areas such as classroom management or information organization (Interviewee No. 14, 25 years old).

In terms of the support needed to use AI effectively, continuous training is considered essential. Several teachers express the need for technical training to learn how to handle AI tools and apply them correctly in the classroom. Another key aspect is the possibility of having practical examples and good practices that show how AI can be integrated into real teaching contexts.

It would need a combination of technical training, pedagogical development, data management, continuous

support, and opportunities to collaborate and evaluate the impact of AI on education (Interviewee No. 4, 22 years old).

I would like to know good teaching practices and their results when applying AI in RBE. In addition to training, constant technical support and the ability to resolve doubts in real-time are essential to ensure that the implementation of AI is smooth and effective. (Interviewee No. 9, 45 years old)

Discussion

Evidence shows that although Artificial Intelligence (AI) has the potential to transform education in a positive way, its integration must nevertheless be managed with care and foresight. In this sense, Sánchez Vera (2024) pointed out that AI is generally perceived as a tool that improves the teaching-learning process, however, it is essential to take into account that its integration raises ethical, social, and pedagogical questions. The teachers pointed out that the use of AI has the potential to transform the world, improving the results and quality of education, although, like any technology, it also has risks associated with its use so it is necessary to use it with caution and responsibility (Ayala-Pazmiño, 2023).

In addition, teachers who have used AI tools in their educational practice, such as ChatGPT, have reported mixed experiences. According to Frutos et al. (2024), AI has facilitated access to different educational resources and has improved learning strategies, allowing personalization that enriches teaching. However, as Zulkarnain and Yunus (2023) mention, the implementation of AI must be careful to avoid excessive reliance on technology that could displace the fundamental role of the teacher in the educational process. Teachers express expectations that AI allows not only more efficient classroom management, but also an improvement in the quality of learning through more adaptive and personalized resources (Gómez, 2023). This transformative potential, however, requires educators to be well trained to integrate these technologies effectively and ethically (Sánchez Vera, 2024).

Likewise, it was found that artificial intelligence facilitates tasks, adapts and responds to the needs of students. As del Puerto and Esteban (2022) point out, AI allows teachers to benefit from AI-based peer tutoring recommendation systems, which saves them time to carry out other activities. AI has generally proven to be beneficial for teacher instruction, allowing them to leverage it in the planning, implementation, and evaluation of their work. Frutos et al. (2024) also highlight that teachers, in general, recognize that AI can help adapt content and learning strategies to the personal characteristics of the students. In the case of primary education, teachers particularly value AI's ability to generate more engaging resources that motivate students, as well as the automation of tasks, which can reduce workload and allow them to focus on other pedagogical areas.

However, despite these benefits, integrating AI into teaching presents a number of challenges. Dwivedi et al. (2021) warn of the risk that excessive automation could reduce essential human interaction in the classroom, which could negatively affect the development of critical and creative skills in students. Polak et al. (2022) also emphasize that the implementation of AI must be accompanied by an adaptation of digital competence frameworks and greater awareness of their ethical implications. The potential for biases in algorithms and fairness issues in educational assessment are concerns that need to be carefully addressed to ensure that AI is used fairly and effectively (Tlili et al., 2023). The

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key is to find a balance between technology and traditional pedagogy, ensuring that AI complements and does not replace human interaction and judgment in the educational process (Zulkarnain & Yunus, 2023). Additionally, the information collected shows that for artificial intelligence (AI) to be well applied, teachers need to receive training on the capabilities it may have. This coincides with Kuhail et al. (2023), as they mention that the inclusion of technologies depends purely on the digital skills that teachers have. Undoubtedly, the integration of generative AI depends entirely on learning how to interact with it. Likewise, Celik et al. (2022), pointed out that as a teacher, it is of utmost importance to be trained in the use of AI to be successful since it has different ways of being used and has great benefits such as improving teaching and learning.

Looking ahead, the continuous preparation and training of teachers will be crucial for a successful integration of AI in education. Allehyani and Algamdi (2023) suggest that teachers should receive comprehensive training that includes both technical aspects and a thorough understanding of the ethical and practical challenges associated with AI. Padilla (2019) highlights that strong digital literacy will allow educators to adapt AI to their specific contexts, creating more personalized and effective learning experiences. In addition, Sánchez Vera (2024) adds that in order to use AI effectively, teachers must be well informed about how to handle these tools and how to avoid problems related to privacy and ethics. In this sense, Tlili et al. (2023) underline the need to establish clear guidelines for the use of chatbots in teaching, ensuring safe and ethical implementation in the classroom. Continuous training will be key to meeting future challenges and maximizing the benefits of AI in education.

Conclusion

The study reveals a varied attitude with a strong trend towards the acceptance of Artificial Intelligence (AI). Teachers recognize that AI has great potential to improve and transform education. It offers great benefits such as improved teaching tasks, greater efficiency, personalization of learning and others. However, despite the advantages, significant concerns are identified about dependence on technology, generating a reduction in efforts that harm the quality of education, as well as the possible loss of personal interaction, especially at such an early age.

For their part, the interviewees emphasized the openness they have towards the integration of AI in the classroom, although not everyone feels prepared and with the necessary knowledge to use it effectively. This reinforces the need to continuously train teachers on new technologies, not only from a technical perspective, but also from a pedagogical one. The success of the use of artificial intelligence depends to a large extent on the ability of education systems to provide their teachers with the resources and training necessary to handle the technology effectively and responsibly. Finally, this work provides a deep understanding of teachers' perceptions and preparations about the integration of artificial intelligence in schools. With this, new lines of research are opened in multiple areas since there is not a great breadth of information. On the one hand, there is a great need for increased studies that investigate the best way to prepare teachers to use AI ethically and pedagogically, as well as research that can measure the effects of the use of AI in the long term. Likewise, this study invites us to delve into the impact of AI at different educational levels (initial and primary), where human interaction is essential for meaningful development and learning. In terms of replicability, the conclusions obtained can serve as a basis for research in diverse educational contexts, allowing a comparison between the challenges and opportunities that arise in different school systems in relation to AI. This analysis could

be complemented with research on the role of education policy and economic barriers to access to advanced technologies to further enrich the understanding of the transformative potential of artificial intelligence in education.

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Academic Integrity in the Age of AI: Exploring on the Educational Experiences for Students and Teachers in a Private University in the Philippines

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Abstract: Artificial Intelligence has evolved much more quickly than any educator could have imagined, and that evolution is creating new challenges to academic integrity for students and teachers in higher education. Even though the advent of new AI systems has made adherence to academic integrity a very important endeavor, there is little focus on practical strategies that promote ethical behaviors regarding AI use and non-use (especially in high-stakes learning environments such as those of higher education), either through policy or technological approaches; hence, it is timely to examine how AI actually affects practices related to academic integrity at a private university in the Philippines. The goal is to probe the attitudes, concerns and adjustments of students and instructors when AI in connected with educational fairness, their reactions to moral quandaries and possible abuse. The study implemented a quantitative survey approach among 100 students and 30 faculty who filled survey forms. Feedback from 330 respondents yielded generalized observations in quantitative data. Results demonstrated that, although useful for enhancing learning experiences, AI tools raise fears about abuse and reliance on them; thus, requiring well-designed academic integrity guidelines. Respondents wanted institutional help and unambiguous ethical guidance about what to say-and not to say-about using AI. The present study adds to the current conversation on artificial intelligence in education by empirically advocating for AI ethics inclusion as part of academic integrity policies from educational institutions. One of the key recommendations is creating workshops for ethical AI use to help students and faculty uphold academic integrity.

Keywords: Academic Integrity, Artificial Intelligence, HEIs Experience and Challenges

Introduction

The rapid advancements in artificial intelligence have brought about significant changes in the educational landscape, posing both opportunities and challenges for academic integrity. As AI-powered tools become increasingly sophisticated, the line between human-authored work and AI-generated content has become increasingly blurred, raising concerns about the erosion of academic honesty and the need for a fundamental shift in educational practices (Mohammadkarimi, 2023; Bulut et al., 2024; Chan, 2023).

One of the primary concerns is the potential for AI-generated content to be used as a means of academic misconduct, undermining the core principles of originality, authenticity, and ethical integrity (Chan, 2023). The ease with which AI can produce coherent and contextually relevant text, making it difficult to distinguish from human-written work, has led to a growing prevalence of "AI-generated academic integrity violations" (Chan, 2023). This trend not only threatens the academic integrity of individual students but also has broader implications for the educational system, as it detracts students from the learning journey towards critical thinking, creativity, and independent learning (Chan, 2023).

To address these challenges, the academic community must collaborate with AI developers to establish robust frameworks for the ethical and responsible use of AI in education (Carobene et al., 2023). This includes the development of transparent disclosure protocols, where the use of AI in the writing process is clearly acknowledged, and proper attribution is given to both human and artificial contributors. Additionally, the exploration of methodologies to preserve the authenticity of AI-assisted academic work is crucial, as the integration of AI as a co-creator of scientific content raises concerns about the preservation of originality.

As the adoption of AI in scientific publishing and educational settings continues to grow, the emphasis on ethical and responsible use of this technology becomes increasingly critical. Researchers, writers, editors, and AI developers must work together to formulate best practices and ensure that AI-generated content adheres to the highest standards of academic integrity, promoting an environment that fosters true learning, critical thinking, and the development of essential skills for students and teachers alike (Carobene et al., 2023).

Furthermore, the use of AI in education must be approached with a deep understanding of its limitations and potential risks. The ethical concerns surrounding AI in education, such as privacy, data access, and the potential for data hacking and manipulation, must be addressed through the establishment of clear ethical guidelines (Ahmad et al., 2023). Institutions must also be vigilant in their partnerships with commercial AI providers, ensuring that their practices and values align with the academic mission and ethical principles of the institution (Holmes et al., 2023).

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As educational leaders navigate the complex landscape of AI-integrated educational experiences, they must strike a delicate balance between leveraging the potential of AI to enhance learning outcomes and safeguarding the fundamental principles of academic integrity (Wang, 2021). Fostering a collaborative and transparent approach to the integration of AI in education, the academic community can transform the educational experience for both students and teachers, empowering learners to navigate the digital age with a strong ethical foundation and a commitment to academic excellence.

Objective of the Study

This study aims to seek the following objects: (1) To describe the demographic profile of faculty and student respondents in terms of category, age, and frequency of AI tool usage in a private university in the Philippines. (2) To examine the perceptions of faculty and students regarding the role of AI tools in promoting or compromising academic integrity. (3) To identify the common challenges encountered by faculty and students in relation to the ethical use of AI in academic settings. (4) To analyze the adaptive behaviors and responses of faculty and students when faced with ethical dilemmas involving AI use in academic work. (5) To determine significant differences in perceptions, challenges, and adaptations related to AI in academic integrity when grouped according to category (faculty or student), age, and frequency of AI tool usage.

Method

This study employed a descriptive quantitative research design to examine the perceptions, challenges, and adaptations related to academic integrity in the age of artificial intelligence (AI) among faculty and students in a private university in the Philippines. The design was appropriate for capturing patterns and trends based on numerical data, enabling the researcher to describe relationships and differences across groups.

The participants of the study consisted of 330 respondents, including 30 faculty members (9.10%) and 300 students (90.90%), selected through purposive sampling. The selection criteria ensured that all respondents had experience or familiarity with AI tools in academic contexts, such as using applications like ChatGPT, QuillBot, or Grammarly.

The research instrument used was a structured questionnaire divided into four parts: (1) respondent profile, (2) perceptions of AI's role in academic integrity, (3) challenges encountered in using AI ethically, and (4) adaptations and responses to AI-related ethical dilemmas. Responses were measured using a 4-point Likert scale (1 – Strongly Disagree to 4 – Strongly Agree), and the instrument underwent expert validation and pilot testing to ensure reliability and clarity.

The data gathering procedure involved online distribution of the questionnaire through official university channels, with prior coordination from faculty and administrative offices to ensure informed participation. Respondents were given adequate time to complete the survey, and clear instructions were provided for consistency.

For data analysis, descriptive statistics (frequency, percentage, mean, and standard deviation) were used to summarize

respondent profiles and general trends in perception. To test for significant differences across categories (e.g., age, role, frequency of AI use), the Mann-Whitney U test and Kruskal-Wallis H test were employed due to the non-parametric nature of the data.

In terms of ethical considerations, the study adhered strictly to ethical research standards. All participants were provided with an informed consent form, which outlined the purpose of the study, voluntary nature of participation, and assurance of confidentiality and anonymity. No personally identifiable information was collected. The potential risks were minimal and outweighed by the benefits of contributing to better understanding and policy formulation on AI in education. The study received ethical clearance from the university's research ethics review committee prior to implementation.

Discussion

This study explored the educational experiences of faculty and students in relation to academic integrity in the age of AI within a private university in the Philippines. The findings highlight notable differences in perceptions, shared challenges, and varied adaptive behaviors based on respondent category, age, and AI tool usage

Table 1. Profile of the Respondents

Profile Variable		N	%
Category	Faculty	30	9.10%
	Student	300	90.90%
	Total	330	100%
Age	18-24 years old	301	91.20%
	25-34 years old	22	6.70%
	35-44 years old	5	1.50%
	45 years old and above	2	0.60%
	Total	330	100%
AI Used	ChatGPT	225	33.89%
	QuillBot	199	29.97%
	Grammarly	195	29.37%
	Google Bard	10	1.51%
	Copilot	9	1.36%
	Turnitin	8	1.20%
	Cici ai	6	0.90%
	Gemini	3	0.45%
	Perplexity	3	0.45%
	Scribbr	3	0.45%
	Blackbox	2	0.30%
	Microsoft Co	1	0.15%
	Total	664	100%

Note: n=330, for AI used there is multiple answer (n=664)

Table 1 presents the demographic profile and AI tool usage patterns among respondents, comprising both faculty and students from a private university in the Philippines. Of the 330 respondents, a large majority (90.90%) were students,

with faculty constituting a smaller portion (9.10%). The age distribution revealed that respondents predominantly belonged to the younger age group, specifically 18–24 years old (91.20%), which aligns with the typical university student demographic. Respondents aged 25–34 years accounted for 6.70%, reflecting younger faculty members and possibly older students.

Regarding the usage of AI tools, respondents reported multiple selections, totaling 664 responses. ChatGPT was the most frequently utilized AI tool (33.89%), followed by QuillBot (29.97%) and Grammarly (29.37%). These three AI tools dominate usage, collectively representing approximately 93% of all reported AI interactions. This preference could be attributed to their accessibility, ease of use, and applicability in various academic tasks such as essay writing, grammar checking, paraphrasing, and idea generation. Conversely, newer or more specialized AI tools such as Google Bard (1.51%), Copilot (1.36%), and Turnitin (1.20%) showed significantly lower usage, possibly due to limited familiarity, specialized functions, or institutional availability. Tools with minimal usage—such as Cici AI, Gemini, Perplexity, Scribbr, Blackbox, and Microsoft Co—each accounted for less than 1%, reflecting their relative novelty or niche focus within the educational context.

Overall, the findings suggest a strong inclination toward popular and general-purpose AI applications among students and faculty. This pattern indicates both awareness and active adoption of AI technologies within academic settings. The dominance of students in this respondent pool underscores the importance of addressing AI-related ethical issues primarily at the learner level. This profile information is critical in guiding future interventions, educational policy adjustments, and training programs to foster responsible AI usage, maintain academic integrity, and optimize the educational benefits of AI tools within the institution.

Table 2. Perceptions of AI's Role in Academic Integrity

	Faculty			Students			Overall		
	Mean	Std. Dev.	V.I.	Mean	Std. Dev.	V.I.	Mean	Std. Dev.	V.I.
AI tools help improve the quality of academic work.	3.73	0.45	SA	3.40	0.60	A	3.57	0.53	SA
AI tools offer unique advantages in academic work that should be explored further.	3.70	0.47	SA	3.30	0.61	A	3.50	0.54	SA
AI tools contribute positively to student learning and academic success.	3.57	0.50	SA	3.16	0.69	A	3.36	0.59	A
AI's role in academic settings is beneficial and should be promoted.	3.53	0.57	SA	3.06	0.69	A	3.30	0.63	A
AI tools (e.g., ChatGPT, Grammarly) are valuable resources for academic work"	3.63	0.49	SA	3.16	0.69	A	3.40	0.59	A
AI tools enhance learning and understanding of subject matter.	3.53	0.51	SA	3.26	0.67	A	3.40	0.59	A
I believe AI tools can enhance understanding of complex academic topics.	3.67	0.48	SA	3.21	0.67	A	3.44	0.57	A
The use of AI tools in academic work should be encouraged.	3.53	0.51	SA	2.94	0.72	A	3.24	0.61	A
Using AI tools aligns with the principles of academic integrity.	3.33	0.66	A	2.93	0.83	A	3.13	0.74	A
Using AI tools for academic assignments constitutes a form of cheating	2.93	0.91	A	2.90	0.83	A	2.92	0.87	A
Composite Mean	3.52	0.38	SA	3.13	0.53	A	3.33	0.45	A

Table 2 presents respondents' perceptions regarding AI's role in maintaining academic integrity, segmented by faculty, students, and overall results. The composite mean revealed a moderate positive perception (3.33), indicating general agreement that AI tools have a beneficial role in academic integrity, although with notable caution. The significant difference between faculty (3.52, SA) and students (3.13, A) highlighted a potential perception gap. Faculty appeared more optimistic about the potential of AI tools to positively influence academic integrity, while students displayed more reservation, reflecting their awareness of ethical complexities and practical implications of AI use.

Faculty perceptions consistently showed higher levels of agreement compared to students across nearly all items. Specifically, faculty strongly agreed (mean ≥ 3.50) with the statements emphasizing AI's role in improving academic quality (3.73), exploring unique advantages (3.70), contributing positively to student learning (3.57), and being beneficial for academic settings (3.53). They also strongly supported the use of AI tools to enhance understanding of complex academic topics (3.67) and to encourage their use (3.53). Faculty agreed (but not strongly) with the statement that using AI aligns with academic integrity (3.33) and somewhat agreed that AI usage in assignments might constitute cheating (2.93).

Student respondents demonstrated generally lower means, ranging from 2.90 to 3.40. They consistently showed agreement (but not strong agreement) across most statements, suggesting cautious optimism towards AI tools. The highest-rated statements by students were about AI's ability to improve academic work quality (3.40), provide unique advantages (3.30), and enhance learning and understanding (3.26). Interestingly, students expressed relatively lower agreement about encouraging AI tools (2.94) and alignment with academic integrity (2.93). Additionally, students acknowledged—albeit slightly—the perception that using AI tools might constitute cheating (2.90), indicating some ethical uncertainty or reservations.

In summary, these findings underscore the need for clearer institutional guidelines and ethical frameworks addressing the use of AI tools. The perceptual gap between faculty and students should be bridged through training, dialogue, and policy discussions to ensure balanced integration of AI technologies into the academic integrity landscape.

Table 3. Challenges with AI in Academic Integrity

	Faculty			Students			Overall		
	Mean	**Std. Dev.**	**V. I.**	**Mean**	**Std. Dev.**	**V. I.**	**Mean**	**Std. Dev.**	**V. I.**
It is difficult to determine when the use of AI constitutes plagiarism.	3.13	0.78	A	2.85	0.76	A	2.99	0.77	A
AI tools make it easy for students to complete assignments without understanding the material.	3.40	0.56	A	3.01	0.75	A	3.20	0.65	A
AI tools can create dependency, reducing students' motivation to learn independently.	3.23	0.68	A	3.18	0.77	A	3.21	0.72	A
There is a lack of clear guidance on the ethical use of AI in academic settings.	3.10	0.71	A	3.15	0.69	A	3.13	0.70	A
Students face pressure to use AI to keep up with academic expectations.	2.93	0.87	A	3.12	0.70	A	3.03	0.78	A
AI tools may compromise students' critical thinking skills.	3.17	0.75	A	3.19	0.71	A	3.18	0.73	A
Misunderstandings about ethical AI use are common among students and faculty.	3.30	0.53	A	3.17	0.68	A	3.24	0.61	A
AI technology creates new forms of academic dishonesty that are hard to detect.	2.90	0.71	A	3.04	0.72	A	2.97	0.72	A

I am uncertain about how to address AI-related misconduct.	2.93	0.64	A	2.89	0.76	A	2.91	0.70	A
It is challenging to determine what constitutes ethical use of AI in academic settings.	3.00	0.53	A	2.97	0.73	A	2.98	0.63	A
Composite Mean	3.11	0.49	A	3.06	0.53	A	3.08	0.51	A

Table 3 illustrates the perceived challenges associated with AI tools concerning academic integrity, as reported by faculty and students. The composite mean scores revealed moderate agreement from both groups—faculty (3.11) and students (3.06)—with only minor differences, indicating a mutual recognition of challenges posed by AI technologies. Across all groups, there was general consensus on several notable concerns. Faculty and students agreed strongly that AI tools could foster dependency, reducing students' intrinsic motivation to learn independently (overall mean = 3.21). There was also broad agreement that AI potentially compromises students' critical thinking abilities (mean = 3.18), reflecting a significant concern over the impact of automation on learning processes.

Faculty members were more concerned than students about the ease with which AI allows students to complete assignments without genuinely understanding the material (faculty mean = 3.40; student mean = 3.01). Additionally, faculty reported higher uncertainty regarding ethical guidelines for AI use, particularly highlighting confusion around plagiarism and ethical boundaries. This suggests a need for clearer institutional policies and guidelines on AI use. Students expressed stronger agreement compared to faculty on feeling pressured to use AI tools to meet academic expectations (student mean = 3.12, faculty mean = 2.93). This indicates that students perceive a competitive academic environment that indirectly encourages reliance on AI for academic performance. The statement regarding misunderstandings about ethical AI use yielded high agreement among both faculty and students (overall mean = 3.24), underscoring a shared concern regarding insufficient understanding or inconsistent messaging from educational institutions. Notably, respondents reported slightly lower but still considerable uncertainty on how to address AI-related misconduct (mean = 2.91), suggesting a knowledge gap among educators and students alike.

Both faculty and students acknowledge that AI use can negatively impact independent learning, motivation, and critical thinking. Faculty appear particularly concerned about the ease of superficial learning enabled by AI. Students feel external pressure to utilize AI, reflecting concerns about competitive academic environments. Clear institutional guidelines and ethical frameworks for AI use remain lacking, contributing to ambiguity and misunderstanding. Both groups recognize the need for clarity in handling AI-related misconduct. These findings highlight the urgency for educational institutions to establish clearer, more explicit guidelines and training initiatives that foster ethical AI use and proactively address the challenges emerging in the age of AI-driven education (George, 2023).

Table 4 explores how faculty and students adapt their behaviors and decision-making in response to ethical concerns surrounding the use of AI in academic settings. Across all statements, both faculty and students showed consistent agreement (mean scores between 3.0 and 4.0), indicating a proactive stance in addressing AI-related ethical dilemmas. The composite mean for both faculty (3.37) and students (3.21) falls within the "Agree" (A) range, with faculty expressing slightly stronger agreement across most indicators. This suggests that faculty are more mindful and deliberate in their efforts to ethically integrate AI, possibly due to their role as academic role models and policy enforcers.

The highest individual item for both groups was: "I refrain from using AI in assignments if I believe it conflicts with academic integrity" (Faculty = 3.57, Strongly Agree (SA); Students = 3.19, Agree). This indicates that faculty show a higher level of self-regulation, while students still express caution, though less intensely.

Table 4. Adaptations and Responses to Ethical Dilemmas

	Faculty			Students			Overall		
	Mean	Std. Dev.	V. I.	Mean	Std. Dev.	V. I.	Mean	Std. Dev.	V. I.
I avoid using AI for assignments if it could misrepresent my own work and abilities.	3.37	0.67	A	3.15	0.66	A	3.26	0.67	A
I discuss AI usage openly with professors to ensure I follow ethical guidelines.	3.17	0.59	A	2.99	0.69	A	3.08	0.64	A
I feel confident in my understanding of ethical vs. unethical use of AI tools.	3.33	0.71	A	3.27	0.62	A	3.30	0.67	A
I feel equipped to differentiate between acceptable and unethical AI use.	3.17	0.65	A	3.28	0.59	A	3.22	0.62	A
I have adapted my approach to using AI tools to avoid potential ethical conflicts.	3.23	0.63	A	3.22	0.60	A	3.23	0.61	A
I have adapted my approach to using AI tools to avoid potential ethical issues.	3.23	0.63	A	3.22	0.61	A	3.23	0.62	A
I modify my use of AI based on ethical concerns around academic integrity.	3.47	0.57	A	3.26	0.61	A	3.36	0.59	A
I refrain from using AI in assignments if I believe it conflicts with academic integrity.	3.57	0.57	AS	3.19	0.67	A	3.38	0.62	A
I seek guidance when unsure about the ethical use of AI in my academic work.	3.50	0.57	AS	3.20	0.66	A	3.35	0.62	A
I support the creation of policies that outline ethical AI practices in academics.	3.63	0.56	AS	3.28	0.62	A	3.46	0.59	A
Composite Mean	3.37	0.46	A	3.21	0.49	A	3.29	0.47	A

Faculty were more likely to seek guidance when uncertain (3.50) and strongly supported policy creation for ethical AI use (3.63), both categorized as Strongly Agree (SA). Students also agreed with these actions (means of 3.20 and 3.28, respectively), showing openness to external regulation and support mechanisms.

Both faculty (3.33) and students (3.27) felt confident in distinguishing ethical vs. unethical AI use, and both groups agreed they had adapted their approaches to avoid potential conflicts (overall mean = 3.23). These findings suggest that as AI becomes more integrated into academic practice, users are becoming more reflective and adaptive, even without formal institutional directives.

Students showed lower agreement (mean = 2.99) than faculty (3.17) regarding discussing AI use openly with professors. This gap may reflect students' hesitation or uncertainty about institutional expectations, or a lack of safe spaces to discuss AI openly.

Faculty are generally more proactive and confident in ethical decision-making regarding AI use, and they support institutional measures for guidance and accountability. Students are adapting and aware, but exhibit slightly lower confidence and transparency, indicating a need for clearer communication channels and education on AI ethics. The results affirm that both students and faculty are not passively engaging with AI tools, but are actively navigating ethical boundaries, though at varying levels of awareness and engagement.

The findings highlight the urgent need for universities to develop clear, inclusive, and participatory policies on AI use in academics. These should be accompanied by training programs, faculty-student dialogues, and accessible guidance mechanisms to help all stakeholders make informed and ethical choices in the AI-driven learning environment.

Table. 5. Significant Difference on The Responses When Grouped According to Profile

Category	H/u value	p-value	Decision	Interpretation
Perceptions of AI's Role in Academic Integrity	2585.500	0.000	Reject the Ho.	Highly Significant
Challenges with AI in Academic Integrity	4353.000	0.767	Retain the Ho.	Not Significant
Adaptations and Responses to Ethical Dilemmas	3467.500	0.037	Reject the Ho.	Significant
Age				
Perceptions of AI's Role in Academic Integrity	16.944	0.001	Reject the Ho.	Significant
Challenges with AI in Academic Integrity	4.192	0.241	Retain the Ho.	Not Significant
Adaptations and Responses to Ethical Dilemmas	8.149	0.043	Reject the Ho.	Significant
AI Frequency Used				
Perceptions of AI's Role in Academic Integrity	54.445	0.041	Reject the Ho.	Significant
Challenges with AI in Academic Integrity	36.444	0.541	Retain the Ho.	Not Significant
Adaptations and Responses to Ethical Dilemmas	37.385	0.498	Retain the Ho.	Not Significant

The findings in Table 5 reveal key demographic and behavioral influences on respondents' perceptions, challenges, and adaptations related to AI and academic integrity. The results highlight where significant differences exist, indicating how factors such as respondent category, age, and frequency of AI tool usage impact views and behaviors. The fact that students aged 18–24 and frequent users of Grammarly and QuillBot provided higher assessments of AI's role underscores the importance of tailoring educational interventions based on actual user behavior. These tools are seen less as threats and more as academic aids, particularly by digital-native students who are accustomed to multitasking and tech integration in learning.

A highly significant result (H/u = 2585.500, p = 0.000) suggests that students and faculty differ significantly in their perceptions of AI's role in academic integrity. As noted in earlier tables, faculty generally rated AI tools more favorably, emphasizing their potential to enhance learning, while students showed more caution. This may reflect the faculty's familiarity with academic standards and their role in policy implementation, as opposed to students' concern with compliance and performance. No significant difference was observed (p = 0.767), indicating that both groups experience similar difficulties such as uncertainty in ethical usage, concerns about dependency, and lack of clear guidelines. This shared experience suggests a universal institutional gap in managing AI integration, regardless of user role. A significant difference (H/u = 3467.500, p = 0.037) implies that faculty and students adopt different strategies when addressing ethical concerns. Faculty appeared to be more confident in modifying their AI usage and refraining from unethical practices, likely due to greater awareness and a higher sense of accountability, supported by McGrath, et al (2023) proving the greater responsibility of the teachers towards academic integrity.

Significant differences (H/u = 16.944, p = 0.001) across age groups indicate that age plays a role in how AI is perceived. Younger respondents (18–24), who are more tech-savvy and immersed in digital tools, reported more favorable views on AI's academic value. This reflects digital nativeness and familiarity influencing attitudes. No

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significant difference (H/u = 4.192, p = 0.241) suggests that regardless of age, respondents encounter similar challenges. These may stem from systemic issues like lack of AI policies, not individual age-related experience. Significant variability (H/u = 8.149, p = 0.043) was observed, suggesting older participants may approach AI with more caution or rely on institutional norms, whereas younger respondents may adjust more fluidly based on peer influence or trial-and-error use. This could imply generational differences in ethical decision-making and risk perception aligning with Klopotan, et al. (2020).

A significant difference (H/u = 54.445, p = 0.041) indicates that those who use AI tools more frequently—particularly Grammarly and QuillBot users—view AI more favorably. These tools are widely used for enhancing grammar, paraphrasing, and structure, aligning with students' desire to improve academic performance. Higher usage likely correlates with greater perceived utility and familiarity, hence more favorable perceptions. No significant differences were noted for either challenges (p = 0.541) or ethical adaptations (p = 0.498). This implies that regardless of how often one uses AI, respondents generally share similar concerns and strategies—suggesting that institutional context, not individual habits, shapes how people respond to ethical issues related to AI, aligning with Du and Xie (2021).

Overall, the findings show that demographic characteristics (especially age and category) and AI usage patterns have significant effects on how individuals perceive and respond to AI in academic contexts, but not necessarily on the challenges they encounter. This suggests a shared institutional experience of navigating AI integration, but different personal interpretations and coping strategies based on role, maturity, or tool exposure.

Conclusion

The study revealed important insights into how faculty and students in a private university in the Philippines perceive, experience, and adapt to the integration of artificial intelligence (AI) in academic settings, particularly in relation to academic integrity. The majority of respondents were students aged 18–24 who frequently used general-purpose AI tools such as ChatGPT, QuillBot, and Grammarly. This high level of AI tool usage among students indicates growing reliance on digital tools to support academic tasks, highlighting the need for targeted ethics training and responsible usage guidelines tailored to the digital habits of younger learners.

Findings showed that faculty members had stronger positive perceptions of AI's role in enhancing academic work and learning outcomes, while students were more cautious, indicating a perceptual gap between the two groups. Significant differences in perception were also observed across age groups and frequency of AI use, with younger and more frequent users tending to assess AI more favorably. These results suggest that familiarity with and exposure to AI tools play a role in shaping how individuals view their academic value and ethical implications. Institutions must therefore consider these differences when designing policies and programs, ensuring that all voices are considered to foster shared understanding and responsible integration. Despite these differences in perception and adaptation, both faculty and students consistently identified similar challenges in using AI, such as difficulty in determining ethical boundaries, risk of overdependence, and the lack of clear institutional guidance. This indicates a systemic gap that affects all stakeholders, regardless of age or experience. Moreover, while faculty were more likely

to seek guidance and support ethical policy creation, students showed less confidence in addressing AI-related dilemmas. These findings imply the need to empower students with the tools and knowledge to make ethical decisions, as well as to provide stronger faculty leadership in mentoring responsible AI use.

Overall, the results emphasize the importance of developing clear, inclusive, and practical institutional policies that address the ethical use of AI tools in academic work. There is a critical need for integrated ethics education, faculty-student collaboration, and digital literacy programs that consider usage behaviors and demographic characteristics. With this, educational institutions can help ensure that the benefits of AI are maximized while maintaining academic integrity and promoting a culture of trust, transparency, and accountability in this modern digital world.

Recommendations

Based on the findings of this study, it is recommended that the university develop and implement a comprehensive policy on the ethical use of AI in academic settings. This policy should clearly define acceptable and unacceptable uses of AI tools, provide concrete examples, and be regularly updated in response to emerging technologies. Alongside this, ethics education should be embedded within the curriculum through workshops, classroom discussions, and digital modules to build awareness and understanding among students and faculty. Special focus should be given to younger students and frequent users of AI tools, who may rely heavily on these technologies without fully grasping their ethical implications. Faculty members, given their stronger grasp of academic standards, should be empowered to serve as mentors, guiding students in navigating ethical dilemmas and promoting open dialogue around responsible AI use. Furthermore, the university should create platforms for continuous consultation and collaboration between stakeholders, including faculty, students, IT staff, and academic affairs personnel, to ensure that institutional responses remain relevant, inclusive, and adaptive to the evolving academic landscape. These efforts will not only safeguard academic integrity but also prepare students and educators to engage critically and ethically with AI in their academic and professional lives.

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Beyond the Numbers: Breaking Down the Silos through Integrative Assessment Tool for Cross Disciplinary Learning in Higher Education

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Abstract: So much has changed in the academe, most especially in terms of assessment. In the 21st century, cross-disciplinary learning is critical not only to develop the learners holistically but to ensure that they are equipped with the necessary skills needed to succeed. Studies reveal that Integrative assessment tools (IAT) have the potential to promote cross-disciplinary skills, but little is known about their effectiveness in higher education. The study aims to explore the current assessment practices employed by the NU Lipa faculty, as well as the students' and teachers' perspectives on IAT for cross-disciplinary learning. The study also seeks to examine the impact of the IAT on the holistic development of students. Additionally, the study sought to identify challenges encountered in the implementation and utilization of the IAT and how they will be addressed. The study utilized a triangulation approach, combining observation, focus group discussions (FGD), and personal interviews, to obtain a comprehensive understanding of the issue. The findings of this study have the potential to provide additional information that may be used for action planning in higher education settings and contribute meaningfully to the literature on cross-disciplinary learning and integrative assessment. Finally, the study aimed to improve the quality of education and better prepare students for the challenges of the modern world.

Keywords: Beyond the Numbers, Silos, Integrative Assessment Tool, Cross-Disciplinary Learning

Introduction

In today's dynamic world, the importance of cross-disciplinary learning cannot be overstated. In a nutshell, cross disciplinary learning is a pedagogical approach that incorporates cognition and other skills from a myriad of academic disciplines to generate innovative and creative solutions that may benefit the academic community, particularly the students and teachers. This approach has been proven to foster creativity, innovation, and collaboration, thereby allowing students to gain a deeper perspective and holistic understanding of the world. Integrating knowledge and skills from different disciplines is proved to develop more sophisticated and creative solutions to pressing social and environmental hurdles.

The method also prepares the learners for the demands of the modern workforce, where multidisciplinary approaches and innovative problem-solving skills are highly emphasized and encouraged. CDL is therefore an important aspect of education that encourages lifelong learning and personal growth. The approach has garnered positive feedback from the Basic Education Curriculum but little is known about this in higher education, thus it is but timely the explore the prospects of adopting the same in HEIs. Results of the study will be helpful to the educators and policy makers to come up with a modified assessment tool that may be used for in the future.

The study generally aims to explore the prospects of adopting an integrative assessment tool to promote cross-disciplinary learning. Specifically, it seeks to answer the following questions: 1. What are the current assessment practices employed by the NU faculty; 2. How do the teachers perceive the implementation of an integrative assessment tool for cross-disciplinary learning in terms of: 2.1. Attitude towards integrative assessment complexity of integrative assessment; 2.2. Perceived benefits of integrative assessment; 2.3. Self- efficacy and confidence in using integrative assessment; 2.4. Perception of fairness and equity; 2.5. Feedback and assessment; 3. What challenges do teachers face when employing integrative assessment; and, 4. What program or course of action may be proposed based on the findings?

Framework

The philosophical assumptions underlying the multi-dimensional assessment model reflect a student-centric approach which is significantly aligned with the Latin origin of 'educer,' which means to lead out or develop potential. This coincides with the definition 'educate' which emphasizes to providing intellectual, moral, and social instruction to individuals. This philosophical foundation contends that assessment and learning should be tailored to the unique needs of each student, rejecting siloed approach in favor of personalized development. This theory serves as the foundation of the current study which highlights the importance of crafting assessment based on the diverse needs of learning. This model proposes that flexibility is necessary in evaluating the performance of the learners.

Moreover, the model introduces the concept of content mastery through five levels of learning: Awareness/Information, Encounter/Knowledge, Interaction/ Understanding, Engagement/Wisdom, and Creation/Love. As compares to traditional assessment models which often fall short in motivating students to

progress beyond the Encounter/Knowledge level, this approach promotes student engagement. In addition, MDA model advocates for assessments at level three and beyond, particularly for students specializing in specific fields. This is so because it seeks to develop higher order of thinking skills among students. The emphasis on assessing interaction, engagement, and creation as indicators of individual scholarly development challenges the relevance of standardized assessments that treat students as mere information receptacles. This assumption forms the basis for the model's assertion that learning at higher levels can be deduced through the measurement of Academic Proficiencies and Outputs. Learning comes in many different forms, and it is not dependent solely in remembering concepts. The five levels mentioned emphasized the ways in which one learns the content. The theory proposes that motivation as a driving force in learning must be tapped to promote students' engagement. When the students are engaged there is a great likelihood that they learn better. Moreover, cross-disciplinary assessment impetuses the development of higher order of thinking skills of learners.

Finally, the goal of assessment is the improvement of the six types of academic proficiency, to wit: observation, communication, organization, execution, specialization, and innovation. They form the core of the assessment plan which is anchored on the assumption that fluency in those proficiencies equips the learners to master learning in any field. Hence, assessment must revolve around measuring those proficiencies and leveraging the results to attain optimum and personalized learning among learners. To attain this goal, the incorporation of output opportunities as a crucial element in the multidimensional assessment model underscores the holistic approach. Students are encouraged to participate in at least one output opportunity within their respective program. The four factors of learning—inputs, learning tools, people, and output opportunities—go against the traditional focus on input recall by guiding students to develop their learnings through diverse methods and interactions with a wide range of people and discipline.

The purpose of assessment, according to this model, is to empower learners by helping them discover their knowledge and providing a framework for educators. This purpose goes beyond measuring quantitative aspects of learning but may include diverse strategies that may harness optimum potentials of the students. Also, the scope of assessment extends beyond measuring the reception and duplication of information. It also delves into examining student methods of learning, attitudes toward learning, performance relative to ability, and the practical application of content to their fields of interest.

Method

Research Design

The study utilized a qualitative phenomenological study to come up with an in-depth understanding of the role of integrative assessment in the holistic development of learners. A phenomenological study is a qualitative research design that aims to explore people's lived experiences about a certain phenomenon. It also involves collecting and analyzing non-numerical data to gain a better understanding of people's beliefs, attitudes, behaviors, and experiences. This fits the current study considering that it focused on the experiences of the learners and teachers on the integrative assessment tools.

Context and Participants

Participants of the study were the faculty members of the National University - Lipa Campus. They were drawn using the pre-defined criteria to wit: The participant must be a faculty member of the university; He/She must have some experience with integrative assessment tools; and He/she must be willing to participate in the study.

Instrument

The study adopted a qualitative-phenomenological approach, hence, the researchers adopted qualitative methods such as observation, interviews, and/or focus group discussions to collect detailed and descriptive data on the participants' experiences. Specifically, a semi-structured interview protocol that includes open-ended questions that encourage participants to reflect on their experiences with integrative assessment was utilized in the study. The interview protocol was designed to elicit rich descriptions of the participants' experiences, including their perceptions of the impact of integrative assessment on their teaching experiences.

Data Gathering Procedure

Proper protocols in data gathering were observed. First, the researchers sought permission from the concerned participants. After the first step, a semi-interview protocol was administered, including FGD and personal interviews for a deeper understanding and analysis of the issue.

Data Analysis

The study adopted Braun and Clarke's thematic analysis approach as one of the most trusted qualitative approaches in the modern era. Thematic analysis is a qualitative research method used to identify, analyze, and report patterns within data. Their approach to thematic analysis involves an iterative process consisting of six steps: (1) becoming familiar with the data, (2) generating codes, (3) generating themes, (4) reviewing themes, (5) defining and naming themes, and (6) locating exemplars. Firstly, the researchers used a deductive approach to come up with the initial themes. Secondly, the qualitative data collected from the semi-structured interview protocol, in-depth interviews, were coded, to determine the recurring themes.

After the coding procedure, the data were categorized into themes and sub-themes. The themes and sub-themes were reviewed and revised several times to ensure that they accurately reflect the data. The results of the study will be compared to the existing studies and literature. Data were analyzed using both deductive and inductive reasoning to identify patterns, relationships, and meanings within and across the data. The findings of the study were interpreted by writing a narrative that captures the key themes, patterns, and meanings that emerged from the data. Quotes from the data were used to support analysis. Researchers also underwent thorough reflection during the analysis process, reflecting on their own biases and assumptions that may have influenced the analysis and interpretation of the data.

Results and Discussions

Current Assessment Practices Employed by National University Faculty

Assessing students' performance is a primordial concern in the academe. Proponents of traditional assessment method value cognitive assessment as the foundation of knowledge. On the other hand, modern educators do not only consider traditional ones but are exploring other means to objectively assess students' performance. Assessment is an essential part of the teaching-learning process. By using a variety of assessment types, teachers can gather information about student learning and make informed decisions about instruction. Students can also benefit from assessment by developing their self-assessment skills and learning from their mistakes. After scrutiny of the coded answers of the informants or participants, the following themes on current assessment practices of the participants have emerged:

Traditional assessment

National University uses a variety of assessment practices to gather information about student learning. The most common types of assessment are pen-and-paper assessments and performance-based assessments. Pen and paper assessments are typically used in major subjects. Lecturers handling major subjects and general education subjects that are directly related to the discipline or specialization often give written examinations. They argued that learners must be familiar with the basic concepts and myriad exercises to better prepare them for the licensure examination as a passport to be successful in their field. Key informant quoted statement revealed:

> "*We have to use written examination to our students because in written examination, we could be able to test the real cognitive abilities and retention of the students about important concepts related to their profession.*" *Mere presentations will not suffice to instill the curriculum content that they need to be familiarized with*".

> "*As much as we would like to adopt cross-disciplinary assessment or integrative assessment, the subjects we are handling require that the students are familiarized with different concepts and processes of the subject as a preparation to the board exam and the workplace. We believe that the students learn better when they are they are given exercises and assessment that are measurable and mirror the types of test given during the licensure examination.*"

Several research implications were drawn from the observation that most professors or instructors teaching major subjects are leaning towards the use of written exams or pen-and-paper evaluation. These implications were classified into main areas, to wit:

Standardized Assessment and Objectivity

While most NU lecturers adopt cross-disciplinary assessment, full-time faculty lecturers argued that written exams and pen-and-paper evaluations provide a standardized way to assess student learning, allowing for easy comparison of student performance across different courses, instructors, and institutions. This standardization can be particularly important for major subjects, where there may be a higher demand for consistency and objectivity in grading. Here is a lifted statement from the participant:

> *"Written examinations are more objective than performance-based assessment. Written exams not only their cognitive but also other skills such as analysis, synthesis, evaluation, and many others"*

Interestingly, this was confirmed in the findings of Somannavar (2019) where he argued that written exams are a common method of assessment in various educational settings due to their perceived objectivity and standardization. However, traditional written exams have limitations, such as the lack of cross-checking by subject experts, under sampling or oversampling of content, and the focus on simple recall rather than problem- solving abilities (Corrigan, et. al., 2013). To address these limitations, various solutions have been proposed, including structuring essay questions, preparing blueprints and scoring rubrics, training subject experts, and using multiple raters. Additionally, there is a new approach called the student-written exam, where students write and answer their exam questions, which has shown positive results in terms of relevance, student involvement, and stress management. It is important to consider these factors when using written exams as a standard assessment method to ensure objectivity and effectiveness in evaluating student learning (Barrows, et. al., 1987; Waldmann, et. al., 1993; William, 1996.

As much as integrative assessment offers an alternative assessment that may unveil holistic skills of the students, lecturers teaching major subjects at NU believe that written exams and pen-and-paper evaluations are specifically designed to assess a range of cognitive skills, including comprehension, analysis, synthesis, and evaluation. These higher-order thinking skills are essential for success in many major subjects as a prelude to licensure examinations. Moreover, written exams also provide a reliable way to measure student proficiency in the areas mentioned. While several studies are pointing to the advantages of written examinations on students' performance, most of the studies were conducted in the past. Recent studies, however, highlighted the advantages of using cross-disciplinary assessments for the students' optimum performance.

Promoting Academic Integrity

Written exams and pen-and-paper evaluations can help to promote academic integrity by making it more difficult for students to cheat or plagiarize. This is because written exams typically require students to work independently and demonstrate their knowledge and understanding of the material. In addition, the use of written exams and pen-and-paper evaluations for major subjects can provide a standardized, objective, and reliable way to assess student learning. These assessments can also help to promote academic integrity by making it more difficult for students to cheat or plagiarize. Here is the statement from the participant:

> *"Written examinations promote academic integrity. Students can plagiarize the assessment unlike in group activities where everything can just be googled and found online".*

Furthermore, subsequent studies revealed that promoting academic integrity through written examinations or pen-and-paper evaluation can be achieved by personalizing assessments, embedding assessments into learning and teaching strategies, and providing timely feedback to students. These approaches aim to decrease instances of academic dishonesty while promoting student engagement and developing skills associated with academic integrity. Additionally, the use of open-book written exams, project, and practical exams, and testing with a

proctoring system can help maintain academic integrity during pen-and-paper evaluations. It is important to consider individual differences and tailor educational interventions accordingly when designing and implementing strategies to promote academic integrity. Additionally, gathering data on academic misconduct, analyzing trends, and engaging students through relevant mediums and methods can also contribute to promoting academic integrity (Egan, 2018; Daraja, et. al., 2022; Zivcakova & Wood, 2015).

Cross-Disciplinary Assessment

Unaware of the adopted practices, faculty members of NU have been utilizing integrative or cross-disciplinary assessment, especially in general education subjects. Teachers may collaborate to serve as a panel of a specific task assigned to groups with other teachers. On the other hand, grading the students is still done independently depending on the task that faculty are assigned to. If done properly, the faculty members believe that collaborative assessment may be beneficial for both the faculty members and students considering the volume of tasks that are needed to accomplish on a day-to-day basis. This is supported by a recent study that revealed that cross-disciplinary assessment can be an effective way to promote student learning. Moreover, it can help students to see the connections between different subject areas and to develop their critical thinking and problem-solving skills (Brown, 2023).

National University faculty also use a variety of other assessment methods, such as role-playing, project proposals, research proposals, concept papers, dance presentations, and sports. These assessment methods are often used to assess higher-order thinking skills and to promote student engagement. Cross-disciplinary assessment is also prevalent among National University faculty. For example, students in the English department and the History department might collaborate on a research proposal about the history of the English language. Students in the Science department and the Art department collaborate on a project to design and build a model of a sustainable city.

These observations were similar to the study conducted by Jones (2023) who revealed that the type of assessment used in a particular subject area is often influenced by the nature of the subject area. For example, in subjects such as math and science, pen-and-paper exams are often used to assess students' knowledge of concepts and procedures. In subjects such as the arts and humanities, project proposals and research papers are often used to assess students' critical thinking and writing skills. In the present study, participants highlighted that pen-and-paper test or evaluations are a common practice for those faculty handling major subjects. Here is the actual answer lifted from the Focus Group Discussion:

> *"We practice pen and paper for major subjects and PT mostly for General Education subjects. Faculty of general education subjects give mostly performance tasks considering that what the subjects require important skills that the students need to possess in preparation to a higher level of learning and the workplace."*

Participants emphasized that cognitive evaluation is the foundation of knowledge especially for those programs that require licensure examinations. "It is imperative that we also test the cognitive ability of the learners to be able

to know their readiness in recognizing and remembering concepts that may appear in the licensure examinations", a statement lifted from another participant. It may be observed that many of the programs offered at NU require licensure examinations, to wit: Nursing, Medical technology (MedTech), Architecture, Engineering, and Accountancy. Only Information Technology (IT) and Business Administration (Financial Management, Marketing) do not require licensure examinations. This explains the adoption of pen-and-paper evaluation as an assessment of students' learning.

It is worth noting, that though traditional examination and testing were still necessary in major subjects it needs to be modified to meet the learning needs of learners (Harris, 2005). He further that it has a role in asynchronous learning. However, recent studies disproved his findings. A recent study found that traditional assessments may not be helpful for every student's learning style, so it is important to consider non-traditional assessment methods in major courses. To illustrate, assessments in biology courses can be non-traditional as non-traditional assessments engage students and evaluate learning (Potvin, 2015).

Similar results were revealed by Ying-jun (2019), who posited that traditional assessment in major courses has disadvantages such as misconception of assessing techniques and purposes, rigid evaluation forms, and unreasonable contents. To prove her point, she describes the traditional method of assessment as a rigid evaluation form, unreasonable, and unscientific. Despite the call to limit if not abolish the traditional modes of assessment, Smith (2023) found that the most common types of assessments used in higher education are pen- and-paper exams and essays. However, the study also found that there is a growing trend towards using more authentic and performance-based assessments, such as role-playing and project proposals.

Finally, cross-disciplinary assessment is important in teaching in higher education because it allows for the development of interdisciplinary modules or courses that can benefit both students and educators. It promotes meaningful learning and active engagement of students in the acquisition of knowledge and skills. Assessment plays a crucial role in shaping the student experience and influencing their behavior, making it a powerful tool for improving teaching and learning. Cross-course peer grading, for example, can be an effective way to adapt to budget constraints and limited resources in online instruction, while also providing educational benefits for both those doing the grading and those whose work is graded. By implementing cross-cultural assessments, equivalence can be assured, leading to international benchmarks and quality assurance in teaching and learning. Overall, cross-disciplinary assessment enhances the learning experience, fosters active learning, and improves teaching practices in higher education (Richardson, et. al.,2014; Gardner, 2017; Oliveira, et, al., 2015; Vander, et. al., 2022; Sambell, 2016).

Teachers' Perception on the implementation of Integrative Assessment Tool for Cross-Disciplinary Learning Attitude of Teachers towards Integrative Assessment

Teachers are welcoming and practice cross-disciplinary assessment

The theme suggests that National University Faculty members are open to using integrative assessment and are

willing to collaborate to implement it. This is evident in the fact that they practice cross-disciplinary assessment and collaborate during major examinations. To be more specific, general education faculty members often collaborate during major examinations. Collaborative assessment or integrative assessment was often the type of examination given by faculty members from at least two disciplines. The teachers ensure that they find a common ground or activity that will fit into the needs of the learners.

Though a plethora of studies do not tackle the acceptance and attitude of teachers towards integrative or cross-disciplinary assessment, some studies suggest that adopting the same may positively impact the learning experience of learners. It was also suggested that cross-curricular assessment works best when children adopt it as part of the integrated classroom experience. However, a caveat must also be observed as assessment techniques need to change to match educational thinking (Taylor, 2015).

> "*We give our 100% support with the adoption of cross-disciplinary assessment so that teachers will have the chance to work with others. Aside from that, CDA allows the teachers the leeway of designing their assessment in a creative and meaningful way*".

> "*Integrative assessment is a great avenue to showcase not only the cognitive ability of the learners but other aspects of their talents and personality. For me it is a big yes.*"

A similar study valued integrated curricular approaches for their effectiveness in teaching, including increasing student interest, developing critical thinking, and promoting class cooperation. On the other hand, what hindered from adopting the same was the lack of experience and knowledge in interdisciplinary planning among teachers. It may also be observed that limited integration is achieved within taught disciplines (Tudor, 2014).

Finally, though other faculty members are still hesitant to adopt cross-disciplinary assessments, most faculty members in general education have started utilizing the same in their respective subjects. However, adopting integrative assessment is limited to collaborative tasks given to students, and grading is still done separately.

Perceived Complexity of Integrative Assessment

Teachers consider integrative assessment as not that complex. It gives opportunity to the teachers to interact and be familiar with one another. However, there are several reasons why integrative assessment may be burdensome to students. At National University, most teachers do not consider integrative assessment as being overly complex despite the hesitation during the initial stage. Instead, they see it as an opportunity to interact and get to know each other better. This is important, as it can help to build trust and collaboration among teachers.

Initially difficult to implement and understand

At first, teachers perceive this assessment strategy as being difficult to implement and understand. This is likely because cross-disciplinary assessment is a different approach to assessment than many teachers are used to. This is the lifted statement from the key informants:

> "*At first there were hesitations. It is normal if someone needs to go out of his/her comfort zone. But as the days pass, we are getting used to it and it becomes part of our* system".

"NU has just started and definitely it is still an adjustment for us to even deal with new environment and people." However, as soon as the semester started, we were able to adjust because we are all professionals, and we are here for a common goal."

Teachers encounter challenges in the complexity of integrative assessment. They find it difficult to implement formative assessment as it requires a complex set of skills. Training teachers to understand that assessment is more than just marking students' work is necessary. Group work assessment is also seen as a challenging and complex practice for teachers. Teachers need support in meeting their needs regarding formative assessment and improving their professional development programs. Classroom and large-scale assessments are needed to make clear the nature of students' accomplishments and progress in learning. Finally, teachers face challenges in implementing and understanding the various forms and purposes of assessment, requiring support and training to effectively navigate the complexity of integrative assessment (Longxi, 2022; Pellegrino & Goldman, 2017; Forsell, et. al., 2021'; Houck, et. al.).

Burdensome for students if not explained carefully

Teachers also perceive thematic assessment as being burdensome for students if it is not explained carefully. This is because this assessment requires students to think critically and connect concepts across different subjects. If the assessment is not explained clearly, students may become confused and frustrated. Lifted statement from the FGD revealed:

"Students would be discombobulated or baffled if not explained the objectives and grading system. However, they would express a sigh of relief once they understood it. Eventually they embrace the assessment." "Adjusting to everything has always been a challenge and the same goes to assessment. No matter how good the plan is if it is new, it is still burdensome for many. In assessment, integrative assessment is still hard for students because it requires preparation and creativity."

Integrative assessment can be burdensome for students due to various factors. One of the challenges is the heterogeneity of students in classrooms, which can create obstacles in formatively assessing learning. Additionally, the pressure of multiple learning demands can prevent effective engagement in assessment. Another barrier is the complexity of designing effective assessments that stimulate learning, especially in the presence of disciplinary and contextual dimensions. Furthermore, nursing students face barriers in performing physical assessments, which can hinder their successful performance. These barriers include personal challenges, challenges related to nursing education, and challenges related to clinical practice. Overall, the burden of integrative assessment on students can be attributed to the need for equitable assessment practices, recognition of strategies to facilitate the uptake of formative assessment, and the integration of constructive and competency-based teaching methods (Arslan, 2022; Jenkins; 2010; Kamardeen, 2014; Maniago, et. al., 2021).

Consequently, teachers consider cross-disciplinary assessment as being fair and beneficial for students once they understand it and are used to it. This is because this assessment strategy allows students to demonstrate their learning in a more authentic and meaningful way. It also encourages students to collaborate and work together which is essential for the successful implementation of integrative assessment.

Perceived Benefits of Integrative Assessment

It is beneficial for both the teachers and students, students will not be required to work on separate tasks, teachers will not be required to write long test papers, and teachers may also learn from the techniques and strategies of others. The lifted statement below was used as the basis of the analysis of the researchers:

> *"There is a plethora of advantages for both the teachers and students. Well, for teachers this assessment means less workload, preparation, and hassles. Teachers may just focus on instruction and probably other important tasks that may require of us from time to time. Students on the other hand, may just focus on core subjects to study. For sure, this will translate to a more competitive group of graduates soon'.*

Reduces workload

This suggests that teachers view integrative assessment as being beneficial for both them and their students. They believe that it reduces the workload on students, as they do not have to work on separate tasks for different subjects. It also reduces the workload on teachers, as they do not have to write long test papers for each subject. Additionally, teachers see integrative assessment as an opportunity to learn from each other's teaching techniques and strategies as the lifted statement highlighted:

> *"It is a great avenue for us to collaborate and learn from one another. Two heads are always better than one, so it is advantageous for us to adopt this method instead of the traditional pen-and-paper test".*

Those statements were in sync with those of Anditchi and Stratan (2022) who found that integrative or cross-disciplinary assessment has several perceived benefits. They emphasized that this mode of assessment helps in creating connections between different entities such as content units, competencies, and skill units, which are usually formed and assessed disparately within different subjects.

Fosters the development of skills

Similarly, the same assessment was believed to help foster the development of several graduate attributes and enhance the constructive alignment of the curriculum, which is important for creating 'global students' in an increasingly competitive and internationalized job market. It also provides opportunities for faculty to engage in cross-disciplinary Scholarship of Teaching and Learning (SoTL) projects, allowing them to exchange ideas about effective teaching and improve student learning.

Furthermore, integrated Assessment (IA) projects, which involve stakeholder input and diverse perspectives, have been shown to increase knowledge and understanding of sustainability issues, create new policy perspectives and processes, leverage new resources, and build coalitions that would not otherwise exist. Finally, cross-curricular pedagogy, through collaboration on common projects, improves students' confidence in solving interdisciplinary problems and enhances their understanding of the connections between different disciplines (Karadzhov, et. al., 2021; Rahman, et. al., 2020; Lund, et. al., 2011; Feinstein, 2022). Integrative assessment allows learners to focus on one performance task that incorporates all the different learning areas. This reduces the number of performance tasks that learners need to complete, which saves them time and effort. It also allows teachers to save time and effort, as they

only need to develop and grade one performance task instead of several.

Self-Efficacy and Confidence of NU Faculty in Using Cross-Disciplinary Assessment

Teachers are generally confident in their ability to use integrative assessment.

Cross-disciplinary assessment is not new to the faculty of the National University. Though limited in application, teachers are familiar with and have basic know-how on when and how to apply it. In terms of self- efficacy in using CDA, teachers believe that it is helpful for them to be effective. Adopting CDA teachers' workloads are reduced and as a result, they can focus on the delivery and preparation of materials relative to classroom instructions. They may also spend their time to better themselves by taking post-degree programs and training that may be beneficial for them in the long run. Here is the lifted statement from the coded response of the participants:

> *"I believe that using integrative assessment in higher education makes me effective because I can focus on important matters. Instead of spending too much time creating or developing assessments, we can just collaborate with others. Aside from that, adopting cross-disciplinary assessment can create a special bond among us and make us united. Here is why in NU we are united despite individual differences. I believe that IA can also help in that aspect of the relationship between colleagues."*

Based on the responses, NU faculty exhibits confidence in the utilization of cross-disciplinary assessments. Here is the lifted statement from the key informant:

> "*I feel confident in utilizing it because I can see the feedback and acceptance of students when I give tasks relative to this type of assessment. Students are very receptive and cooperative. They are the ones initiating and requesting that they be given authentic classroom assessments that are enjoyable and memorable.*"

It is worth noting that teachers' confidence in using integrative or cross-disciplinary assessment varied across the studies. In one study, teachers in physical education and music education reported high levels of confidence in their attitudes and beliefs toward the inclusion of students with disabilities in regular education settings. Another study found that teachers rated themselves highest in effective communication of assessment results, indicating a level of confidence in this aspect of assessment. Additionally, teachers who reported using alternative methods of assessment more frequently also reported feeling more prepared to develop those types of assessments and had more confidence in their validity. However, the specific confidence levels of teachers in using integrative or cross-disciplinary assessment were not explicitly addressed in the previous studies (Chandler, 1995; Hawkins, 2017; Gahan; 2003; Ludwig, 2014; "Teacher Confidence", 2023).

Perception of Fairness and Equity

NU faculty perceived cross-disciplinary assessment as an avenue not only in terms of giving opportunities to students to express themselves creatively but also in assessing their performance. While traditional assessments evaluate the cognitive ability of the students cross-disciplinary assessment allows the learners to unleash other types of intelligences and incorporate them into the course learning outcomes. Analysis of the participants' answers revealed the following themes:

Educational Fairness

Fairness and equity in the academe are important aspects of the teaching process. Teachers must ensure that each learner has an equal opportunity to succeed. Teachers perceive Integrative assessment as an avenue to promote educational fairness as this strategy allows the learners to focus on the area of their strength. This further opens an opportunity for them to excel and focus on something that they are interested in. In Psychology, there is a concept of individual differences, and each learner is unique. Each of them has their inclination and here is why it is the teacher's role to tap that specific area and align the assessment strategy that would harness that skill or area.

Cross-disciplinary assessment plays a crucial role in promoting fairness in the educational landscape. It allows for the transfer of knowledge and models across institutions, which may pave the way to improved students' learning outcomes. Through these assessment models, institutions can achieve similar performance to locally- trained models without sacrificing fairness. Cross-disciplinary assessment also helps in identifying and addressing biases in assessment models, ensuring that all types of learners, including those with unique characteristics, are treated fairly. Finally, it was recommended that to promote fairness in the classroom, assessment should consider the dynamic relationship between assessment, teaching, and learning, and prioritize fairness in supporting student learning (Xonzoda, 2022).

There are several factors contributing to fairness in assessing the performance of learners. These include unbiased assessment methods, resource allocation, and access to educational opportunities. In assessing the performance of the learners, traditional schools adopt rigid assessment practices like pen-and-paper evaluation. However, participants contradict this practice and prefer cross-disciplinary assessment to assess not only the cognitive aspect of the learners but also to evaluate other aspects of their being. Lifted statement from the informant revealed:

"Contrary to the traditional view, cross-disciplinary assessment promotes transparency in assessing the academic performance of the students. It allows us, the teachers to see the hidden gem in every student." Assessment no matter how good is not perfect. Though others may be more advantageous to adopt than others. Cross-disciplinary assessment is no different. There are also some challenges in its adoption. Information obtained from the informants highlighted in the statements:

> *"Challenges could encompass issues like socio-economic disparities, teacher bias, and inadequate support systems. Overcoming these challenges may involve implementing inclusive policies and practices."*

> *"Key barriers may include resource disparities, discrimination, and inadequate support structures. Addressing hese barriers involves equitable funding, anti-bias training, and proactive support systems."*

Above are the areas that need to be considered in adopting an assessment. Teachers must ensure that proper protocols in administering the test are observed. It is also necessary that they prepare the rubric material not only for future use but for objectivity purposes. Transparency is crucial for building trust and ensuring accountability. It allows stakeholders to understand how decisions are made, how resources are allocated, and how student performance is assessed. In terms of transparency, below were the recommendations of the key informants:
"Improving transparency may involve clear communication of assessment criteria, standardized grading practices,

and publicly accessible information about resource allocation. Additionally, involving stakeholders in decision-making processes can enhance transparency."

When utilized properly, IA can unlock the hidden potential of the students. There are some observables and reported cases where some students do not perform well in the written examination but excel in other areas like presentations. Individual differences may be pointed out as the reason behind this.Fairness and equity in integrative assessment are important considerations in various fields, including education. In the field of education, fairness in assessment involves transparency, timely access to results, and meaningful opportunities for students to demonstrate their learning. Strategies for fairer educational assessment include creating a constructive learning environment for diverse students and encouraging evaluative thinking before, during, and after assessments. In engineering education, assessments play a role in both gatekeeping and talent finding, and there is a need to ensure fairness and equity for diverse learners. This can be achieved through culturally responsive assessment practices that capture the strengths of diverse students. In the context of Air Traffic Management, fairness and equity considerations are important in trajectory-based operations, and metrics have been proposed to assess the impact of decisions on the distribution of cost penalties among different users (Xonxoda, 2022; Douglas, 2022; Liu, 2016; Del Pozo, 2012).

Finally, a scrutiny of the findings revealed that cross-disciplinary assessment is useful in different disciplines in the academe. Whether major or general education subjects, there is a greater chance of learning when the learners are immersed with authentic and genuine experiences where they can relate to. In Psychology, it is an established fact that the human brain despite its infinite ability only hold on something that holds significant value. This is the exact same reason why only 10% of the information on average is retained when lecture is given in an auditory manner.

Inclusivity and Opportunity

Cross-disciplinary assessment promotes inclusivity and creates a myriad of learning opportunities not only for the learners but also for the teachers. Students fail the assessment due to varied factors, one of which is individual differences. Each learner learns at a different pace and method. There is no such thing as a one-fits-all assessment because each learner has unique abilities and skills. Therefore, teachers should devise each assessment that will cater varying needs of individuals.

CDA promotes inclusivity. It can serve as a bridge for those learners who may be weak in a specific discipline by working on something that he is good at without sacrificing academic achievement. He or she may just be tasked to focus on something that he is good at and probably perform lesser in a specific activity that would require the skills that they do not perform better at. In an essence, everybody in a class or group may be tasked to participate in an activity where they will be having specific role for each discipline. By integrating the assessment, the learners have chances to learn from others and not only based on the information being fed by the teacher. Subsequently, each one has an equal opportunity to thrive in those disciplines included in the assessment. Here are the lifted statements from the participants:

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"Integrative assessment as part of cross-disciplinary assessment allows all students learn and co-exist in varied disciplines without sacrificing their forte or innate abilities. Not all students can be good at everything; hence, it is very helpful in bridging the gaps in learning. It also opens the window of opportunity for those who may not be good at specific course but performs well with others. For example, those students who may not be good at Math can be given a specific task in other subjects incorporating math subject in the assessment. So, instead of focusing on the computation that he struggles with, he may just be given activity in science or discipline that may be integrated in Mathematics that may allow the student to still be familiarized with those tasks without sacrificing important competencies or learning outcomes expected of the students."

"Effective strategies include differentiated instruction, promoting diverse curricula, and providing support for students with varying needs. Inclusivity can be enhanced through teacher training and creating a welcoming classroom environment."

Cross-disciplinary assessment (CDA) emerges as a promising approach to education, aligning with the understanding that students possess diverse strengths and weaknesses. As highlighted by Smith and Johnson (2019), CDA allows for individualized learning experiences, enabling students to excel in their respective domains without compromising their innate abilities. This approach not only bridges gaps in learning but also fosters a holistic educational experience, as students are encouraged to apply their skills across different disciplines. However, the successful implementation of CDA demands careful coordination among educators and an investment in teacher training programs (Jones et al., 2020). Despite its potential challenges, such as resource intensiveness and the need for seamless integration, CDA presents an opportunity for students to familiarize themselves with tasks in subjects where they may struggle while retaining crucial competencies (Brown & Williams, 2018).

Effective strategies for inclusivity, such as differentiated instruction and diverse curricula, further enhance the educational landscape. According to a study by Martinez and Garcia (2021), differentiated instruction accommodates diverse learning needs, ensuring that each student receives tailored support for optimal understanding and engagement. The promotion of diverse curricula, as suggested by educational theorists like Anderson (2017), contributes to representation and relevance, addressing the varying interests and backgrounds of students. Moreover, creating a welcoming classroom environment through teacher training has been shown to positively impact inclusivity (Johnson et al., 2018). As schools embrace these strategies, consistent implementation, ongoing assessment, and community involvement emerge as essential components, ensuring that inclusivity becomes a cornerstone of a positive and supportive educational culture (Garcia & Smith, 2019).

Finally, ensure that inclusivity is attained in giving assessment, teachers need to consider not only the cognition but also other skills of the students. Teachers must be very clear to the purpose of his/her assessment and prepare the activity or the assessment task that would cater those needs. In Tai (2023), assessment has multiple purposes. One of those is to determine if students have met learning outcomes at the requisite level. It has been reported that low performance in traditional assessments frequently posed a problem for the students which was attributed to students' diversity and/or background characteristics. Additionally, the assessment might also be inequitable and therefore exclude students inappropriately. To be inclusive, assessment design needs to be reconsidered, and

educators should look beyond simplistic categories of disability or social equity groups, towards considering and accounting for diversity on many spectra. This article introduces the concept of *assessment for inclusion*, which seeks to ensure diverse students are not disadvantaged through assessment practices. Assumptions in assessment design are problematized from this point of view, and three central concerns relating to assessment traditions, assessment expectations, and academic integrity are interrogated. Contemporary design strategies of authentic assessment, programmatic assessment, and assessment for distinctiveness are then harnessed to illustrate approaches to assessment for inclusion. Assessment for inclusion therefore builds on the synergies between inclusive practice and good assessment design (Tai, et. al., 2023).

Transparency and Trust

Within the context of cross-disciplinary assessment, this theme highlights the importance of transparency and trust. It involves practices that ensure assessment methods are clear, consistent, and trustworthy. Simply put, in the adoption or utilization of CDA, students and educators should have confidence in the fairness and impartiality of the assessment process.

> *"Cross-disciplinary assessment is best at unveiling the hidden intelligence among students. It harnesses not only the cognitive aspect of their brain, but it allows them to develop holistically thereby harnessing their full potential. Cognitive is just an aspect of their brain so the teachers should craft their assessment in such a way that their other skills and abilities will be honed."*
>
> *"This assessment prioritizes other aspects of students' personality. Developing other aspects of human is also important. It's not just about the grades; it's about the students themselves. Here is why CDA can be really trusted. I believe that it can be the start or a more holistic approach of individual's development."*

Integrative assessment emerges as a pivotal strategy for instilling transparency and trust in educational practices. Acknowledging the diversity of students' strengths and weaknesses, IA facilitates an inclusive learning environment. Smith and Johnson (2019) emphasize the significance of CDA in addressing individual learning needs, ensuring that no student is left behind due to challenges in a specific subject. This tailored approach not only enhances transparency but also builds trust as educators transparently align assessments with students' abilities.

The implementation of IA encourages interdisciplinary collaboration among educators, fostering an open exchange of insights and strategies. Brown and Williams (2018) highlight that this collaborative environment promotes a culture of transparency. By sharing assessment methods and successful practices across disciplines, educators contribute to a collective effort in enhancing educational transparency. This interdisciplinary collaboration also allows for the development of more comprehensive and transparent assessment strategies. CDA's impact on transparency and trust extends to the realm of individualized learning plans. Martinez and Garcia (2021) emphasize the potential for CDA to facilitate personalized learning experiences. Through the incorporation of differentiated instruction strategies, educators can address each student's unique needs transparently. This individualized approach fosters trust among students and parents as they witness a tailored educational journey designed to maximize learning outcomes. Moreover, ongoing professional development opportunities for educators, as suggested by Johnson et al. (2018), play a crucial role in ensuring the successful implementation of CDA. Training programs focusing on collaborative teaching methods and cross-disciplinary assessment strategies empower

educators, contributing to a culture of trust in the educational community Inclusive education and cross-disciplinary assessment in higher education have been explored in several studies. One approach is to use accommodations and accessibility features in assessments to promote inclusivity.

Accommodations involve individual changes to assessments, while accessibility features are informed by Universal Design for Assessment (UDA) principles, allowing all students to engage with material flexibly. Another study focuses on the importance of teachers' understanding of disciplinary epistemology to develop a more inclusive form of assessment]. In the field of science education research (SER) and environmental education research (EER), there is a call for theoretical inclusivity by incorporating non-Western theories to create a more robust and just research landscape which is also true and applicable in the Philippine education landscape. Additionally, interdisciplinary learning has been emphasized in higher education to develop students' boundary-crossing skills, and student conditions such as curiosity, openness, respect, and humility have been identified as enabling interdisciplinary thinking (Tai, et. al., 2023).

Feedback and assessment

Positive Impact on Workload

A prevalent theme among the participants is the positive impact of collaborative learning on reducing individual workloads. Students appreciate the lighter burden and stress associated with shared responsibilities. This aligns with the literature highlighting the potential benefits of collaborative learning in distributing the academic workload (Johnson et al., 2014).

Quoted Messages: "Reduce workloads for the students" (Multiple Participants), "Less workload"

The theme further suggests that workload reduction, as expressed by multiple participants through statements such as "Reduce workloads for the students" and "Less workload for teachers," holds significant implications for the implementation of collaborative learning strategies. Due to the volume of the tasks that the participants need to accomplish daily as part of their jobs, CDA may help alleviate this plight and maximize their effectiveness inside the classroom. This perspective echoes the findings of Johnson et al. (2014), emphasizing the positive impact of collaborative approaches in alleviating individual academic burdens. Another key implication is the need for educators to recognize and capitalize on collaborative learning as a viable means to mitigate the stress and workload often associated with individual tasks. It may be observed that teachers are also faced with not only instructions, material preparation, checking, but other duties and responsibilities that might be given to them. Designing collaborative tasks that promote shared responsibilities while maintaining academic rigor becomes paramount. Educators should explore strategies for effective workload distribution within groups, ensuring that tasks are distributed equitably and align with individual strengths.

Moreover, the implications extend to the broader educational context, advocating for a shift towards collaborative pedagogies that prioritize the well-being of students. Institutions could consider incorporating collaborative

elements into course structures, providing students with opportunities to engage in shared learning experiences. This not only fosters a sense of community but also contributes to a more balanced and supportive academic environment. Finally, the identified theme underscores the potential of collaborative learning to alleviate individual workloads and enhance the overall student experience. By embracing this, educators can refine their instructional practices and institutions can cultivate a learning atmosphere that promotes both academic excellence and student well-being.

Subject Integration and Competency Alignment

Assessment is one of the evolving issues in education. The integration of disciplines has emerged as a topic of considerable interest and significance. In this study, participants in the discussions highlight the advantages of collaborating with two subjects. The recurrent theme revolves around the perceived benefits of integrating subjects that share similarities or relevance. This notion aligns with contemporary educational theories and is underpinned by research, such as that conducted by Johnson et al. (2018), which posits that integrated learning not only aligns competencies but also fosters meaningful connections between different domains of study. In delving into the perspectives of the participants, it becomes evident that subject integration holds significant potential in enriching the educational experience and promoting a holistic understanding of diverse concepts.

Quoted Messages: "Collaborating with two subjects," "Marketing in one subject and combined," "Similar/related to one another" (Multiple Participants)

> *"If I would decide, I would push for continuance of this assessment strategy considering that teachers like us are busy. We always divide out time between school works and family life not to mention professional and personal growth. So, this is the first step towards realizing that goal."*

The participants emphasize the integration of subjects, particularly when they are related or similar. This integration is seen as beneficial, aligning competencies, and creating meaningful connections between different areas of study. Research by Johnson et al. (2018) supports the idea that integrated learning enhances students' understanding and application of concepts. The recurring theme among participants expressing the importance of collaborating with two subjects, specifically when they are related or similar, signifies a shared acknowledgment of the value in interdisciplinary education. The notion of "Marketing in one subject and combined" underscores the practical application of integrating disciplines, illustrating how this approach can be purposeful and advantageous. This aligns with the broader concept of interdisciplinary education, which emphasizes the interconnectedness of various disciplines to foster a more holistic understanding of knowledge (Repko, 2018).

The idea of subjects being "Similar/related to one another" reinforces the belief that educational content can be more effectively conveyed when it relates to students' existing knowledge base. This aligns with constructivist theories, suggesting that learning is most successful when new information is connected to prior experiences and understanding (Vygotsky, 1978). The participants' perspective resonates with the argument that subject integration

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aligns competencies, providing students with a comprehensive view that encourages critical thinking and application across domains (Johnson et al., 2018).

The implications of this perspective are substantial. Education programs that purposefully integrate related subjects may better prepare students for the complexities of real-world problem-solving, where issues often require a multidisciplinary approach. Such an approach aligns with the demands of a dynamic job market that values individuals with versatile skills and an ability to navigate across different knowledge domains (Bridgstock, 2009). The emphasis on subject integration, as echoed by the participants, suggests a need for educational institutions to explore and implement interdisciplinary approaches that go beyond traditional disciplinary boundaries. This could result in curricular designs that enhance students' adaptability, critical thinking, and capacity for innovation.

The participants' emphasis on subject integration aligns with existing literature supporting the positive outcomes of interdisciplinary education. Repko (2008) argues that interdisciplinary approaches cultivate a more interconnected understanding of complex issues, encouraging students to apply knowledge from various domains. Vygotsky's (1978) constructivist theories further validate the participants' perspective by highlighting the importance of connecting new information to existing cognitive structures for effective learning. Additionally, Johnson et al.'s (2018) research supports the idea that integrated learning enhances students' understanding and application of concepts. The participants' views on subjects being "Similar/related to one another" resonate with the literature, suggesting that such alignment not only facilitates learning but also contributes to the development of critical thinking skills. Overall, the synthesis of participant insights and relevant literature underscores the potential benefits of interdisciplinary education in fostering holistic learning experiences.

Challenges Encountered in the Implementation of Integrative assessment among NU faculty

Time-Intensive Preparation and Design

Faculty members often find that preparing and designing materials and activities for integrative assessment can be time-consuming. This theme underscores the need for efficient planning and time management to ensure that assessments are effectively executed. Key informant highlighted:

> *"It's great to adopt integrative assessment, however as much as we love to implement it, it is time-consuming and needs expertise to be able to devise such a tool."*
>
> *"It takes some time to be able to finish in the preparation and crafting integrative assessment. It requires commitment and dedication. However, at the end of the day it is all worth it."*

Designing an integrative assessment tool takes time and effort. Commitment and dedication in crafting this are necessary for the teachers. Understanding the learners and how they behave is also paramount to be able to create an assessment that is unique and something that will stimulate the interest of the learners. Today's learners are digital natives, meaning they have grown up with technology and have a natural affinity for it. They are also more independent and self-directed than previous generations. They expect information to be available anytime, anywhere, and they tend to be impatient especially if the activity or the task is something that goes against their leanings. Here is why, it is always a challenge for teachers to make school assessments engaging and interactive.

These characteristics of today's learners have several implications for education. One implication is that educators need to find ways to engage learners in interactive and engaging learning experiences. This scenario poses a great challenge on the part of the teachers considering the volume of the tasks assigned to them not to mention the actual delivery of the lesson. This confirms the former findings which revealed that teachers faced challenges in the preparation of integrative assessment due to poor planning, lack of resources, and inadequate training. The study also emphasized poor planning, preparation, and implementation of curriculum innovation (Silas, et. al, 2021; Suslaningtias, et. al, 2016).

Today's learners are not content to sit passively and listen to lectures. They want to be able to interact with the content and with each other. Furthermore, educators need to provide learners with control over the learning process. Today's learners want to be able to choose when they learn, what they learn, and how they learn. Educators need to find ways to give learners flexibility in their learning. Finally, educators need to find ways to make learning relevant to today's learners. Today's learners are bombarded with information from all sides. They need to see the value of what they are learning and how it applies to their lives. Educators need to make learning meaningful and engaging.

Initial Resistance to Unfamiliarity

Educators face resistance when implementing integrative assessment, especially during its early stages. The unfamiliarity of this approach was also met with apprehension from both students and teachers. Coded responses from the participants revealed the following:

> *"Integrative assessment was new to us, and naturally, there was resistance initially. It takes some time for us to be acquainted on something most especially if it is something that we have little idea about."*
> *"At first, it was not that easy. Adopting to something new is always a struggle for everyone including teachers. So, it is always a challenge, however everything goes smoothly once the transition period is over."*

National University faculty members utilize varied assessment methods but only few of them adopt integrative assessment. Many teachers still go back to the traditional silos in devising assessment. It may be observed that most of the teachers still cling on pen and paper evaluation. They may work in a group through departmental exam but very seldom adopts integrated assessment tool. Moreover, some teachers may use performance tasks but very few are adopting integrative Performance tasks.

> *"We work collaboratively but in grading is done separately."*

In Hong, et. al. (2021) revealed some of the challenges of integrative assessment in education which include the pressure related to instruction, learning, and assessment, as well as the need for changes in theories and practices. Despite the call for integrative assessment, still, the educational sector still faced challenges in its implementation. Inevitably, change must be introduced but change may also be challenging for some, and this is also true with teachers. Thus, the challenges of challenges in education include the need for understanding and implementing the principle of integrative assessment, not to mention the teaching practices. Due to its complexity, one of the recommendations is the adoption of a multifactor approach to assessment (Sutton, 2010).

Lack of Collaboration

Effective collaboration among faculty members from various disciplines is essential for ensuring the seamless integration of assessment methods - a factor integral for achieving alignment with overarching learning objectives. The importance of collaboration becomes evident in the challenges posed by inadequate communication and coordination among teachers from diverse domains. Without robust collaboration, educators may encounter difficulties in harmonizing assessment strategies with the intended learning outcomes. The statement, "Collaboration issues among teachers from different domains hinder our efforts to align assessments with learning goals," underscores the significance of overcoming barriers to collaborative efforts. In this context, fostering improved collaboration emerges as a key solution to enhance the effectiveness of assessment practices in education.

"Collaboration issues among teachers from different domains hinder our efforts to align assessments with learning goals."

Despite the growing interest in integrative assessment, collaboration is found to be a hindrance in furthering this agenda in education. In Thistlethwaite (2012), it was emphasized that educators stressed the importance of integrative assessment and collaboration to deliver authentic learning experiences. He further discussed other challenges relative to its implementation including the difficulty of aligning learning outcomes and the growing focus on individual professional development.

While teachers are exposed to different group dynamics, individual differences are still present among them. Teachers also work better when they are comfortable with the organization not to mention the group or clique, they are working with. Some challenges faced by teachers in collaboration for integrative assessment include constituting professional learning communities, dealing with group demographics and diversity, connectivity and technology issues, and providing feedback and support (Carolina, et, al., 2022). Moreover, they added other challenges such as the knowledge and skills of the teachers, the content of the curriculum, time spent, basic know-how, and the cost that may arise from the said activity. Nonetheless, despite the challenges, it was emphasized that integrative assessment provides plenty of opportunities for active learning so that the students grow and learn better (Carolina, et. al., 2022).

Interpretation Differences

Maintaining fairness and equity in the assessment process is a recurring challenge for faculty. This theme emphasizes the importance of transparent evaluation criteria and methods to address disparities in individual effort and performance within groups. Differing interpretations of the impact of integrated assessments among teachers may pose some serios challenges on the assessment's effectiveness and outcomes.

> *"One of the informants mentioned that "Diverse interpretations of integrative assessment outcomes make it challenging to measure its true impact."*

This implies that teachers may have varying interpretations in adopting integrative assessment and this situation may lead to unfair judgement prejudicial to the learners. The same was reported in the study conducted by Candia and Watson (2022) who argued that assessment in mathematics is interpretative in nature, thus, interpretations of students' achievements can vary among teachers (Candia & Watson, 2022). As a result, inconsistencies in

measuring their performances may also happen. In Rasooli, et. al. (2022), it was revealed that teacher's conceptions and fairness in classroom assessment were influenced by individual and social mechanisms, highlighting the importance of teachers in the success of its adoption and implementation. In a separate study, the same findings were found and added that challenges arose from differences in interpretation criteria, particularly when assessing integrated competencies versus separate skills (Tierney, 2014). However, it is worth noting that the use of rubrics in integrative assessment is often valued by students. They posited that it provides transparency, clear expectations, and evaluation criteria. These are the direct quotes from the participants:

> *"When we introduced rubrics, we noticed a positive change in students' attitudes. They appreciated having clear guidelines." "Rubrics are indispensable in ensuring that students comprehend what is required for successful completion."*

Hence, according to Carol (2021), rubric familiarization and training in its creation and adoption were valuable not only for the teachers but also for future teachers. She also emphasized that rubrics provide consistency in terms of evaluating the outputs of the learners, thus creating fair assessment and judgment based on pre-defined criteria. In addition, she mentioned that fairness in classroom assessment is a complex quality and teachers' professional judgment plays a crucial role. Rubric may also lead to a negotiable consensus between the facilitators and the learners. It was recommended in the study that trainings on rubric making must be included in the faculty development seminars and workshop to enhance teachers' competence in the criteria involved in crafting integrative assessment tools.

Conclusion

National University faculty members exhibit a notable reliance on traditional assessment methods, particularly written examinations, or pen-and-paper evaluations, especially in major subjects requiring licensure examinations. However, a shift is evident in general education subjects, where cross-disciplinary assessments are adopted to foster interdisciplinary learning and collaborations. This dynamic reflects a nuanced approach to assessment, balancing the need for standardized evaluation in major subjects with the benefits of collaborative, integrative assessments. The findings highlight the ongoing differences between established practices and the evolving landscape of the assessment in higher education, emphasizing the importance of adapting other assessment strategies to accommodate diverse learning styles and promote critical thinking across disciplines.

The research conducted at National University (NU) reveals a positive perception of integrative or cross-disciplinary assessment among faculty members. There is a demonstrated willingness among teachers to embrace integrative assessment, especially during major examinations, with general education faculty members already engaging in collaborative assessments across multiple disciplines. Despite some hesitancy and challenges, including the need for a shift in assessment techniques and limited integration within disciplines, the overall perception is favorable. The findings indicate that NU faculty recognizes the complexity of integrative assessment but views it as an opportunity for interaction and mutual understanding among themselves. The perceived benefits include workload reduction, enhanced creativity in assessment design, and the promotion of a holistic understanding of diverse concepts. Despite challenges, NU faculty members express confidence in utilizing cross-disciplinary assessment, highlighting its positive impact on teaching effectiveness and student learning experiences.

The research underscores the importance of ongoing support, training, and clear communication to successfully navigate the complexities of integrative assessment at NU.

The challenges encountered in the implementation of integrative assessment among National University (NU) faculty members encompass several key themes. Firstly, the time-intensive preparation and design required for integrative assessments emerge as a significant hurdle. Faculty members acknowledge the need for efficient planning and time management to execute assessments effectively. The challenge is compounded by the characteristics of today's learners, who are digital natives with a preference for interactive and engaging learning experiences. Secondly, initial resistance to unfamiliarity with integrative assessment is evident, with educators facing apprehension during the early stages of implementation. The resistance stems from the unfamiliarity of this approach, requiring a transitional period for both teachers and students. Despite calls for integrative assessment, some faculty members still revert to traditional silos in assessment design. Thirdly, the lack of collaboration among faculty members from different disciplines poses a substantial challenge. Inadequate communication and coordination hinder the seamless integration of assessment methods, making it difficult to align assessments with overarching learning objectives. Finally, interpretation differences among faculty members regarding the impact of integrated assessments highlight challenges in maintaining fairness and equity. Differing interpretations may lead to inconsistencies in measuring students' performances, emphasizing the need for transparent evaluation criteria and methods. Despite these challenges, the use of rubrics in integrative assessment is valued by students for providing clarity, clear expectations, and evaluation criteria. The findings emphasized the importance of addressing these challenges through faculty development, training on rubric creation, and fostering a collaborative environment to enhance the effectiveness of integrative assessment practices at NU.

Recommendations

Recognizing the existing issues between traditional assessment methods and the evolving educational landscape, National University may encourage a balanced approach to assessment. While major subjects requiring licensure examinations may necessitate standardized evaluations; general education subjects may continue to explore and implement cross-disciplinary assessments. This approach ensures adaptability to diverse learning styles and promotes critical thinking across disciplines, fostering a more comprehensive and student-centered learning environment.

NU may continue to invest in faculty development programs to address the challenges associated with its implementation. Workshops, training sessions, and other institutional support can equip faculty members with the necessary skills and strategies for effective integrative assessment. Focus areas should include time-efficient preparation, collaborative assessment design, and the integration of technology to engage today's digital-native learners.

There is a need for NU to actively encourage interdisciplinary collaboration among faculty recognizing that the opportunities outweigh the challenges. Establishing platforms for regular communication, sharing best practices, and fostering a collaborative culture will facilitate the seamless integration of assessment methods. Faculty

members from diverse disciplines can work together to align assessments with learning outcomes or objectives, ensuring a genuine and comprehensive educational experience for students.

NU may continue to emphasize the importance of clear communication among stakeholders and transparent evaluation criteria to promote integrative assessment. Faculty members may be encouraged to use rubrics to ensure consistency, clear expectations, and fairness in assessment or evaluation. Training on rubric creation may also be integrated into faculty development programs to enhance teachers' competence in crafting effective integrative assessment tools.

The university may develop a supportive policy framework that recognizes and rewards innovative assessment practices. Acknowledging the challenges faced by faculty in transitioning to integrative assessment methods, the policy framework may provide incentives for collaborative efforts, interdisciplinary projects, and successful implementation of integrative assessments. This will further motivate faculty members to embrace change and contribute to the ongoing improvement of assessment practices at NU.Top of Form9. The university may adopt or craft a departmental or cross-disciplinary assessment tool to create a more integrative and holistic assessment experience.

Acknowledgements

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Integrated Logistics Management Model for Metalworking Companies: A Case Study of JIT, ROP, and 5S Implementation

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Abstract: Inventory logistics is crucial for maximizing a company's productivity. It has evolved over the years into a science aimed at optimizing warehouse logistics. The objective of this research was to propose a logistics management model inspired by Just in Time (JIT), Reorder Point (ROP), and 5S tools for companies in the metalworking sector. To this end, an experimental applied improvement design was used, employing engineering techniques through four methodological phases, from diagnosing and analyzing the problem to analyzing the results. The contribution of this research aligns with improving the level of logistical service through the management of inventories and warehouses, aiming to increase customer satisfaction and thus contribute to the development of more efficient logistics management models tailored to the needs of modern companies. The main improvements include a reduction of 6 days in delivery times, an 80% decrease in the percentage of service orders experiencing stockouts, and a 61% reduction in inventory inaccuracy rates.

Introduction

This case study focuses on a metalworking company operating in Lurin, Peru, specializing in the reconstruction and manufacturing of high-quality industrial machinery components. The company primarily serves the mining and construction sectors, offering personalized services tailored to client's specific needs. A core service is the manufacturing and reconstruction of hydraulic cylinders, which involves a process that spans from receiving service requests to production and dispatch. Despite its good performance in recent years, the company faces significant

challenges in its inventory management, particularly in the procurement and management of raw materials, as well as in post-production.

The company under study adopts a minimum inventory policy, maintaining stock levels at 25% for highly used raw materials to address its operational needs. However, this approach frequently leads to stockouts, especially in fulfilling service orders, as the inventory levels is insufficient to meet client demand. Moreover, excessive material waste contributes to the accumulation of obsolete inventory, resulting in significant disorganization within the company's warehouses. Furthermore, the absence of a systematic inventory management system increases these challenges, as evidenced by an alarmingly high inaccuracy rate of 95% in inventory records. These inefficiencies severely compromise the company's logistical service performance, particularly in the order fulfillment and adherence to delivery schedules.

Currently, the company's average order delivery time is 53 days, significantly exceeding the industry standard of 38 days. This technical gap underscores broader technical gaps that extend beyond delivery times; the stockout rate is 80%, compared to an industry average of 33%, while the inaccuracy in inventory records and the obsolescence rate is also significantly higher than sector benchmarks. These inefficiencies highlight the critical need for a systematic approach to optimize the company's logistics processes and improve overall performance.

To address the identified challenges, this research proposes and validates a logistics management model that integrates Just in Time (JIT), Reorder Point (ROP), and 5S methodologies, specifically tailored to the metalworking industry. This proposed approach includes a simulation of JIT and ROP principles to effectively align supply with demand, alongside a pilot implementation of the 5S methodology aimed at optimizing warehouse organization and operational efficiency. Through the application of these strategies, the study seeks to reduce lead times, eliminate stockouts, and improve inventory accuracy, thereby enhancing the company's operational and logistical performance. Although the findings are context-specific to the case study, they offer valuable insights and provide a solid foundation for future research in logistics management within the metalworking sector.

Economic Sector Analysis

The metalworking sector encompassed a wide range of operations, from raw material extraction to product distribution to final consumers (Carrillo et al., 2022). In Ecuador, this sector had the largest participation in the national GDP, accounting for 13% and achieving a growth rate of 2.1%, which generated over 80,000 jobs (Galiano et al., 2019). Similarly, in Colombia, the metalworking sector experienced significant economic growth, representing approximately 6% of the national GDP and creating multiple jobs and collaborative governmental projects (Mercado et al., 2019). In Peru, the sector saw notable growth in recent years, contributing 16% to the national GDP, generating economic activity between one and one and a half billion dollars annually, and demanding a direct labor force of 100,000 people and an indirect labor force of 300,000 (Di Natale et al., 2017).

However, the rapid technological evolution posed challenges for companies to endure over time due to the changing environment and fierce competition (Hernández & Irigoin, 2018). As shown in Table 1, the sector's average delivery

time exceeded the standard by 15 days. Additionally, the percentage of service orders with stockouts, where companies lacked necessary products to meet customer demand, was 67%. The inaccuracy rate in inventory records showed a 27% difference, while the obsolescence rate registered a nominal variation of 32%. The sector analysis revealed issues related to incorrect supply chain management and lack of systematic planning. These challenges, which included storage, production, marketing, procurement, inventory control, distribution, and reverse logistics, resulted in uncertainty and additional costs (Mercado et al., 2019). Moreover, the absence of technical and systematic implementation in planning, organization, and supervision affected the effective management of production processes (Galiano et al., 2019).

Table 1. Sector Indicators (Current Situation vs. Standard)

KPI	Current Situation	Industry Standard	Gap
Order Delivery Time (days)	53 days	38 days	15 days
Percentage of Orders with Stockouts	67%	20%	47%
Inventory Inaccuracy Rate	30%	3%	27%
Obsolescence Rate	37%	5%	32%

Method

The methodological approach initiated with a diagnostic assessment of the company's core challenges. This was achieved by comparing its performance against industry standards and other companies using key indicators: average order delivery time, percentage of service orders affected by stockouts, inventory record inaccuracies, and inventory obsolescence rate. Once the technical gaps in each indicator were identified, root cause analysis was conducted, focusing on delayed order deliveries as the main issue. The identified causes were systematically linked to targeted solutions and their corresponding performance metrics (see Figure 1).
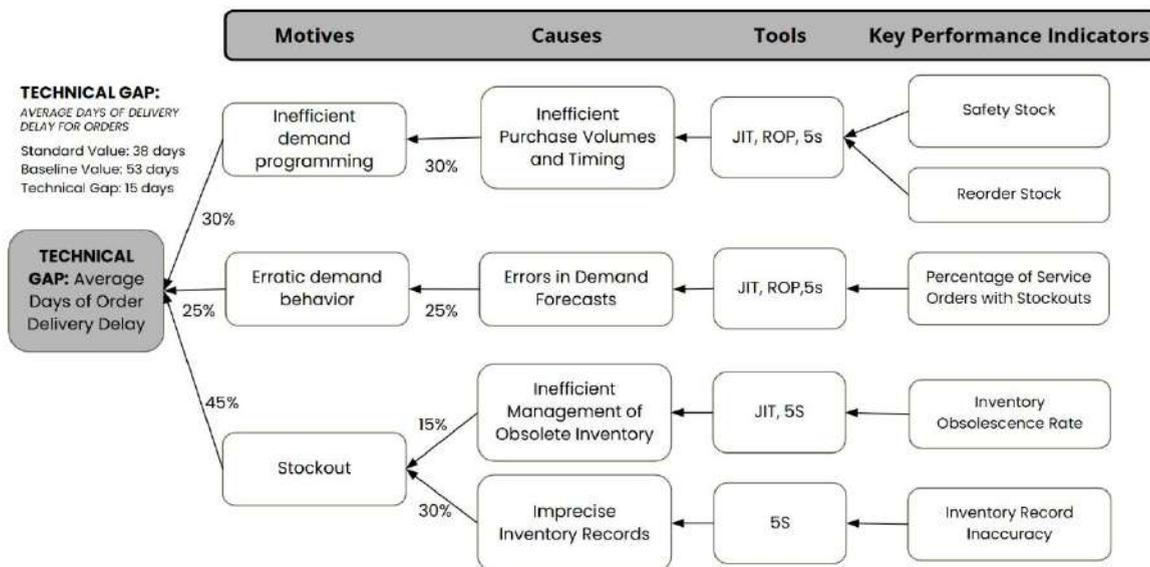
Figure 1. Root Causes Diagram

To address these challenges, a two-part solution was proposed: implementing a logistics model based on JIT and ROP methodologies and applying the 5S philosophy. The JIT and ROP model aimed to schedule material procurement precisely when needed. However, high supplier leads times caused frequent stockouts. To mitigate this, an optimal inventory level was calculated, establishing a reorder point to trigger new orders when inventory levels fell below this threshold. Initially, the JIT and ROP methodologies were implemented through the development of an optimization model. A mathematical framework was established to design a logistics model capable of determination optimal safety stocks levels and lead time for each type of material, both for maintenance and hydraulic cylinder repair purposes. To ensure accuracy, a monthly updated record of lead times and material demand was maintained.

The primary objective of the model was to provide an efficient combination of safety stock and the optimal reorder point, aiming to minimize total costs associated with ordering and inventory maintenance while completely avoiding stockouts. The process involved identifying required parts with their respective monthly demand over the last 12 months, followed by calculating their monthly standard deviation. The logistics model then calculated the average daily demand for each material, extracted the latest lead time data, and normalized the standard deviation in days. The safety stock and optimal reorder quantity were calculated based on established principles of inventory management, incorporating a 95% safety level to ensure the reliability of the results. To validate the model, simulations were performed in Arena V.16, incorporating approximately 385 iterations.

The results from the Arena V.16 simulation were thoroughly rigorously analyzed to assess the effectiveness and robustness of the proposed methodologies. During the validation phase, the initial implementation of JIT and ROP served as the foundation for ensuring the practical applicability and accuracy of the logistics model. After determining an appropriate sample size for simulation iterations, inputs for the model, including lead times and demand data, were collected directly from the case study. Key materials, such as hydraulic tubes, chrome bars, seal kits, pistons, and caps, were selected as the unit of analysis due to their critical role in maintenance and repair operations. The logistics framework was subsequently crafted and structured to facilitate thorough computations and scenario evaluations. The validation of the model was conducted in collaboration with methodological experts and the company's general manager, ensuring alignment with organizational requirements and executive realities.

The 5S philosophy was implemented in the company's warehouses through a series of structured activities designed to enhance organization, cleanliness, and operational discipline. The implementation process required on-site visits to assess the current state of the warehouses and identify areas for improvement. The reorganization prioritized high-turnover materials to optimize retrieval times and improve warehouse efficiency. Unnecessary items were systematically removed to reduce clutter and free up valuable storage space, while storage areas were carefully arranged to facilitate easy access to frequently used materials.

Following the initial validation and pilot implementation of the 5S methodology, further actions were implemented to ensure the sustainability of the improvements achieved. A critical aspect of this process involved integrating the 5S practices into the company's broader operational policies. This included the establishment of a continuous improvement committee responsible for overseeing the ongoing adherence to the 5S standards and identifying

additional opportunities for optimization. Regular feedback sessions were conducted with warehouse staff to assess the impact of the methodology and address any practical challenges encountered during its execution.

Moreover, a performance tracking system was established, incorporating metrics such as retrieval times, inventory accuracy, and space utilization rates. These metrics were compared to baseline figures collected during the Current State evaluation phase to measure the advantages gained from the 5S methodology. This data-focused strategy not only confirmed the effectiveness of the approach but also enabled well-informed choices for expanding the application to other storage facilities within the organization. The thorough incorporation of these metrics made certain that the 5S philosophy became a fundamental part of the company's business culture, promoting ongoing enhancements in efficiency and output.

To ensure adherence to the methodology and monitor progress, a red card system was introduced. This system allowed for continuous tracking and provided a visual indicator of compliance with the established standards. Additionally, routine cleaning and maintenance schedules were instituted to uphold the order and cleanliness achieved during implementation. Comprehensive guidelines and procedures were developed to reinforce these practices, and employees were trained to internalize the principles of 5S. Emphasis was placed on fostering a culture of discipline and personal responsibility, ensuring long-term sustainability of the improvements achieved.

Results

Upon the implementation of the 5S methodology and the V.16 Arena model simulation, a comparative analysis was conducted to evaluate the pre and post intervention scenarios (see Table 2). Regarding order delivery times, there was a significant reduction from the initial 53 days to approximately 47 days. This represents an 11% improvement that translates into faster and more reliable product delivery to customers. The stock out percentage achieved outstanding results by completely eliminating this issue. This implies a substantial improvement in inventory management and customer satisfaction, as all orders could be fulfilled without delays due to product shortages. Additionally, the inventory record inaccuracy rate also experienced a notable enhancement, decreasing from an initial 95% to just 5%. This indicates greater accuracy in stored information and facilitates decision making based on reliable, consistent, and actionable data. Finally, the obsolesce rate was reduced from the initial 80% to 19%. This result indicates better management of products in the warehouse, avoiding the accumulation of obsolete inventory and optimizing resource utilization.

Table 2. Results Indicators (Pre Test vs. Post Test)

KPI	Pre Test	Post Test	Impact
Order Delivery Time (days)	53 días	47 días	6 días
Percentage of Orders with Stockouts	80%	0%	80%
Inventory Inaccuracy Rate	95%	5%	90%
Obsolescence Rate	80%	19%	61%

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In terms of the results obtained and in relation to industry standard (see Table 3), the order delivery time recorded a total duration of 47 days compared to the sector average of 38 days. Although the technical gap was reduced, it was not completely closed. In terms of the stock out percentage, the results showed a zero percent compared to the sector`s 67%, thereby achieving a reduction of more than 600 basis points in the technical gap. Concerning the inventory record inaccuracy rate, the results indicate a final rate of 5% compared to the sector`s 30%, representing a closure of the technical gap by over 250 basis points. With respect to the obsolescence rate indicator, a post test rate of 19% was achieved compared to the sector`s 37%, thus closing the gap by over 180 basis points.

Table 3. Results Indicators (Post Test vs. Sector)

KPI	Post Test	Sector	Impact
Order Delivery Time (days)	47 días	38 días	9 días
Percentage of Orders with Stockouts	0%	67%	67%
Inventory Inaccuracy Rate	5%	30%	25%
Obsolescence Rate	19%	37%	18%

Discussion

The present research, focused on the implementation of JIT, ROP, and 5S methodologies in the hydraulic cylinder warehouse, yielded highly satisfactory results in improving inventory management indicators. The findings revealed a substantial increase in the logistics service level by reducing delivery times from an initial 53 days to approximately 47 days. Although the technical gap was not fully closed, there was an 11% reduction in delivery time compared to the initial case study.

When comparing these results with previous research, it was identified that integrating advanced logistics frameworks, such as deep logistics with JIT and ROP, reduces processing times and improves overall logistical performance (Tang & Yang, 2021). In a study of a manufacturing company, a significant reduction in the total daily inventory of ten products by 23% was achieved, which in turn increased the service level by 22% (Jaijit & Witthayapraphakorn, 2023). Additionally, Ji et al. (2023) demonstrated that implementing a logistics model with these tools can achieve a 95% service level through the use of technology and financial process automation.

While stockouts in orders were reduced, it is important to acknowledge, as noted by Ebrahimnejad et al. (2021), that the ROP system can generate additional costs due to excess inventory, inefficiencies in transportation, and operational complexity. Furthermore, Arda et al. (2019) found that the costs associated with using the ROP system can significantly increase storage and transportation expenses in inventory management. ROP can lead to a 35% increase in storage costs due to maintaining excess inventory to meet reorder levels, especially in environments with fluctuating demand (Azam et al., 2021).

The implementation of the JIT and ROP models, while reducing service duration, increased the amount of inventory in storage in this case study. This outcome diverged from the results obtained by Singgih & Umry (2019), whose ROP

model showed a 17% reduction in inventory levels once applied in the textile industry. Similarly, the JIT model applied by Balthrop & Blackhurst (2023) reduced inventory levels by 50% and storage costs by 30%, representing a difference from the results of our model. In terms of inventory accuracy, similar results were observed in a hardware company case study, where the 5S tool improved the IRA indicator to 88.47% (Alvarez et al., 2022). Additionally, in a manufacturing sector case, the application of Lean 5S resulted in inventory record accuracy of 98.17%, comparable to the findings of this study. There was also a 66.12% reduction in material search time (Eyzaguirre et al., 2019). Similarly, a textile company saw inventory accuracy increase from 55% to 95% following the adoption of 5S practices (Macassi et al., 2022).

Moreover, the gradual implementation of 5S has been crucial in significantly reducing inventory obsolescence. A similar outcome was seen in a Peruvian retail company in the pharmaceutical sector, which achieved an 80% reduction in obsolete inventory after implementing 5S methodology (Castro et al., 2023). In the case study by Campos et al. (2022), obsolescence was reduced by up to 57%, akin to the magnitude of reduction observed in this study. However, as Cárcel & Rodríguez (2019) highlighted, the success of the 5S methodology heavily depends on the continuous commitment of employees and management, which can be challenging to sustain over time, potentially resulting in a 13% negative variation. Additionally, one of the main threats to the 5S methodology is the lack of adequate control, leading to issues of overstock, affecting warehouse efficiency and safety, or understock, potentially disrupting production (Mahecha et al., 2020). In both cases, the primary objective of this research could be compromised, negatively impacting the service level.

Conclusion

The initial diagnosis of the metalworking sector revealed significant gaps in logistical service levels, such as long order delivery times (53 days), high stockout rates (80%), and considerable inaccuracies in inventory records (95%). These gaps indicated clear opportunities for improvement. The implementation of the proposed logistics model has significantly closed these gaps, reducing delivery times, eliminating stockouts, and drastically improving inventory record accuracy. However, there remains a gap in delivery time compared to the industry average, suggesting there is still room for further optimization in this aspect.

The application of an integrated logistics management model, combining Just in Time, Reorder Point, and 5S methodologies, has yielded promising results in a metalworking sector company. Although order delivery times remain above the sector average, a reduction of 11% was achieved, bringing it down from 53 to 47 days. Furthermore, this model's implementation has completely eliminated stockouts and significantly increased inventory record accuracy, reducing the inaccuracy rate from 95% to 4.7%. These findings demonstrate the effectiveness of this approach in optimizing logistics processes and improving operational efficiency. It is important to note that the results obtained are not generalizable, given the specific storage conditions, storage areas for raw materials and finished products, and storage times unique to our case study.

The design of the logistics model was based on a thorough analysis of the critical factors impacting logistics service levels, using industrial engineering tools. The integration of JIT and ROP allowed for better synchronization between

demand and supply, while the 5S methodology optimized warehouse organization and efficiency. The reduction in order delivery times and improvement in inventory accuracy indicate the model's success. However, the model's implementation also increased the amount of inventory in the warehouse, which contrasts with some previous studies and highlights a potential area for adjustment to improve inventory efficiency. Although the delivery time gap has been reduced compared to the industry average, it has not been eliminated.

Recommendations

In light of these findings, it is recommended to continue optimizing inventory management by conducting periodic adjustments based on detailed demand analyses. The adoption of advanced technological tools, such as ERP systems, can enhance forecast accuracy and prevent unnecessary stock accumulation. Additionally, fostering an organizational culture focused on continuous improvement through regular training and active employee participation in implementing methodologies will help internalize practices and expand achieved improvements. This approach will ensure the long-term sustainability of the results.

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Optimizing Customer Satisfaction Levels Through 5S, Standardized Work, and SLP: The Case of a Restaurant in Metropolitan Lima

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Abstract: The Peruvian gastronomic sector plays a crucial role in the economy and culture, particularly in Lima Metropolitan. However, inefficiencies such as long wait times and suboptimal operational management significantly impact customer satisfaction. This study aimed to enhance customer satisfaction in a Lima restaurant by implementing engineering tools including 5S, Standardized Work, and Systematic Layout Planning (SLP). A pre-and-post-test experimental design was simulated using Arena V.16. The methodology followed four phases: problem diagnosis, proposal design, result analysis, and a master implementation plan. Results demonstrated a 26% reduction in wait times, from 28 to 20.7 minutes, nearing the industry standard of 20 minutes. Customer satisfaction increased by 11 percentage points, from 68% to 79%, surpassing the sector average of 71%. Additionally, daily customer throughput rose by 16.9%, with a positive Net Present Value (NPV) of USD 5,000 and an Internal Rate of Return (IRR) of 28%. These findings provide a practical framework for optimizing efficiency in high-demand restaurants, suggesting future research on Lean methodologies to enhance service quality.

Keywords: Lean Tools, Customer Satisfaction, Wait Time, Restaurant Efficiency

Introduction

The restaurant industry plays a pivotal role in cultural and economic development worldwide. In Latin America, this sector generates approximately USD 250 billion annually, with Peru contributing 2.9% to its national GDP, equivalent to 3 976 million soles in the first quarter of 2023 (Sociedad de Comercio Exterior del Perú, 2023). Despite its significance, the industry faces persistent challenges, such as inefficiencies in customer service and operational management, which have been further exacerbated by the COVID-19 pandemic. This has led to substantial economic

repercussions, including the closure of 50% of restaurants in Peru and the loss of 500 000 jobs (Dube et al., 2023). These challenges underscore the critical need for operational improvements to enhance customer satisfaction and business sustainability.

This study focuses on a well-established restaurant chain specializing in Peruvian cuisine, with over 40 years of experience and four strategically located branches in Lima. The research centers on the San Miguel branch, a two-story establishment with a primarily local clientele composed of families seeking affordable yet high-quality dining experiences. Despite its popularity, this branch struggles with long customer wait times, averaging 28 minutes, which exceeds the industry standard of 20 minutes (Agurto & Falconi, 2015). This discrepancy contributes to a lower customer satisfaction index of 68%, compared to the sector average of 71% (Pavlickova, 2015). Additionally, the branch serves an average of 188 customers per day, five fewer than the sector benchmark of 193 (Díaz et al., 2015). These issues highlight a technical gap that negatively impacts both customer perception and the restaurant's competitiveness.

Table 1. Indicators and technical gaps

KPI	Sector Standards	Case of study	Technical Gap
Customer Waiting Time (minutes)	20	28	8
Customers Served Per Day	193	188	5
Customer Satisfaction Level	71%	68%	3%

The economic implications of these inefficiencies are significant. Low customer satisfaction leads to reduced loyalty and fewer repeat visits, negatively impacting revenue. Studies suggest that a 5% increase in customer loyalty can result in a 25%-95% increase in revenue (Hanaysha, 2016). Furthermore, the restaurant incurs approximately USD 250 monthly in expenses related to complaints and refunds, while spending USD 750 monthly on advertising to attract new customers. Enhanced customer satisfaction could reduce marketing costs by up to 50%, underscoring the financial benefits of addressing these issues.

Root Causes and Lean Tools for Improvement

An analysis of the restaurant's operations identified key factors contributing to customer dissatisfaction: prolonged wait times, inconsistent food quality, and a lack of coordination between service and kitchen staff. A customer survey revealed that 55% of complaints were related to service delays, while 20% were due to dissatisfaction with food preparation. These inefficiencies have led to a 15% decrease in customer volume compared to previous years, an increase in negative online reviews, and a 25% year-over-year rise in complaints, further emphasizing the urgency of addressing these issues.
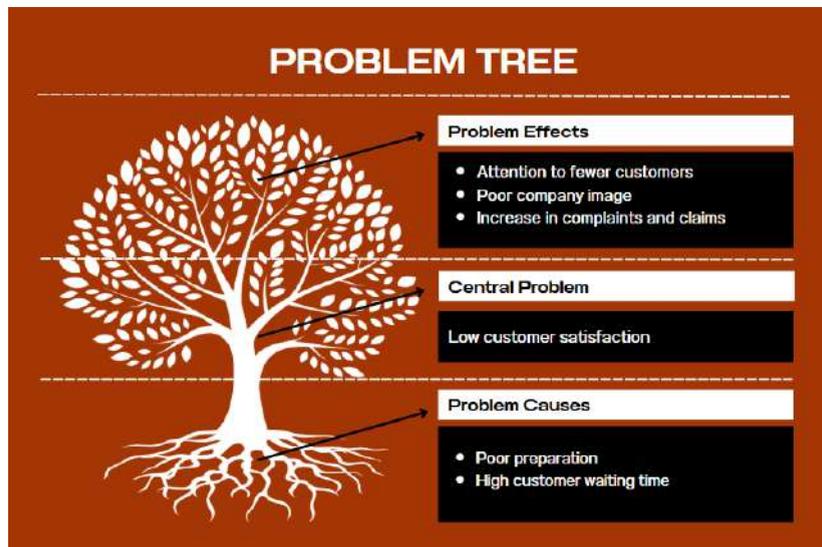
Figure 1. Problem tree

To tackle these challenges, three Lean tools were implemented to target the identified root causes: standardized work, 5S, and Systematic Layout Planning (SLP). Each tool was strategically selected to address specific inefficiencies, with the goal of optimizing operations and enhancing customer satisfaction.

Standardized work ensures consistency in task execution by defining the preferred method for specific activities. This approach delivers timely results and maintains quality across staff (Castillo-Muguerza et al., 2023). The 5S methodology—comprising sort, set in order, shine, standardize, and sustain—focuses on eliminating unnecessary elements, fostering efficiency, and improving workplace organization (Orynycz et al., 2020). Finally, SLP enhances space utilization and workflow efficiency by creating diagrams that optimize the relationships between operational units, reducing material handling distances and accelerating product delivery (Yang, 2020).
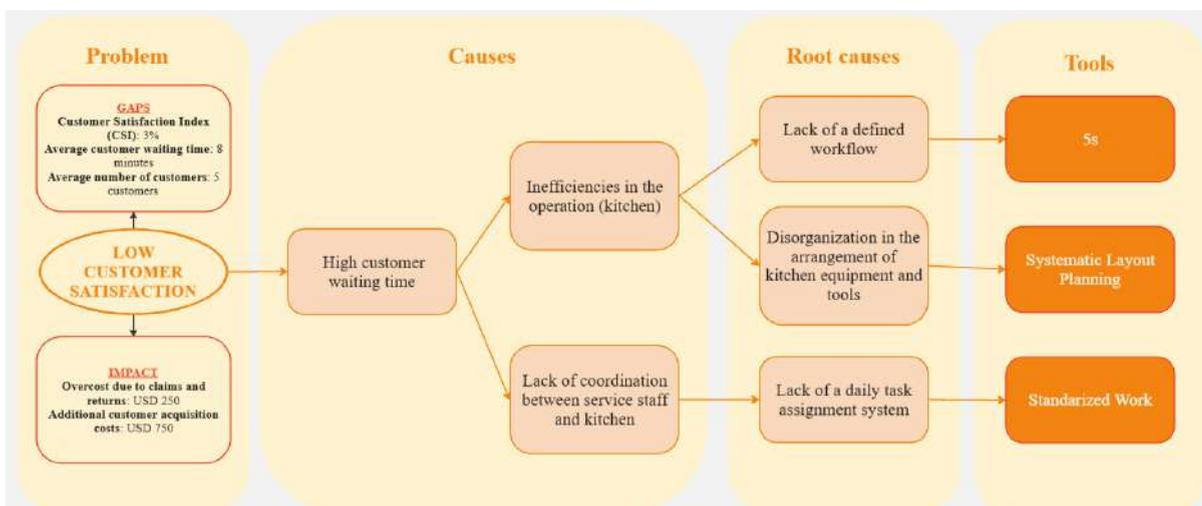
Figure 2. Roots cause analysis

However, the study faced constraints that limited the scope of the intervention. Financial and temporal limitations made the full-scale implementation of the proposed Lean Service model unfeasible. Instead, the study was validated through a pilot test and simulations, focusing exclusively on the San Miguel branch. While the results are not

universally generalizable, they provide valuable insights that can be adapted and replicated in similar contexts with appropriate adjustments.

Method

The implementation of the proposed Lean tools was carried out in three distinct stages, focusing on the systematic application of 5S, Standardized Work, and Systematic Layout Planning (SLP). These tools were selected to target the restaurant's operational inefficiencies and enhance customer satisfaction. A pilot test was conducted at one of the locations of the Peruvian restaurant chain, with each methodology tailored to specific operational needs.

5S

The implementation of the 5S methodology in the restaurant was carried out systematically, involving the entire staff. It began with Sorting (Seiri), where unnecessary utensils and materials were removed to optimize workspace. In the Setting in Order (Seiton) phase, specific locations were assigned to each item, making them easily accessible. During the Shining (Seiso) phase, daily routines were established to maintain hygiene and promote a clean environment. In the Standardizing (Seiketsu) phase, checklists and procedures were created to guide staff in 5S practices. Lastly, sustaining (Shitsuke) was encouraged through ongoing training and audits, fostering a culture of discipline. This comprehensive approach led to improved organization, greater operational efficiency, and a safer, more productive work environment.

Standardized Work

To implement Standardized Work, detailed templates were developed outlining the preferred methods and step-by-step procedures for key activities, such as the preparation of the most frequently ordered dishes. Additionally, specific checklists were created for essential roles within the restaurant, addressing one of the identified opportunities: the lack of clear task delineation, which had led to confusion and reduced operational efficiency. This structure not only facilitates staff training but also ensures consistency in service quality and food preparation.

Systematic Layout Planning (SLP)

To apply the Systematic Layout Planning (SLP) methodology, the movements of kitchen assistants were analyzed. It was identified that repositioning the scale, originally located outside the kitchen in a separate area, presented an opportunity to reduce unnecessary movement. By relocating the scale to a more central location, the constant trips to the external area were eliminated, reducing congestion and saving valuable time spent on weighing ingredients. This simple change not only improved workflow within the kitchen but also allowed kitchen assistants to focus more on productive tasks, contributing to greater operational effectiveness and faster dish preparation times. Additionally, reducing the number of movements minimized the risk of accidents in an already high-traffic work environment, thus improving workplace safety. These changes were validated through simulations using Arena V.16 software, which demonstrated a 26% reduction in customer waiting times, supporting the positive impact of the layout adjustments.

Validation Model

The proposed Lean tools were validated through a simulation model developed in Arena V.16 software. This approach enabled the evaluation of the interventions' impact on key operational metrics, including customer wait times and service efficiency. The simulation replicated the restaurant's workflow both before and after implementing the improvements, offering a data-driven analysis of the proposed changes.
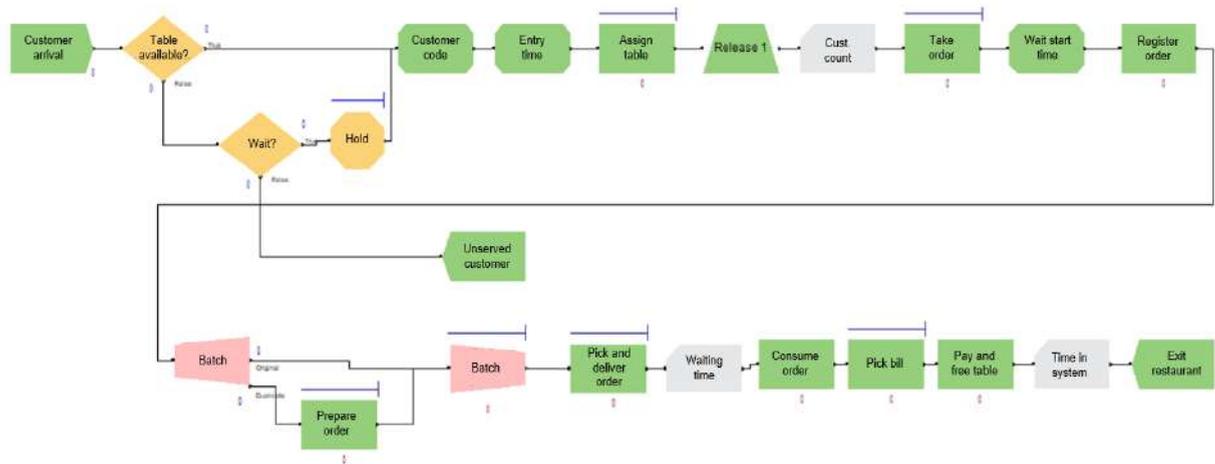
Figure 3. Simulation model

The redesigned layout, along with the 5S methodology and Standardized Work, underwent simulation to assess its impact on operational efficiency. Adjustments in task flow and space utilization reduced bottlenecks, predicting a 26% reduction in wait times. The simulation showed that implementing the proposed Lean tools would bring service times in line with industry standards while enhancing coordination between kitchen and service staff. This validation process established a reliable framework for evaluating the feasibility and effectiveness of the proposed changes prior to physical implementation.

Results

The implementation of Lean tools, combined with simulation-based analyses, proved effective in enhancing key performance metrics, including customer wait times, satisfaction levels, and workplace organization. The results are presented in detail, highlighting both the operational improvements achieved and their broader implications for economic and social sustainability.

The simulation analysis revealed a noteworthy reduction in customer wait times following the implementation of Lean methodologies. The average wait time, initially 28 minutes, decreased to 20.7 minutes, confirming the effectiveness of the proposed improvements. Additionally, the number of customers served daily showed a modest increase, rising from 188 to 190. A post-test survey, conducted under the same conditions as the pre-test, demonstrated a 17% improvement in customer satisfaction, increasing from 68% to 79%.

Table 2. Comparative analysis of key performance indicators

KPI	Sector Standards	Pre-Test	Post-Test
Customer Waiting Time (minutes)	20	28	20.7
Customers Served Per Day	193	188	190
Customer Satisfaction Level	71%	68%	79%

The 5S methodology resulted in **considerable** improvements in workplace organization and efficiency. The initial audit scored 18 points, identifying **clear** opportunities for enhancement across all pillars. After implementing standardized practices, such as the removal of unnecessary tools, daily checklists, and regular training, the final audit score increased to 38 points. The most **pronounced** advancements were observed in the pillars of sorting, cleaning, and discipline, highlighting the effectiveness of structured interventions in achieving sustainable operational improvements.
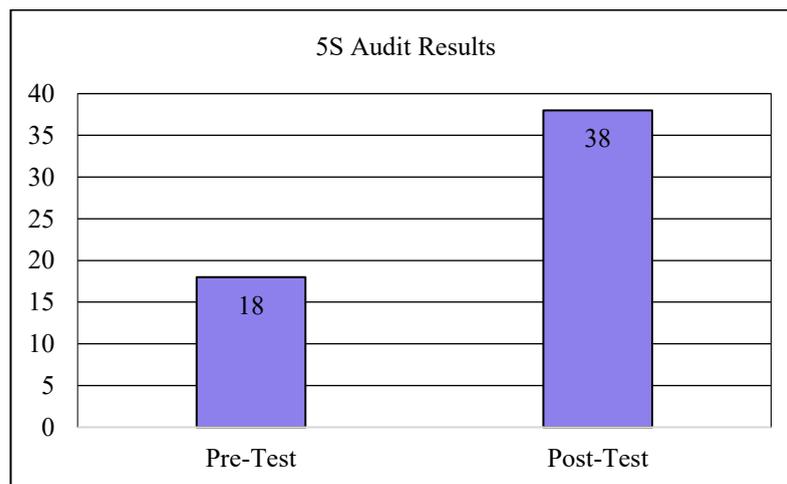
Figure 3. Comparative 5S audit results

Economic Sustainability

The economic analysis confirmed the project's financial viability over a three-year period. The Net Present Value (NPV) was estimated at approximately USD 16,000, while the Internal Rate of Return (IRR) reached 18.18%, surpassing the estimated Cost of Capital (CoC) of 10%. These indicators indicate that the incremental revenues generated by the changes exceed the associated costs, ensuring a positive return on investment. The financial benefits reinforce the sustainability of the proposed changes, enhancing the restaurant's economic resilience and ensuring long-term profitability.

Social Sustainability

The integration of Lean tools into the restaurant's operations brought significant social benefits, directly contributing to several Sustainable Development Goals (SDGs). By streamlining processes and enhancing customer experiences, the improvements not only **boosted** operational efficiency but also fostered safer working environments, stimulated local economic activity, and promoted the responsible use of resources.

In terms of workplace safety, the reorganization of tools and equipment reduced hazards, creating a safer environment for employees and aligning with SDG 8: Decent Work and Economic Growth. Furthermore, the initiative prioritized staff development, providing an average of 15 training hours per employee each month. This commitment to continuous education enhanced workforce skills and productivity, aligning with SDG 4: Quality Education. Lastly, the reduction in service times and the resulting improvement in customer satisfaction strengthened the restaurant's reputation, stimulating economic growth in the local community and further advancing SDG 8.

Discussion

The application of Lean Service tools, including Standardized Work, 5S, and Systematic Layout Planning (SLP), resulted in significant improvements in both operational efficiency and customer satisfaction. This study achieved a 28.5% reduction in customer service times, a gain of four additional customers served per day, and a 17% increase in customer satisfaction levels. These results surpass previous findings, such as the 9.84% reduction in wait times reported by Onaga-Nishimura et al. (2022), showcasing the effectiveness of combining Lean tools in high-demand restaurant environments. Additionally, the optimized layout and standardized processes addressed the root causes of inefficiencies, providing a replicable framework applicable to similar industries.

Improvements in customer satisfaction align with trends reported in other studies, emphasizing the role of efficient operations in enhancing customer experiences. The 17% increase observed in this study mirrors the 16% improvement found by Onaga-Nishimura et al. (2022), although this research places greater emphasis on customer interactions. Findings by Vergara et al. (2019) and Tasar et al. (2020) further support the importance of reducing wait times and improving service quality as key factors in customer satisfaction. Moreover, the integration of Standardized Work streamlined operations, reduced errors, and ensured that service delivery met customer expectations.

Comparisons with other industries highlight the adaptability of Lean tools. For example, Castillo-Muguerza et al. (2023) reported a 90% efficiency improvement in veterinary services using Standardized Work and 5S, showcasing the versatility of these tools beyond the restaurant industry. The application of 5S in this study minimized waste (MUDA) and improved workplace organization, leading to more efficient workflows. Similarly, SLP was instrumental in optimizing spatial layouts, supporting the findings of Morales-Contreras et al. (2020), who emphasized the importance of effective space management in reducing delays and improving coordination between workstations.

This research reinforces the growing body of evidence supporting Lean methodologies in service industries. Studies by Shamsuzzaman et al. (2018) and Chin et al. (2019) confirm the replicability of Lean tools across diverse contexts,

emphasizing their role in driving continuous improvement. The results not only highlight the operational benefits of Lean practices but also demonstrate their impact on customer retention and loyalty. This study contributes to the broader understanding of Lean's potential in high-demand sectors, offering practical insights for managers aiming to optimize processes and prioritize customer satisfaction.

Conclusion

The implementation of a Lean Service model in the analyzed restaurant in Lima Metropolitana proved highly effective in enhancing the customer experience. By reducing wait times by 26%, from 28 to 20.7 minutes, and increasing satisfaction levels by 11 percentage points, from 68% to 79%, the proposed approach brought performance closer to industry benchmarks. Tools such as 5S, Standardized Work, and Systematic Layout Planning (SLP) not only optimized operational efficiency but also generated a positive economic impact. Monthly overcosts related to customer complaints and returns, initially estimated at USD 250, were projected to decrease significantly. Additionally, marketing expenses, currently at USD 750 per month, could potentially be reduced by 50% due to increased customer loyalty.

The economic analysis further validated the financial feasibility of the proposal, with a Net Present Value (NPV) of USD 5,000 and an Internal Rate of Return (IRR) of 28%. This study underscores the substantial benefits of applying continuous improvement methodologies—traditionally associated with manufacturing—to the service sector. By addressing a critical gap in Lean practice documentation for restaurants, this work contributes to the broader literature on efficiency in non-industrial environments. While the findings are specific to this case, the proposed model holds promise for replication with minimal adjustments in similar establishments, providing transferable and practical insights for the hospitality industry.

Recommendations

Future research should explore the integration of automation technologies and artificial intelligence to further enhance customer service processes and reduce operational times. Additionally, assessing the impact of implementing a comprehensive and continuous Lean model in other areas, such as inventory management and employee training, could amplify the benefits achieved and reinforce the sustainability of improvements. Longitudinal studies are also recommended to evaluate the long-term effects on customer experience and operational efficiency, offering deeper insights into the durability of Lean methodologies in the service sector. These approaches would broaden the understanding of Lean's adaptability, promoting its application across diverse contexts within the hospitality industry.

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The Influence of Sanitation and Clean Water on Academic Achievement of High School Students in Gugus 1 Kabupaten Tangerang

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Abstract: This study aims to examine the influence of sanitation and clean water on the academic achievement of high school students in Cluster 1 of Tangerang Regency. Given the critical role that health and environmental factors play in student learning outcomes, the research investigates how access to clean water and sanitation facilities correlates with students' academic performance. A quantitative research approach was employed, with data collected using a Likert-scale questionnaire administered to high school students, and analyzed through multiple linear regression to assess the relative influence of each variable. The findings reveal that, when combined, sanitation and clean water have a significant impact on academic achievement, accounting for 53% of the observed variance in performance. However, a closer examination of the individual contributions of each variable indicates that clean water alone has a statistically significant effect, while sanitation does not. This suggests that while sanitation facilities may support overall student health and comfort, direct access to clean water is more essential for influencing academic outcomes, likely due to its immediate impact on hydration, cognitive function, and general well-being. These findings underscore the importance of prioritizing clean water access in educational institutions to enhance learning environments and support academic success.

Keywords: Sanitation, Clean Water, Academic Achievement, Students

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Introduction

The quality of education is not solely determined by academic factors; it is also significantly influenced by health and the physical environment in which students learn. One critical yet often overlooked element is the condition of sanitation facilities and access to clean water within school settings. In various regions, including Tangerang Regency, inadequate school sanitation and limited access to clean water can negatively impact students' comfort, health, and learning concentration.

Poor sanitation increases the risk of illness, particularly gastrointestinal and skin infections, which may lead to frequent student absences and hinder optimal participation in learning activities. Similarly, the lack of adequate and safe clean water can disrupt basic student activities such as handwashing, drinking, and maintaining personal hygiene. The accumulation of these conditions can ultimately affect students' academic performance both directly and indirectly.

Cluster 1 of Tangerang Regency, as a developing educational area, serves as a significant representation for examining the relationship between school environmental factors—specifically sanitation and clean water availability—and students' academic achievement. Therefore, this study aims to analyze the extent to which sanitation and access to clean water influence the academic performance of senior high school students in the region.

School sanitation encompasses hygiene-related facilities and infrastructure, such as toilets, handwashing stations, wastewater drainage systems, and proper waste management. According to the World Health Organization (WHO), adequate sanitation in schools is an essential component of every child's fundamental right to a safe and healthy education (Unicef, 2024).

Proper school sanitation plays a vital role in creating a comfortable learning environment that supports the educational process. The availability of adequate sanitation facilities—such as clean toilets and handwashing stations—can significantly enhance students' learning comfort. A study conducted at UPT SDN 75 Gresik revealed a correlation between well-maintained sanitation and physical environments with students' comfort levels during learning. Moreover, good sanitation practices also influence student well-being (Shohibatul Mas'Ulah, 2024). Research at SD Exiss Abata found that school sanitation contributed 28.5% to student well-being, encompassing both physical and psychological aspects (Iftiyah safitri, 2025).

School sanitation refers to the provision of adequate and appropriate facilities and services within school settings, including the proper disposal of excreta and solid waste. It also involves activities that promote sanitary conditions and healthy behaviors among school staff and students, aimed at preventing water- and sanitation-related diseases and parasitic infections. The broader objective of school sanitation and hygiene education is to develop students' life

skills, foster a healthy and safe school environment, and extend positive impacts to families and communities (Marielle Snel, 2003).

Research has identified a link between poor school sanitation conditions and a higher incidence of illnesses among students, such as fever and other health issues. Furthermore, studies have shown that effective school sanitation programs can reduce the prevalence of diseases among students. Adequate school sanitation—such as the availability and cleanliness of toilets—can enhance students' comfort and promote hygienic behavior, ultimately contributing positively to their overall health (Anita Dewi Moelyaningrum, 2023).

The availability of sufficient clean water is crucial for daily life, particularly within the school context. Clean water is essential for drinking, personal hygiene, and maintaining a clean and healthy school environment. In schools, water safety—especially drinking water—can be ensured through the application of the Hazard Analysis and Critical Control Points (HACCP) system, an effective approach for controlling biological and chemical hazards in school water supplies (Feng Xiu-rong, 2006).

A systematic review by Jasper found that access to safe drinking water and hygienic toilets that provide privacy has substantial potential to positively impact children's health. Studies have also reported a decrease in diarrheal and gastrointestinal illnesses with improved access to adequate sanitation facilities in schools (Christian Jasper, 2012). Access to clean water is vital for safeguarding students' health; research has shown that a lack of clean water can lead to various illnesses, such as diarrhea, which may disrupt students' learning processes.

At SDN 1 Kaliombo, insufficient access to clean water and poor water quality negatively affected students' personal hygiene practices (Nanda Puspita Damayanti, 2023). Similarly, Zhong Hu's research in Hebei Province revealed comparable findings: although self-built centralized water supply systems are commonly used in schools, their water quality management and supervision remain inadequate. Only 28.6% of these water sources held hygiene licenses, and 20% were located near pollution sources, raising concerns about the safety of the water consumed by students (Zhong Hu, 2000).

Water safety education plays a crucial role in enhancing students' knowledge, skills, attitudes, and behaviors related to the safe use and management of water. Employing diverse teaching methods can further increase students' enthusiasm and active participation in water-related hygiene practices. However, the quality of water in school environments can vary significantly—tap water is generally the cleanest, while pond water tends to be the most contaminated. These disparities underscore the importance of regular water quality monitoring and systematic management to ensure student safety and health.

A number of studies have demonstrated a correlation between sanitation, access to clean water, and students' academic outcomes. Students who study in environments with adequate sanitation tend to exhibit higher attendance rates and better concentration compared to those in poorly sanitized settings. Thus, sanitation and clean water not only affect students' health but also make a significant contribution to their academic achievement.

A systematic review by Sharma found that WASH (Water, Sanitation, and Hygiene) interventions in schools improve students' health status, attendance regularity, and educational achievement. Adequate WASH facilities protect students from various infectious diseases caused by poor access to water, sanitation, and hygiene. School-based WASH interventions enhance students' health, school attendance, and academic performance (Mohan Kumar Sharma, 2022).

A study by Shrestha et al. (2024) in Nepal demonstrated that inadequate WASH facilities in schools negatively affect students' health and well-being, school attendance, and academic performance. Schools need to prioritize and promote the provision of improved WASH facilities to enhance student health, attendance, and educational outcomes (Mohan Kumar Sharma, 2024). Research conducted by Pokharel et al. (2022) revealed that school WASH interventions can reduce student absenteeism.

A study in Kenya found that the provision of safe drinking water, handwashing facilities, and hygiene education in primary schools reduced student absenteeism by 35% (McMichaelORCID, 2019). A study by Bo Ye showed that school environmental programs, such as the EPA Tools for Schools (TfS), can improve student test scores across various subjects in New York public schools. This improvement was partially mediated by increased student attendance rates (Bo Ye, 2022).

In Indonesia, research conducted by Suryani indicates that improved access to clean water is associated with enhanced educational indicators in rural areas. Better access to clean water can increase student attendance, particularly among primary school students (Ni Putu Wiwin Setyari, 2023). Angeliana's study found that only 16% of schools in Indonesia have access to all basic water, sanitation, and hygiene (WASH) services, and approximately 43.5 million Indonesian children lack access to safe drinking water (Angeliana Kusumaningtiar, 2023).

Adequate sanitation and access to clean water contribute significantly to improving students' academic performance. A clean and healthy learning environment enhances students' concentration and comfort during study. Research indicates that poor sanitation and water quality can lead to health issues such as stunting, which adversely affect children's cognitive development (Fita Purwaningsih, 2021). Moreover, students' knowledge and attitudes toward environmental sanitation also influence their behavior in maintaining cleanliness, which ultimately supports the learning process. A study conducted at SMPN in Liukang Tangaya District demonstrated that students' knowledge and attitudes regarding environmental sanitation significantly affect their sanitation-related behaviors (Nur Hayat, 2024).

Research Methods and Hypothesis

Research Methods

This study adopts a quantitative research design with a descriptive approach, employing Multiple Linear Regression analysis to investigate the relationships between variables. The primary objective of this method is to describe and analyze existing phenomena or issues through the examination of numerical and statistical data, as noted by R. Kurniawan (2016). According to Jan Malte, while simple regression models are effective for prediction purposes

within regression frameworks, they are particularly advantageous when compared to more complex statistical models, especially in handling extensive and varied datasets drawn from real-world contexts.

Regression analysis serves as a statistical tool to measure the strength and direction of relationships among variables. In this research, four variables are analyzed, with independent variables being those that influence outcomes and the dependent variable representing the outcome affected. Specifically, the multiple linear regression technique is applied to assess how factors such as sanitation and access to clean water impact students' academic achievement.

The data collected for this study is primary data, which means it was obtained directly from the original sources by the researchers themselves. This kind of data is considered original and reflects the most current information available. To collect this data, questionnaires were administered directly to students in classrooms across various schools involved in the study. Following data collection, the responses were systematically processed and analyzed using the IBM SPSS Statistics software, allowing for thorough statistical examination and interpretation of the results.

Hypothesis

Ho1 = The Sanitation has no a significant influence on Academic Achievement

Ha1 = The Sanitation has a significant influence on Academic Achievement

Ho2 = The Clean Water has no a significant influence on Academic Achievement

Ha2 = The Clean Water has a significant influence on Academic Achievement

Ho3 = The Sanitaton and Clean Water has no a significant influence on Academic Achievement

Ha3 = The Sanitaton and Clean Water has no a significant influence on Academic Achievement

Population and Sample

This study is limited to sampling only high school students within Region 1 of Tangerang Regency, Banten Province. The scope of the research focuses specifically on this geographic area, which may affect the generalizability of the findings to other regions. Questionnaires were distributed across several high schools in Region 1 of Tangerang Regency, resulting in a total of 96 students who participated by providing their responses. These respondents form the basis of the data used for analysis in this study.

Results

Validity and Reliability Test

Validity Test

This test is conducted to determine whether the instrument measures what it is intended to measure. In the validity test, if the calculated r-value (r count) is greater than the critical r-value (r table), the instrument is considered valid. Based on the results obtained, it can be concluded that the instrument is valid.
.

Table 1. Validity Test Result

Question item	r value	r table	Result
X1.1	0,628	0,195	Valid
X1.2	0,683	0,195	Valid
X1.3	0,806	0,195	Valid
X1.4	0,751	0,195	Valid
X1.5	0,645	0,195	Valid
X2.1	0,648	0,195	Valid
X2.2	0,754	0,195	Valid
X2.3	0,753	0,195	Valid
X2.4	0,789	0,195	Valid
X2.5	0,776	0,195	Valid
Y1	0,662	0,195	Valid
Y2	0,699	0,195	Valid
Y3	0,857	0,195	Valid
Y4	0,833	0,195	Valid
Y5	0,816	0,195	Valid

Reliability Test

The reliability test results demonstrate that each variable yields a Cronbach's Alpha coefficient exceeding 0.60. This outcome indicates that all the variables meet the minimum threshold for internal consistency, confirming their reliability for further analysis. In other words, the questionnaire items used to measure each variable consistently reflect the underlying construct, ensuring that the data collected is dependable and suitable for drawing valid conclusions in the context of this study.

Table 2. Reliability Test Result

Variable	Cronbach's Alpha	Standard	Description
X1	0,731	0,60	Reliable
X2	0,799	0,60	Reliable
Y	0,834	0,60	Reliable

Classical Assumption Test

Normality Test

The Kolmogorov-Smirnov normality test results show a significance value of 0.075, which exceeds the standard threshold of 0.05. This indicates that the data distribution does not deviate significantly from the normal distribution. In other words, the residuals in the data set follow a normal pattern, which meets one of the main assumptions needed to perform parametric statistical analysis such as regression. This normality strengthens the validity and reliability of the statistical test.

Table 3. Normality Test Result

One-Sample Kolmogorov-Smirnov Test			
			Unstandardized Residual
N			96
Normal Parameters[a,b]	Mean		.0000000
	Std. Deviation		2.23105376
Most Extreme Differences	Absolute		.086
	Positive		.083
	Negative		-.086
Test Statistic			.086
Asymp. Sig. (2-tailed)[c]			.075
Monte Carlo Sig. (2-tailed)[d]	Sig.		.074
	99% Confidence Interval	Lower Bound	.067
		Upper Bound	.081

Multicollinearity Test

The findings from the multicollinearity test indicate that all independent variables exhibit tolerance values above 0.10 and Variance Inflation Factor (VIF) values below 10. These results confirm that there are no signs of multicollinearity among the variables, meaning each independent variable contributes unique information to the regression model without being excessively correlated with the others. The absence of multicollinearity ensures the accuracy and stability of the regression coefficients, thereby strengthening the validity of the analytical outcomes and supporting the reliability of the model's interpretations.

Table 4. Multicollinearity Test Result

		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
Model		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	5.099	1.478		3.449	<,001		
	X1	.132	.088	.135	1.491	.139	.611	1.636
	X2	.593	.084	.638	7.029	<,001	.611	1.636

a. Dependent Variable: Y

Heteroscedasticity Test

The heteroscedasticity test is used to determine whether there is a violation of the classical assumption of heteroscedasticity, which refers to the presence of unequal variances of the residuals for all observations in the

regression model. One of the prerequisites that must be met in a regression model is the absence of heteroscedasticity symptoms. There are several methods to test this, one of which is by observing the scatterplot. If the dots are scattered randomly without forming a clear pattern, it indicates that heteroscedasticity does not occur. In this case, the scatterplot shows that the dots are randomly dispersed, and therefore, it can be concluded that there is no heteroscedasticity present.
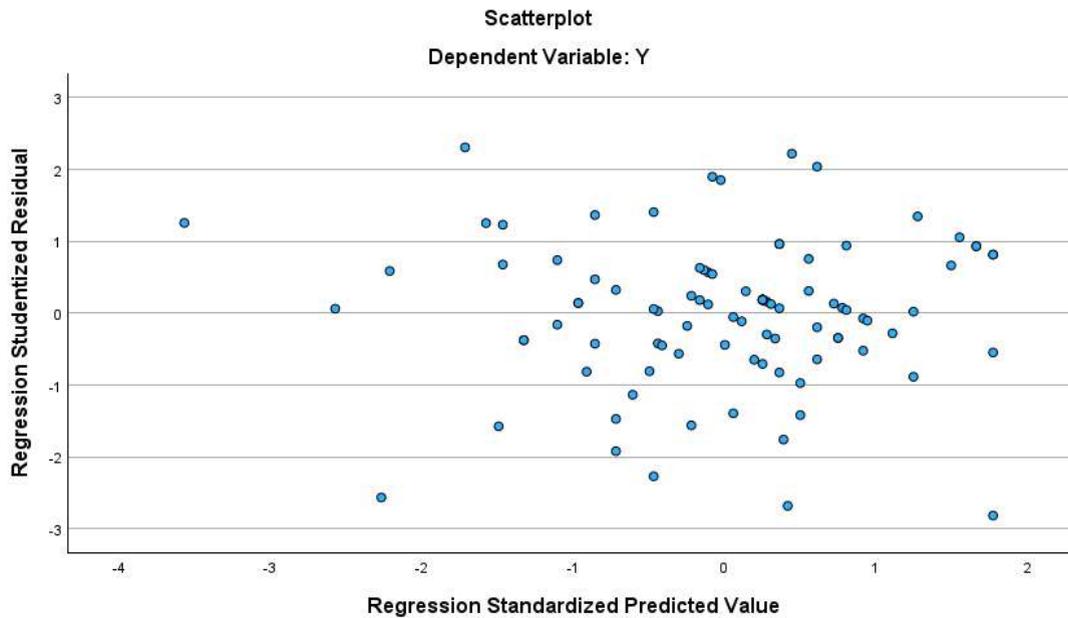
Figure 1. Heteroscedasticity Test Result

Hypothesis Test

R2 Determination Coefficient Test

The Adjusted R Square value obtained in this study is 0.532, which is equivalent to 53%. This means that the independent variables X1, X2, and X3 collectively account for 53% of the variability or changes observed in the dependent variable Y. In other words, just over half of the variation in Y can be statistically explained by the combined influence of these three predictors. The remaining 47% of the variance is attributed to other factors or variables that were not included in the current regression model. This suggests that while the model has a moderate level of explanatory power, there is still a considerable proportion of influence from external or unmeasured variables, indicating opportunities for further research to identify and include those additional factors to improve the model's accuracy and comprehensiveness.

Table 5. Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.730[a]	.532	.522	2.25492

a. Predictors: (Constant), X2, X1

b. Dependent Variable: Y

F-Test

The analysis yields an F value of 52.916, which exceeds the critical F table value of 3.094. Additionally, the significance level is less than 0.001, falling below the 0.05 threshold. Based on these results, the null hypothesis (H_0) is rejected, and the alternative hypothesis (H_a) is accepted. This confirms that the independent variables X1, X2, and X3 collectively have a statistically significant influence on the dependent variable Y.

Table 6. F Test Result

ANOVA[a]

	Model	Sum of Squares	df	Mean Square	F	Sig.
1	Regression	538.117	2	269.059	52.916	<,001[b]
	Residual	472.872	93	5.085		
	Total	1010.990	95			

a. Dependent Variable: Y

b. Predictors: (Constant), X2, X1

T-Test

The individual (partial) effects of the independent variables on the dependent variable are as follows: First, variable X1 has a t-value of 1.491, which is lower than the critical t-table value of 1.986. Additionally, the significance level is 0.139, which is greater than 0.05. This means that the null hypothesis (H_{01}) is accepted, and the alternative hypothesis (H_{a1}) is rejected, indicating that X1 does not have a significant impact on the dependent variable. Second, variable X2 shows a t-value of 7.029, exceeding the t-table value of 1.986, with a significance level of 0.001, which is below the 0.05 threshold. Therefore, the null hypothesis (H_{02}) is rejected, and the alternative hypothesis (H_{a2}) is accepted, confirming that X2 has a significant influence on the dependent variable.

Table 7. T Test Result

Variable	t value	t Table	Sig.	Criteria
X1	1,491	1,986	0,139	Variable X1 does not have a significant effect on Y
X2	7,029	1,986	0.001	Variable X2 influences Y significantly

Multiple Linear Regression Equation

Table 8. Multiple Linear Regression

		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
Model		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	5.099	1.478		3.449	<,001		
	X1	.132	.088	.135	1.491	.139	.611	1.636
	X2	.593	.084	.638	7.029	<,001	.611	1.636

a. Dependent Variable: Y

The linear regression equation derived from the analysis is: Y = 5,099 + 0,132X1 + 0.593X2

The constant coefficient has a value of 5.099 and is positive, indicating that when the independent variables X1 and X2 are present, the dependent variable Y is expected to increase by 50.99%. The beta coefficient for X1 is 0.132, suggesting that if all other variables are held constant, a 1% rise in X1 will result in a 13.2% increase in Y, and a decrease in X1 would lead to a similar reduction in Y. Meanwhile, the beta coefficient for X2 stands at 0.593, meaning that a 1% increase in X2, with other variables remaining unchanged, would lead to a 59.3% rise in the value of Y, and a decrease in X2 would cause a proportional decline in Y.

Discussion

The research findings indicate that, simultaneously, sanitation and clean water have a significant influence on students' academic achievement, contributing a total of 53%. However, when analyzed partially, only the clean water variable shows a significant effect, whereas sanitation does not demonstrate a statistically significant contribution to academic performance.

These findings suggest that access to clean water has a direct impact on students' cognitive processes and health. This aligns with the theory proposed by the World Health Organization (WHO) and the study by Jasper (2012), which state that clean water plays a critical role in maintaining health and reducing the risk of diseases such as diarrhea and digestive disorders—conditions that can lead to absenteeism and reduced learning concentration.

Meanwhile, although school sanitation is theoretically expected to contribute to the comfort and cleanliness of the learning environment, it does not show a direct significant effect on academic performance in the context of this study. This may be due to two possible reasons: First, the minimum sanitation standards in schools within Cluster 1 of Tangerang Regency may already be adequately met, resulting in limited variation and therefore an insignificant difference in outcomes. Second, the impact of sanitation may be more indirect or mediated, for example, through psychological comfort, long-term health, or the development of hygienic habits, which may not immediately reflect in academic achievement.

These findings also reinforce the results of studies by Sharma (2021), Shrestha et al. (2024), and Pokharel et al. (2022), which show that WASH (Water, Sanitation, and Hygiene) facility interventions can improve attendance and academic performance overall, but clean water often emerges as the key contributing factor in those outcomes.

Conclusion

The results of the study indicate that sanitation and access to clean water, when considered together, significantly influence students' academic achievement, explaining approximately 53% of the variation in performance. This highlights the collective importance of these two environmental health factors in shaping educational outcomes. However, further analysis of each variable's individual contribution reveals that only clean water access has a statistically meaningful impact on academic performance, while the effect of sanitation alone is not significant. This distinction implies that, although proper sanitation infrastructure may contribute to a healthier and more comfortable school environment, it is the availability of clean water that plays a more critical and immediate role in supporting students' cognitive functions, hydration, concentration, and overall physical health—all of which are essential for effective learning. These findings emphasize the need for schools and policymakers to place a higher priority on ensuring consistent and safe access to clean water. Doing so could not only improve students' academic performance but also foster a more supportive and health-promoting learning environment. Therefore, investment in clean water infrastructure should be seen as an integral part of educational development strategies.

Recommendations

Based on the results of the study, the author offers several recommendations for further action and policy development, First, prioritize the provision of clean water in schools. Given that clean water has been proven to significantly influence student academic achievement, local governments and school authorities within Cluster 1 of Tangerang Regency should ensure the following: The availability of clean water sources that meet quality standards, regular maintenance of the drinking water distribution systems, adequate drinking water and handwashing facilities within the school environment.

Second, reevaluate school sanitation programs. Although sanitation did not show a statistically significant effect, its indirect role should not be overlooked. It is recommended to conduct regular evaluations of school toilets, handwashing stations, and waste management systems, integrate clean and healthy living behavior (PHBS) education into the curriculum to improve students' awareness and habits, measure the long-term impact of sanitation on student absenteeism and quality of life.

Third, integrate WASH programs into educational planning. these findings reinforce the urgency of integrating the WASH (Water, Sanitation, and Hygiene) approach into school facility development and improvement planning. WASH programs not only impact health but also support educational outcomes. Studies by Sharma (2021) and Bo Ye (2020) confirm that a healthy learning environment promotes student attendance and academic achievement.

Further studies are recommended to include mediating variables such as student attendance rates, learning comfort,

or health indicators. It is also necessary to expand the geographical area or population to enhance the generalizability of the findings. This study is limited by its reliance on student perceptions to measure sanitation and clean water access. In the future, combining quantitative approaches with field observations or school facility audits may yield more objective and valid data.

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Appendix

Our research data can be found at the following link:

https://docs.google.com/spreadsheets/d/11eyiAKoCHqRxiZb_pK0u-

W2zpJeeEKh8CzbkAR5R02c/edit?usp=sharing

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- Formulating the research problem and objectives.
- Developing the theoretical framework and conducting the literature review.
- Determining the quantitative methods to be used in the research, including the development of the questionnaire.
- Writing the introduction, literature review, methodology, and main discussion sections.
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Enhancing STEM Education Through Simulation-Based Learning: A Study on Student Engagement and Comprehension in Foundation Courses

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Abstract: Simulation-based learning (SBL) presents a promising solution to bridge the gap between theoretical knowledge and practical application in STEM education. This study explores the implementation of simulation tools in four Foundation-level modules such as Fundamentals of Programming, Communication Networks, Biology and Chemistry which aiming to enhance student engagement and understanding while offering lecturers an avenue to innovate their teaching methods. Through hands-on workshops and post-implementation feedback from students and lecturers, the study examines the pedagogical value and practical challenges of integrating simulations. Results indicate increased student focus, enthusiasm, and conceptual clarity, alongside educator satisfaction and a commitment to continued use of simulations. This paper presents insights into effective practices, challenges, and future directions for scaling simulation-based pedagogy to higher education levels.

Keywords: Simulation-Based Learning, STEM Education, Student Engagement, Teaching Innovation

Introduction

STEM education continues to face the challenge of transforming theoretical knowledge into meaningful, practice-oriented learning experiences. Traditional lecture-based teaching methods, though structured and widely used, are increasingly seen as insufficient for engaging students and promoting higher-order thinking skills, especially in foundational STEM programmers (Freeman et al., 2014). These approaches often lead to passive learning environments where students struggle to visualize abstract concepts, particularly in modules such as programming, chemistry, and networking.

In response, Simulation-Based Learning (SBL) has gained traction as an effective pedagogical innovation. SBL leverages technology to create interactive environments that emulate real-world systems or phenomena, enabling students to explore, manipulate, and understand complex scientific processes in a safe and controlled setting (Rutten et al., 2012; Lateef, 2010). Through simulations, learners can test hypotheses, receive instant feedback, and engage in experiential learning factors known to significantly improve engagement and conceptual understanding.

Recent studies affirm that digital simulations not only enhance student engagement but also support inclusive and scalable teaching models, particularly in online and hybrid learning settings that became more widespread post COVID-19 (Makransky & Mayer, 2017; Kang et al., 2020). In STEM disciplines, simulations offer an efficient and cost-effective alternative to physical labs, making them especially relevant for pre-university and resource constrained institutions (Cheng et al., 2021). They also align well with constructivist learning theories, which emphasize active knowledge construction through experience and interaction (De Jong et al., 2013).

Moreover, newer research highlights the growing integration of adaptive and AI-driven simulations in higher education, providing personalized learning pathways that respond to individual student needs (Choi & Lee, 2021). For educators, simulation tools provide novel opportunities for assessment, collaborative learning, and curriculum innovation. However, despite their potential, simulation-based strategies are still underutilized in many Southeast Asian higher education contexts, particularly at the foundational programme level, where students often lack the cognitive maturity or prior exposure to advanced technology-enhanced learning tools (Ismail et al., 2022).

This study addresses this gap by introducing structured simulation-based workshops across four STEM modules Fundamentals of Programming, Communication Networks, Chemistry, and Biology in a Foundation in Science programmer in University Nottingham Malaysia. It explores how simulation tools such as CodeCombat, Wireshark, and ChemDraw influence student engagement and conceptual understanding. Simultaneously, it captures lecturers' reflections on the integration process, examining how simulations shift teaching practices and enhance instructional design.

Research Objectives

This study aims to:
1.   Evaluate the effectiveness of simulation-based learning in enhancing student engagement and conceptual

understanding in foundational STEM modules.

2. Examine how simulation tools influence educators' teaching practices, lesson delivery, and assessment design.

3. Identify key enablers and barriers in implementing simulation-based learning in a Malaysian pre-university curriculum.

Research Questions

1. To what extent does simulation-based learning improve student engagement and focus in Foundation STEM courses?

2. How does the use of simulation tools impact students' comprehension of complex, abstract STEM concepts?

3. What are educators' perceptions of the benefits and challenges of integrating simulation-based learning into their teaching practice?

4. How can simulation-based learning be effectively designed and implemented to complement traditional pedagogy in foundational programmes?

Literature Review

The integration of Simulation-Based Learning (SBL) in STEM education has received increasing scholarly attention over the past two decades due to its potential to bridge the gap between abstract theory and practical application. Rooted in experiential learning theory (Kolb, 1984), SBL enables learners to explore, manipulate, and engage with dynamic models that reflect real-world systems, fostering deeper understanding through trial-and-error, feedback, and self-reflection. This pedagogical approach aligns with constructivist principles, wherein learners actively construct knowledge rather than passively absorb information (De Jong et al., 2013).

Early studies have demonstrated that simulations can significantly improve student learning outcomes in science and engineering by promoting active engagement, supporting visualization of complex processes, and facilitating inquiry-based learning (Rutten et al., 2012). For instance, simulations in chemistry have allowed students to explore molecular interactions that are otherwise invisible or difficult to replicate in a standard lab environment (Cheng et al., 2021). In computing, simulation platforms like CodeCombat or Scratch have proven effective in introducing programming logic to beginners in a gamified and interactive manner (Grover et al., 2015; Shulman et al., 2020).

Recent research, particularly post pandemic, has reaffirmed the value of simulations in hybrid and online learning environments. A study by Kang et al. (2020) found that simulation-based virtual labs led to higher student achievement and engagement compared to traditional instruction in physics courses. Similarly, Makransky and Mayer (2020) highlighted how immersive simulations can enhance learning outcomes by fostering higher emotional engagement and cognitive presence, especially when physical access to laboratories is restricted.

In the Malaysian context, the implementation of SBL is gaining momentum, yet remains inconsistent across institutions. According to Ismail et al. (2022), lecturers in local universities acknowledge the pedagogical value of

simulations but cite challenges such as insufficient training, lack of access to tools, and limited curriculum integration as barriers. Nevertheless, the Malaysian Education Blueprint (MOE, 2015–2025) encourages the adoption of technology-enhanced learning, positioning simulation tools as key drivers for Education 4.0.

When applied to foundation programmes, simulations serve an essential scaffolding role for students who often transition from rote learning environments into more inquiry-driven tertiary curricula. Foundation level learners typically face difficulties in grasping abstract STEM concepts due to limited prior exposure or cognitive maturity. Here, simulations can lower the cognitive load by breaking down complex phenomena into visual, interactive steps (Choi & Lee, 2021). For instance, Wireshark as a networking simulation tool allows students to visualize packet transmission, offering practical reinforcement of theoretical concepts.

Furthermore, educators' roles in facilitating simulation-based activities are pivotal. Studies have shown that the effectiveness of SBL is influenced not only by the quality of the tool itself but also by how it is integrated into teaching practices (Quinn et al., 2020). Pedagogical strategies such as pre-simulation briefings, guided exploration, and post-simulation debriefings significantly enhance learning effectiveness. Thus, understanding lecturers' perceptions and instructional adjustments is crucial for institutional adoption and scalability.

While the benefits of simulation are well-established, there remain gaps in empirical research particularly in the context of pre-university programmes in Southeast Asia. Existing literature predominantly focuses on higher education or medical simulations, with relatively few studies exploring how foundation-level students experience simulations across multiple STEM disciplines. This study contributes to filling this gap by examining both student engagement and lecturers' pedagogical responses to simulation workshops in programming, networking, biology, and chemistry modules.

In summary the literature supports the integration of SBL in foundational STEM education for enhancing conceptual understanding, promoting student engagement, and supporting educators in delivering dynamic, interactive lessons. However, successful implementation requires institutional commitment, adequate infrastructure, and ongoing faculty development to ensure sustainability and pedagogical impact.

Method

This study employed a mixed-methods research design to investigate the effects of simulation-based learning (SBL) on student engagement and teaching practice across STEM modules in a Foundation in Science (FiS) programme at University Nottingham Malaysian, a higher education institution. The research was implemented in four phases: collaborative planning, workshop execution, data collection, and analysis. A total of 105 students voluntarily participated in structured two-hour workshops integrated into their core modules, namely Fundamentals of Programming, Communication Networks, Chemistry, and Biology. These workshops were designed and facilitated by the respective module convenors, who formed a collaborative academic team for the initiative. Prior to implementation, several coordination meetings were conducted among the educators to select appropriate simulation tools, align workshop activities with module learning outcomes, and ensure consistent delivery across disciplines.

Each workshop utilized simulation tools suited to the module content: CodeCombat for Fundamentals of Programming, Wireshark for Communication Networks, and ChemDraw for Chemistry and Biology. CodeCombat offered a gamified programming environment where students progressed through logic based coding challenges, allowing for experiential learning in algorithmic thinking. Wireshark enabled learners to analyze real time network packets, making abstract networking concepts tangible through live demonstrations. In Chemistry and Biology modules, ChemDraw allowed students to explore molecular structures and reactions through visual modelling, thus supporting conceptual clarity in complex biological and chemical systems. All workshops were conducted in computer laboratories equipped with the necessary software, ensuring that students engaged directly with the technology throughout the session.

To assess student engagement in the workshops, the study employed a validated instrument adapted from the work of Burch et al. (2015), who developed a survey to measure engagement across three key domains: emotional, physical, and cognitive. This survey was originally published in the Journal of Education for Business and provides a robust framework for analyzing how students connect affectively, behaviorally, and mentally with a learning experience. The emotional engagement section evaluates student enthusiasm, interest, and energy (e.g., "I am enthusiastic about this class/workshop"), physical engagement measures effort and intensity (e.g., "I exert my full efforts toward this class/workshop"), and cognitive engagement assesses attentional focus in class (e.g., "When I am in the classroom, I concentrate on class discussion and activities"). Each item is scored on a 7-point Likert scale, ranging from 1 ("Very untrue of me") to 7 ("Very true of me"). The questionnaire was reviewed by academic peers and adapted to the context of simulation-based workshops before being administered.

Surveys were distributed to students at the end of each session, and responses were collected anonymously to preserve confidentiality. Descriptive statistical methods were employed to analyze student responses across each dimension of engagement, with the data further disaggregated by module to explore variations based on simulation tools or subject matter. To complement the quantitative data, qualitative insights were collected from lecturers through structured post-workshop reflections. These reflections focused on observed student behavior, challenges faced during facilitation, perceived benefits of the simulation tools, and pedagogical shifts experienced as a result of the initiative. Thematic analysis was used to identify common patterns and support triangulation with the survey results. Beside this, there is survey to collect the lecturers feedback on the entire initiative of introducing the simulation based learning activities and how its help them in increasing the student engagement.

All research activities adhered to institutional ethical guidelines. Participants were fully informed about the purpose of the study and their rights, and no personally identifiable information was collected. The study design, validated measurement tools, and integration of both student and educator perspectives provided a rigorous methodological foundation for evaluating the impact of simulation-based learning in foundational STEM education.

Results

The study aimed to assess the level of student engagement in three different workshops: Communication Networks (CN) Workshop, Programming Workshop, and Biology/Chemistry Workshop. Engagement was measured across

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three dimensions: Emotional Engagement, Physical Engagement, and Cognitive Engagement. The table below summarizes the average engagement scores for each dimension across the three workshops (see Table 1).

Table 1. Average Engagement Score

Dimension	Communication Network	Programming	Biology /Chemistry
Emotional Engagement	5.42	6.12	6.18
Physical Engagement	5.23	5.89	6.05
Cognitive Engagement	5.14	6.21	6.32

Here is the bar graph illustrating the average student engagement scores across three workshop types Communication Network (CN), Programming, and Biology/Chemistry measured across three dimensions emotional, physical, and cognitive engagement (see Figure 1).
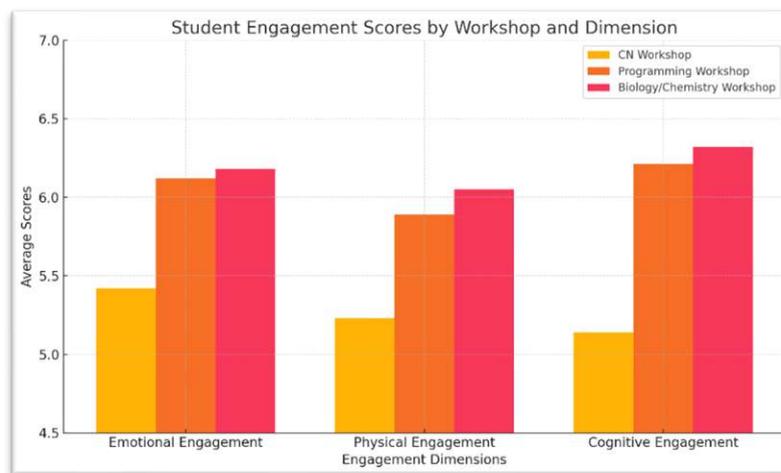
Figure 1. Centre the Caption below the Figure

Discussion

Emotional engagement, which reflects the students' emotional connection and enthusiasm towards the workshop content, was highest in the Biology/Chemistry Workshop (6.18). This suggests that the students in this workshop felt the most emotionally invested, likely due to the relevance and interest they found in the subject matter. It could also indicate that the teaching methods employed in this workshop were particularly effective at fostering an emotional connection.

The Programming workshop had a slightly lower emotional engagement score of 6.12, suggesting that while students in this workshop were still relatively emotionally engaged, the emotional impact of the content may not have been as strong as in the Biology/Chemistry workshop. Programming can sometimes be seen as a more abstract or challenging topic, which might influence students' emotional connection to the material.

The Communication Network workshop had the lowest emotional engagement score (5.42), which could indicate that students felt less emotionally connected to the subject matter. Communication Networks is a highly technical field, and students may not find it as inherently engaging or relatable as Biology/Chemistry, which deals with real world biological systems and chemical processes. This module is core module for all the student regardless their progression. This also could be a reason because mix crowd of students from different background.

Physical engagement measures the level of physical involvement students have during the workshop. The Biology/Chemistry workshop scored the highest in this dimension with a score of 6.05, suggesting that students were highly engaged in physical activities such as laboratory experiments, demonstrations, or hands-on tasks. The interactive and practical nature of biology and chemistry may contribute to this high score, as these subjects often require students to perform experiments and engage with tangible materials.

The Programming workshop had a physical engagement score of 5.89, which is higher than the CN Workshop but slightly lower than the Biology/Chemistry Workshop. While programming exercises often involve working on computers and engaging in practical tasks, they may not involve as much physical movement or hands-on interaction as a lab-based science workshop. This may explain the lower physical engagement compared to the Biology/Chemistry Workshop.

The CN Workshop had the lowest physical engagement score of 5.23, which might reflect the nature of the content. Communication Networks are often taught through lectures and theoretical exercises, which may not require as much physical activity compared to subjects like Biology or Chemistry that involve lab work. The limited physical engagement in the CN workshop could point to opportunities for incorporating more interactive or hands-on activities to enhance physical engagement.

Cognitive engagement refers to the mental effort and deep thinking students invest in the learning process. The Biology/Chemistry Workshop again scored the highest in this dimension with a score of 6.32, indicating that students were highly cognitively engaged. The complex nature of scientific concepts and the need for critical thinking in experiments and problem-solving in biology and chemistry likely contributed to this high level of cognitive engagement.

The Programming Workshop scored 6.21 in cognitive engagement, indicating that students were also deeply engaged in the material. Programming often requires problem-solving, logical thinking, and applying theoretical knowledge to practical tasks, which may explain the high cognitive engagement. However, it is slightly lower than the Biology/Chemistry Workshop, possibly due to the nature of programming, which some students may find more challenging or abstract compared to the tangible nature of scientific experiments.

The CN Workshop had the lowest cognitive engagement score of 5.14, which may suggest that students were less mentally engaged with the material. Communication Networks, although a fundamental area of computer science, can sometimes be perceived as difficult or theoretical, which may hinder students' deeper cognitive engagement. To

enhance cognitive engagement in this workshop, instructors might consider incorporating more interactive content, real-world applications, or problem-solving activities that connect theory with practice.

The results reveal that the Biology/Chemistry workshop consistently outperformed the Programming and Communication Networks (CN) workshops in terms of emotional, physical, and cognitive engagement. This could be due to the highly interactive and hands-on nature of biological and chemical experiments, which may evoke stronger emotional and physical involvement, as well as stimulate more cognitive processing due to the complexity of scientific inquiry.

On the other hand, the Programming workshop had relatively high levels of engagement, especially in the cognitive dimension. However, the slightly lower emotional and physical engagement could be attributed to the nature of programming tasks, which tend to be more abstract and less physically interactive compared to the other workshops.

The CN Workshop had the lowest engagement scores across all three dimensions. This suggests that students may find the material less engaging due to its abstract nature and theoretical content. To improve engagement in the CN workshop, instructors might consider integrating more practical, real-world scenarios, interactive simulations, or activities that require physical involvement to make the content more accessible and engaging for students.

In addition to the student engagement survey, feedback was also gathered from lecturers who utilized simulation based learning activities during their workshops. The perspectives shared by the lecturers offer valuable insights into the impact of simulation-based learning on student engagement and learning outcomes compared to traditional classroom methods. This section integrates the lecturer feedback into the discussion.

From the feedback provided by the lecturers, it is evident that simulation-based learning led to significantly higher levels of student engagement compared to traditional classroom teaching methods. Several lecturers highlighted that student exhibited much higher engagement in simulation-based workshops compared to traditional methods. The simulation tools allowed students to interact with content in ways that were not possible through traditional lectures or textbook-based learning. This feedback aligns with the student engagement survey, where emotional, physical, and cognitive engagement were notably higher in workshops that included simulation activities, particularly in Programming and Biology/Chemistry workshops. These findings suggest that simulation-based learning effectively captures students' interest and promotes deeper engagement with the subject matter.

Lecturers consistently observed that the engagement levels were much higher in simulation-based workshops than in traditional methods. This observation is corroborated by the student engagement data, where workshops involving more interactive, hands-on content resulted in higher engagement across the emotional, physical, and cognitive dimensions. The increase in engagement suggests that simulation tools can make learning more interactive and accessible, enhancing the overall student experience.

Feedback on the impact of simulation on problem-solving skills was mixed. While some lecturers noted that students demonstrated improvements in their ability to solve problems, particularly when using tools that allowed them to

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manipulate and visualize complex concepts (e.g., 3D modeling for molecular structures), others found that simulation-based activities did not lead to noticeable improvements in problem-solving. This discrepancy could be due to the varying levels of complexity of the subjects and the different types of problems posed in the simulations. In subjects like Programming, where logical problem-solving is a key skill, the benefits may not have been as immediately evident.

In contrast, in more visually oriented subjects like Biochemistry, where simulations allowed students to manipulate 3D molecular models, the feedback was more positive regarding the improvement of problem-solving abilities. This suggests that simulation-based learning might be more effective in enhancing problem-solving skills in disciplines that require spatial reasoning and visual representation of abstract concepts.

The shift from traditional teaching methods to simulation-based learning led to more active participation in the classroom. The simulation activities encouraged students to work independently and interact with content in a more hands-on manner. This is reflected in the increased levels of physical and cognitive engagement recorded in the student surveys. Lecturers noted that simulation-based workshops provided opportunities for students to engage in active learning, allowing them to experiment with content and build their understanding in real time. This shift in classroom dynamics suggests that simulation-based learning fosters a more student-centered learning environment.

Despite the positive outcomes, lecturers also identified some challenges in implementing simulation-based learning. Time management was cited as a challenge, with some lecturers finding it time-consuming to introduce students to the simulation tools and familiarize them with the approach. This issue was particularly prominent when introducing new tools for the first time. Technical issues, such as slow computer startup times, affected the efficiency of some workshops. IT support was highlighted as a critical factor for ensuring that simulation-based learning runs smoothly and does not suffer from technical delays. Some lecturers also noted the need for appropriate resources and tools to fully leverage the potential of simulation-based learning. In particular, tools that allow for more interactive visualizations, such as 3D modeling software for subjects like Chemistry and Biology, were seen as highly beneficial for enhancing students' understanding of complex concepts.

The integration of simulation-based activities not only improved student engagement but also fostered a more interactive, hands-on learning environment. As highlighted by the lecturer feedback, active participation and conceptual understanding were significantly enhanced by simulation-based learning. The use of tools that allowed for real-time interaction with the content led to higher levels of engagement and helped students grasp difficult concepts more effectively. While the initial challenges faced by both students and lecturers in adopting simulation-based learning were acknowledged, the overall feedback indicates that the benefits far outweigh the difficulties. Active learning, problem-solving, and conceptual understanding were all enhanced through the use of simulation tools.

Conclusion

The feedback from both students and lecturers indicates that simulation-based learning can significantly enhance student engagement across multiple dimensions emotional, physical, and cognitive. The integration of interactive

tools in the classroom has been shown to increase student participation and improve their understanding of complex concepts, particularly in subjects such as Programming, Biology/Chemistry, and Communication Networks.

However, the adoption of simulation-based learning does present some challenges, such as technical issues, time constraints, and the need for appropriate resources and support. Addressing these challenges by providing better IT support, training, and access to appropriate tools will be crucial in maximizing the potential of simulation-based learning.

Overall, the findings suggest that simulation-based learning has great potential to transform traditional teaching methods by creating a more interactive, engaging, and student-centered learning environment. By continuing to integrate these tools and addressing the challenges identified by lecturers, educators can significantly enhance the learning experience for students across a variety of disciplines.

Recommendations

Based on the results, it is recommended that Biology/Chemistry workshops continue to leverage hands-on, interactive learning to maintain high levels of engagement. Programming workshops may benefit from incorporating more collaborative and project-based tasks that increase emotional and physical engagement, such as group coding challenges or programming in real-world contexts. CN workshops should explore opportunities to integrate more practical applications, simulations, and interactive activities to boost emotional, physical, and cognitive engagement. More tangible, real-world examples and projects could make the content more relatable and engaging for students. By tailoring workshop designs to increase engagement across these dimensions, educators can improve the overall learning experience and outcomes for students in these diverse subjects.

Acknowledgements

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Optimization of the Supply Chain of an SME Ice Cream Distributor Using the ABC Methodology, Economic Order Quantity, and Reorder Point

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Abstract: The economic order quantity, reorder point, and ABC methodology are engineering tools that aid in achieving better inventory management in companies across various industrial sectors. The aim of this research was to design and validate a simulated proposal that optimizes the organization's supply chain using engineering resources. To this end, an applied improvement design was employed utilizing simulation software, divided into four phases: diagnosis, current and proposed simulation design, development of implementation manuals, and measurement of project impacts on society. The main findings demonstrate that the delivery time of finished products to the end customer can be reduced through proper inventory management that does not interfere with the production process. The research contribution focuses on reducing the percentage of late deliveries and stockouts by implementing the aforementioned engineering tools. This proposed solution represents a more cost-effective alternative compared to ERP systems currently used by large companies to manage their inventory, aiming to enhance supply chain efficiency, ultimately resulting in an approximate 3-day improvement in delivery time for the finished product to the primary customer.

Keywords: Inventory management, Supply chain, Logistics, Optimization

Introduction

The present research focused on inventory improvement using engineering tools to enhance the supply chain of the selected company. Order fulfillment issues in small enterprises result in untimely delivery of products to customers. This problem can stem from inadequate inventory management, leading to delays in production of finished goods and disruptions in the supply chain. According to the National Logistics Survey, small businesses achieve an average order fulfillment rate of 34.5%, whereas large enterprises reach 51.1% (ComexPerú, 2022). It is estimated that around

60% of orders in microenterprises are delivered late. The studied company experiences a 40% rate of late deliveries to its main client, Cencosud, whereas industry experts suggest an ideal rate of 20%. This technical gap of 20% represents an opportunity to optimize the supply chain, improve procurement times, and consequently shorten delivery times. Persistent delays in delivery to the primary client may prompt reduced orders or the consideration of switching suppliers, resulting in continuous economic losses in terms of sales and long-term commercial relationships. Currently, nearly half of the orders are delivered late, underscoring the significant opportunity for the company through enhanced purchasing and inventory management.

Furthermore, through comprehensive analysis, it was identified that demand planning deficiencies and inadequate procurement and inventory management are the primary causes in the case study. These factors contribute to a high stock out rate and prolonged lead times for purchases. These indicators, in turn, lead to two main issues: extended lead times in customer service and a high percentage of late deliveries. As a consequence, there is a reduction in sales to the primary customer, increased costs due to unplanned inputs, and a need for overtime hours among operators to meet demand within their workday. Ultimately, these consequences result in an economic impact on the company, with estimated annual economic losses amounting to approximately 19,440 USD.

Objectives

The aim of this study is to design and validate a simulated proposal aimed to optimize the supply chain of a Peruvian company using engineering tools. This research includes an extensive review of the project's background and current literature, establishing a comprehensive understanding of the context. Through detailed analysis, opportunities for enhancing the supply chain of a fast-moving consumer goods company are identified leveraging industrial engineering methodologies. The study proceeds to develop tailored solution proposals for the Micro and Small Enterprise in the consumer goods sector. Subsequently, the implemented solution is validated within the Micro and Small Enterprise, evaluating both its economic feasibility and its impact on relevant stakeholders.

Method

This research was categorized as an applied improvement case study through simulation. This framework consists of four phases: diagnosis, design of current and proposed simulation models, development of implementation manuals, and measurement of project impacts on society.

During the initial stage, information provided by the company was gathered to identify the main issues, their root causes, and consequences. As part of this process, site visits were conducted to observe the production process and specific stages of the supply chain, which helped identify opportunities for improvement. Additionally, key performance indicators of the company were collected, enabling measurement of organizational performance in specific aspects.

The simulated improvement model, an integral part of the study's second phase, is structured around three key tools: ABC methodology, economic order quantity (EOQ), and reorder point. Regarding the implementation of the first tool

in the simulation, the Queue data module is used to prioritize products classified as A upon entry into each process. This enables the software to reduce customer service lead time and bottlenecks, thereby improving time-related indicators. Additionally, calculating the economic order quantity is essential to ensure the availability of inputs in the warehouse before planning gelato production. This calculation prevents the generation of obsolete products in inventory by identifying the optimal quantity order from suppliers for each product input. The corresponding formula is provided below.

$$Q = \sqrt{\frac{2DS}{IC}}$$

Where:

D: anual demand

S: cost of placing an order

I: storage cost

C: unit cost

Finally, the concept of reorder point is used to define the optimal replenishment time and order frequency. The corresponding formula is shown below.

$$PRO = (d * TE) + SS$$

Where:

d: demand in units per delivery time

TE: delivery lead time

SS: safety stock

The proposed solution aimed at reducing the percentage of late deliveries to Cencosud clients has a positive impact on the company's supply chain. Firstly, by minimizing this percentage, a shorter customer service lead time can be achieved, thereby strengthening the business relationship by fulfilling the commitments made in the agreement. Secondly, implementing engineering tools to manage inputs, procurement, and warehouse operations can ensure effective inventory management, resulting in reduced lead time for purchases and lower stockout percentages. Finally, it enables avoidance of reprocessing in purchases, facilitates planned procurement of inputs, and enhances storage efficiency.

Data Collection

For the simulation, we determined that conducting 10 replications (n=10) would be sufficient to achieve our objective. This decision was based on aiming for a 95% confidence level, which required us to set the number of replications at 10. The calculation involved using an estimated standard deviation (σ) of 5 units and the critical value ($Z\alpha/2$) corresponding to the 95% confidence level, approximately 1.96. This approach ensures that our simulation results are statistically reliable and provide a robust estimation of the parameter of interest across the multiple replications.

The simulation model developed in Arena spans 52 weeks with an established work shift of 8 hours per day. Additionally, two different models have been designed: the "as is" model, representing the current processes related to inventory management within the company, and the "to be" model, which evaluates proposed improvements and optimizations through simulation. Both models provide a comprehensive view of process performance and their potential evolution. The weekly distribution of orders for chocolate brownie gelato from the client Cencosud was calculated. Exponential Normal distribution was obtained and utilized in the simulator to model weekly orders. It is also noteworthy that the unit of analysis in this process is the purchase order for gelato destined for Cencosud.

A comprehensive analysis of historical sales of the selected product was conducted to identify patterns, trends, and other valuable insights related to gelato demand throughout different seasons of the year. This approach provided a more precise and complete understanding of sales without relying on inferences from a sample. Moreover, it mitigates potential sampling errors that could arise from analyzing only a portion of the available data. Additionally, the company agreed to allow the use of all sales data by providing a two-year sales report compiled in Excel.
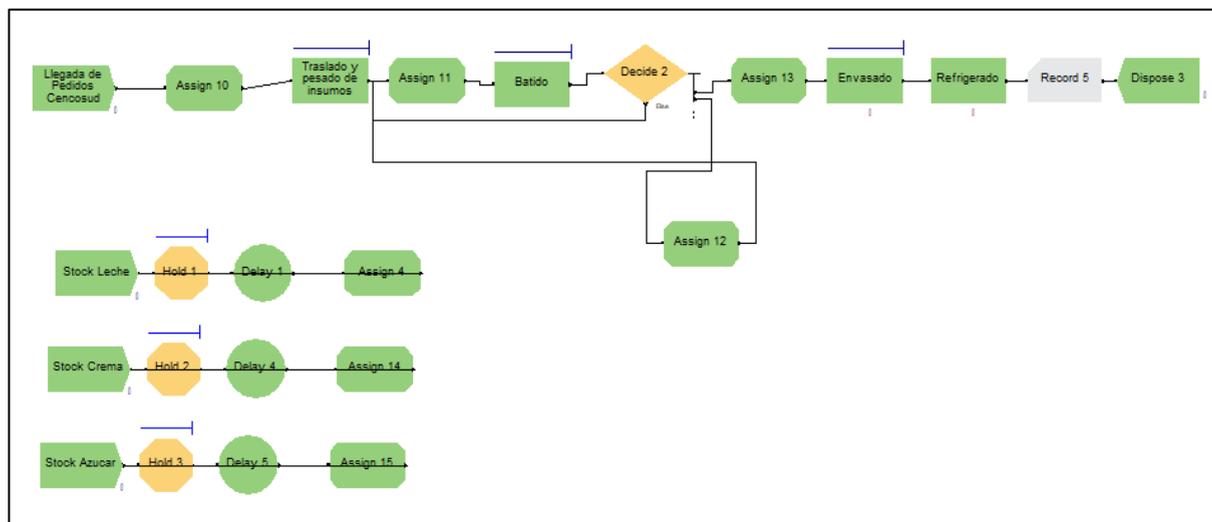
Figure 1. Arena model of the company's ideal inventory and production process

Results

The results are presented using inventory indicators, such as customer delivery time, percentage of late deliveries, and stockouts. To establish the confidence intervals, 10 replicas were set in the simulation, calculated using the general sample calculation formula.

Numerical Results

By running 10 replicas, the study aimed to account for variability and provide a robust analysis. A 95% confidence interval was applied to these calculations to ensure that the results are statistically significant and reflective of the true performance of the supply chain under different scenarios. The following table 1 presents the results of each replica, divided into the initial situation and the final situation. The replicas were calculated in Arena software to ensure the accuracy and reliability of the simulation results.

Table 1. Comparison of Results of Scenarios with 10 Simulated Replicas

Replica Number	Customer delivery time		Percentage of late deliveries		Percentage of sotckouts	
	As is	To be	As is	To be	As is	To be
1	4.49	1.61	5.76%	2.95%	39.19%	21.53%
2	5.48	1.81	5.76%	2.52%	40.28%	21.44%
3	4.8	1.7	6.38%	2.58%	38.84%	19.80%
4	5.49	2.2	5.13%	2.94%	40.04%	20.59%
5	5.48	1.52	5.05%	2.48%	39.18%	19.11%
6	5.81	2.42	6.70%	3.24%	41.83%	20.67%
7	3.61	2.29	7.03%	2.31%	41.58%	21.17%
8	4.28	1.93	6.77%	2.22%	40.19%	18.31%
9	4.35	2.55	7.54%	2.65%	41.03%	19.89%
10	4.53	2.34	7.79%	3.17%	39.77%	21.38%

Table 2. Average Results Obtained in Current and Proposed Models

Indicator	As is	To be
Customer delivery time	4.832	2.037
Percentage of late deliveries	6.39%	2.71%
Percentage of sotckouts	40.19%	20.39%

Each indicator represents a significant improvement after utilizing the engineering tools. This allows for a reduction in delivery time to the main customer, which is the key indicator for the presented case study. Additionally, the percentage of stockouts, representing the percentage of time a material is unavailable relative to the total production time, decreases, allowing operators to work with fewer interruptions. Finally, the rate of late deliveries decreases indirectly as a consequence of the other indicators. The following Table 3 presents the reduction in the technical gap for order delivery time to customers. Table 3 presents the reduction in the technical gap for the order delivery time to customers, which is our key performance indicator

Table 3. Reduction in technical gap of average delivery time to clients (days)

Scenario	Average	Minimum	Maximum	Average Width	Lower Limit	Upper Limit
Actual	4.832	2.69	6.8	6.887	2.14	11.63
Propuesto	2.037	1.85	2.88	2.552	0.19	4.92
Reduction of technical gap	**2.795**	**0.84**	**3.92**			

In the current scenario, delivery times range between [2.69; 6.8] days, with an average of 4.8 days from order placement to customer receipt. In contrast, the proposed model presents a range between [1.85; 2.88] days, with an

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average of 2.04 days. The difference between the current and proposed models is 2.7 days, reflecting a significant improvement in purchase order lead time following the implementation of the proposed engineering tools.

Graphical Results

To conduct a more detailed analysis, the Output Analyzer tool was used, which is designed to evaluate and interpret the results of simulation experiments. Figure 3.6 presents the Output Analyzer report, and Table 4 shows the reduction of the technical gap in the stockout rate.

Figure 2. Output Analyzer lead time results to customers

In the current scenario, delivery days range between [2.69; 6.8] with an average value of 4.8 days from the time the order is placed until the customer receives it. On the other hand, in the proposed model, the range of delivery days is between [1.85; 2.88], with an average of 2.04 days. The difference between the current model and the proposed model is 2.7 days, reflecting a significant improvement in the lead time of purchase orders after the implementation of the proposed engineering tools.

Economic Evaluation

An economic evaluation was conducted by comparing the income statement with and without improvements to assess the business's economic performance with savings in expenses and costs. Table 4 shows the differences in each income statement.

Table 4. Difference in income statement with applied improvement and without improvement in USD

Economic evaluation	Year 1	Year 2	Year 3
Revenue (Aditional)	1,074.14	1,181.56	1,299.71
-COGS (Aditional)	-1,263.16	-1,263.16	-1,263.16
Gross Profit (Aditional)	2,337.30	2,444.71	2,562.87
-SG&A	-1,578.95	-1,578.95	-1,578.95
EBIT	3,916.25	4,023.66	4,141.82
-Interest Expense	0.00	0.00	0.00
EBT	3,916.25	4,023.66	4,141.82
Taxes	391.62	402.37	414.18
Net Income	3,524.62	3,621.30	3,727.64

The income statement reflects an approximate annual savings of 3,500 USD attributed to various outcomes resulting from the implementation of improvements. Firstly, greater efficiency and savings in purchase orders have had a positive impact on the cost of sales, estimated at around 1,200 USD annually. Additionally, reducing overtime hours for staff has contributed to a decrease in annual operating expenses by 1,500 USD. Lastly, for the case study, the income tax rate is 10%, reflecting its legal classification as a Micro and Small Enterprise (SME). The economic cash flow is presented in the following table.

Table **5**. Analysis of economic cash flow in USD

Cash Flow	Year 0	Year 1	Year 2	Year 3
Net Income	0.00	3,524.62	3,621.30	3,727.64
-Staff training on new software	-269.74	0.00	0.00	0.00
-Macros system for economic batch calculation	-131.58	0.00	0.00	0.00
-Implementation of ABC system for inputs (Labels)	-39.47	0.00	0.00	0.00
-Reinstallation of shelves for ABC system	-39.47	0.00	0.00	0.00
-Data analysis consultancy for ice cream sector Economic Cash Flow	-52.63	0.00	0.00	0.00
Economic Cash Flow	-532.89	3,524.62	3,621.30	3,727.64

Financial calculations were conducted using cash flow analysis to assess the project's profitability. Initially, a Cost of Capital (COK) rate of 10% was established, representing the expected return for investors. The Net Present Value (NPV) calculation yielded a result of 7,695,22 USD, indicating that the project will generate income exceeding financing costs. This suggests that an investment of 532.89 USD could result in significant savings for the company.

Additionally, an Internal Rate of Return (IRR) of 663% was obtained, interpreted as the investment's rate of return. However, it's important to note that this figure can be misleading since the company's profitability is not based solely on the investment made, but also on sales growth in the ice cream sector. Therefore, although the IRR exceeds the COK, the more relevant financial indicator remains the Net Present Value. The NPV considers future cash flow and financing costs more comprehensively, providing a more accurate assessment of the project's profitability.

Discussion

An analysis of the results reveals significant alignment with prior research by Opoku et al. (2021) and Teplická and Čulková (2020). These researchers demonstrate that methodologies like Economic Order Quantity (EOQ) and ABC analysis are effective tools for managing warehouse inventories, enhancing production productivity, and minimizing bottleneck times in supply chains. Consistent with these findings, the present study observed a reduction in stock-out rates and an increase in production output within a given timeframe. A critical focus was inventory availability, addressed through the application of EOQ in both studies. Both works highlight that stock shortages adversely affect supply chains by delaying the delivery of finished products. They further emphasize the necessity of ordering optimal material quantities at the right intervals to ensure adequate inventory levels.

On the other hand, this research differs from the approach established by Chopra et al. (2022), who base their inventory management proposals on using Enterprise Resource Planning (ERP) systems. This perspective is supported by Yu

et al. (2021), whose study underscores the utility of this technology-driven method for collecting and processing company information. In contrast, this research proposes methodologies that do not rely on integrated systems or information technologies. The use of ABC analysis, EOQ, and reorder point represents more cost-effective alternatives for companies while meeting the necessary functions to achieve the objectives established in this study.

Furthermore, as highlighted by Qaffas et al. (2023), the usefulness of adopting the ABC methodology for effective inventory management is justified. However, in contrast to the present case study, it is argued that integrating artificial intelligence as a complementary component of this methodology is essential. The proposed approach is grounded in the framework of explainable artificial intelligence, specifically through Shapley Additive explanations (SHAP), which provides a clear representation of the contribution of each criterion in forming inventory categories. This facilitates understanding the reasoning behind assigning items to specific categories.

Finally, Emar et al. (2021) highlight the importance of effective management of computer spare parts (CSPs) inventory to prevent both excess stock and stock-outs, which affect service quality. Their study at Power-One Jordan Computer Hardware-Software Company (POJCHSC) used the EOQ model to forecast a 20% increase in demand for certain products. The company achieved a profit margin of 48%, and the results suggest that improvements in inventory management, particularly for slow-moving items, could further reduce losses. The authors recommend an enhanced ABC classification model that accounts for the criticality of these items. These findings offer valuable insights for companies seeking to optimize slow-moving inventory and boost profitability.

Conclusion

This study has effectively addressed the needs of a growing ice cream company by optimizing inventory management through engineering tools such as ABC classification, economic order quantity, and reorder point. These improvements have not only enhanced operational efficiency and reduced costs but also significantly reduced lead time to the main customer, thereby improving customer service and strategic production planning.

A significant contribution to industrial engineering has been made by demonstrating how these tools can be practically and economically applied in small ice cream companies. This approach not only fills a gap in the literature on inventory management in resource-limited companies but also offers a replicable and generalizable model to other industries facing similar challenges, thus promoting business efficiency and competitiveness. As a result, late deliveries have been reduced to 20.1%.

Previous studies consistently support the effectiveness of economic order quantity, ABC analysis, and reorder point in inventory management, demonstrating reductions in stockouts and improvements in productivity. This research proposes cost-effective alternatives compared to approaches requiring advanced technology investments, such as ERP systems or artificial intelligence, generating significant savings in logistics costs and ensuring the achievement of strategic business objectives. The difference between the current model and the proposed model is 2.7 days.

Based on these findings, there is an opportunity to explore new research avenues, such as integrating inventory

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management tools with emerging technologies like artificial intelligence and IoT for small businesses or developing hybrid models that combine traditional techniques with real-time data-driven solutions. These initiatives could further enhance the accuracy and efficiency of inventory management, strengthening the competitiveness and sustainability of businesses in a dynamic economic environment.

Recommendations

The findings of this study highlight the importance of leveraging engineering tools such as the ABC methodology, Economic Order Quantity (EOQ), and reorder point to enhance inventory management and improve supply chain performance. It is recommended that companies, particularly small and medium-sized enterprises (SMEs) in the consumer goods sector, adopt these methodologies to address inefficiencies in procurement and inventory systems. Implementing these tools can significantly reduce stockouts, improve lead times, and enhance overall customer experience by ensuring timely deliveries.

Future research should explore the integration of these tools with emerging technologies, such as artificial intelligence and machine learning, to further optimize inventory management processes and adapt to the dynamic demands of Industry 4.0. Additionally, broader case studies across different industries and geographic regions could provide more generalized insights into the application of these methodologies.

Acknowledgements or Notes

The findings of this study are specific to the selected case company and may require adaptation for broader application in different industries or regions. While simulation models offer robust insights, real-world implementation may present unforeseen challenges, making it advisable to conduct pilot tests before full-scale deployment. Additionally, the financial estimates provided are based on data from the company and may vary depending on market conditions and operational changes.

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Multimodal Strategies in Literacy Teaching in Vocational High Schools

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Abstract: The integration of literacy instruction with multimodal strategies is essential in today's rapidly changing educational landscape, as they can effectively address the diverse learning styles of students. This study aimed to investigate the use of multimodal approaches in literacy teaching, focusing on both receptive and productive language activities. This qualitative study involved students from both public and private Vocational High Schools in Central Java, Indonesia. The findings reveal that the literacy instruction frequently incorporated a range of multimodal strategies, utilizing text, audio, visuals, kinaesthetic activities, and combined multimodal. The integration of these strategies enhances students' understanding of abstract and complex concepts, fosters deeper analysis, and improves long-term retention through real-world applications. Furthermore, these approaches equip students to navigate a fast-paced professional environment. By employing diverse multimodal strategies, teachers can better meet individual learning needs, thereby increasing student engagement and comprehension.

Keywords: Multimodal Strategies, Teaching, Literacy, Vocational High Schools

Introduction

Literacy learning in vocational education, especially in the context of the digital era, has an essential role. Literacy practices, especially reading and writing skills, have not been the main focus in vocational education so students often experience difficulties in achieving competence and understanding technical symbols (Rahmawati, 2017). The role of literacy is vital for understanding instructions, interpreting technical manuals, forming vocational identities and communicating effectively in the world of work so as to support the achievement of learning objectives (Rahmawati, 2017; Schneider & Foot, 2013; Visén, 2021). In this context, literacy is more than just a cognitive activity. Literacy is part of a social practice that is essential in students' adaptation to their work environment (Shiohata & Pryor, 2008).

The curriculum in vocational education must be continuously developed, including digital literacy. New skills such as coding, big data and artificial intelligence should start to be integrated in learning (Verawadina et al., 2019). The integration of STEM literacy in is also proposed to bridge the gap between education and industry needs (Mustain, 2020). Furthermore, the concept of vocational literacy, which includes practical knowledge, vocational skills and

professional attitudes, can effectively develop critical thinking skills in vocational high school students to prepare them for the complex challenges of the modern workforce (Rahmadani et al., 2023; Wisudojati et al., 2024).

Multimodal approaches have proven to be effective in language learning across the globe. In the US, research by (Lim et al., 2022) proved that teaching English by integrating multiple modes (text, image, audio, video, etc.) enriches the learning experience and supports a broader interpretation of meaning. These findings are supported by research conducted by (Yi, 2014) with his findings that multimodal approaches help English as an additional language (EAL) learners in exploring their identity, as well as building critical understanding of texts. Similarly, the multimodal approach is used in the UK in language learning. By introducing different modes of communication, whether in text, images or digital technology, students can develop a better understanding of the context and material being taught, and prepare them for the challenges of the world of work (Rahmanu & Molnár, 2024; Tang et al., 2020).

The implementation of literacy in school learning can utilise multimodal strategies. A multimodal strategy is the use of various forms of text and digital media to improve students' literacy skills. The use of digital technologies such as digital books, learning videos, interactive multimedia and social media can increase students' interest in learning and literacy skills (Kardika et al., 2023; Olvah et al., 2024). These approaches allow students to interact with diverse modes of communication, providing richer learning experiences and better understanding of the material (Kardika et al., 2023). However, challenges in improving students' literacy still exist, mainly due to inadequate literacy practices and environments (Kharizmi, 2019). To overcome this, a joint effort from the government, schools, teachers and parents is needed to facilitate good literacy practices (Kharizmi, 2019). The implementation of multimodal literacy in the classroom also includes meaningful social interactions where children use different modes of literacy that they observe and experience in their daily lives. Thus, multimodal strategies not only help in the development of basic literacy skills but also prepare students for the digital age and complex communication.

Multimodal strategies and literacy learning play a key role in efforts to improve vocational skills. Some studies show that students who have good literacy skills tend to master technical skills better than those who are less literate. Some students with low reading interest and comprehension were found to affect learning activities and proactive engagement in learning (Mubaidilla et al., 2024). In vocational education, although exam questions in various fields are aligned with the principles of applying literacy skills, lesson plans are often lacking, indicating the need for improvement in incorporating literacy skills into teaching preparation (Tamrin & Nurhidayati, 2020).

In addition, several other studies have shown that the systemic functional approach in multimodal literacy education prioritises the development of students' critical skills in analysing and producing multimodal texts (Lim, 2018). Through the framework of Systemic Functional Theory and Learning by Design, this approach provides support that enables students to interpret and generate meaning in multimodal texts. As such, it highlights the importance of linguistic features and functions in multimodal texts, as well as identifying common strategies for meaning construction. In the context of English language teaching, multimodal composition also facilitates the creation of artefacts that demonstrate student learning outcomes (Lim & Unsworth, 2023). This study examines how teachers can design engaging and productive learning experiences and provide guidance to students in developing multimodal literacy.

Another study reviewed empirical literature relating to multimodal literacy applications in K-12 education from 2000 to 2020 (Si et al., 2022). The focus was on teachers' use of print and digital texts to support teaching practices. Furthermore, this study explored the contribution of multimodal literacy courses to the improvement of students' multimodal literacy skills in the context of early childhood education (Papadopoulou et al., 2018). Based on data from 20 undergraduate students at the University of Thessaly, results showed significant improvements in multimodal literacy and students' awareness of the application of multimodal pedagogical approaches in their educational practice. The study results show that the importance of multimodal strategies in literacy learning in the vocational education curriculum to equip students with the necessary skills to face the challenges in the future world of work. Literacy enables students to access and apply work-relevant information, increase their independence and participation in the community (Olufunke & Foluke, 2013).

Based on this, this study aims to examine in depth the use of multimodal strategies in teaching literacy, both in the receptive and productive aspects of the language of vocational high school students. By applying a qualitative approach. This study seeks to identify how various modalities such as text, audio, visual and kinesthetic can be integrated in the curriculum to improve students' literacy skills. This research will answer critical questions regarding multimodal strategies in improving students' language comprehension and production, as well as the implications for a more inclusive and effective pedagogical design in literacy education today.

Method

This study uses a qualitative method to explore the implementation of multimodal strategies in literacy learning in Vocational High Schools (SMK) and Religious Aliyah Madrasahs (MAK) in several areas of Central Java Province, Indonesia, namely Pemalang District, Pekalongan District, Brebes District, Rembang District, Cilacap District. This method was chosen because it provides an opportunity for researchers to intensively understand how teachers and students implement and respond to the use of multimodal strategies in literacy learning environments. The focus of this study is on how teachers design learning activities that are not only interesting but also effective by integrating multimodality, and how students utilise these strategies to strengthen their literacy skills.

The subjects in this study included 12 teachers and 48 students from several public and private vocational schools in Central Java in Class X, Accounting Department. This selection of subjects is intended to provide a broad understanding of how multimodal strategies are implemented in different types of schools. The research location in Central Java was chosen based on the diversity of its educational conditions, which allows this study to generate a more in-depth view of the way multimodal strategies are integrated in literacy teaching.

Data will be collected through three main methods: classroom observations and interviews with teachers and learners. Data will be analysed using content analysis techniques that focus on multimodal strategies. Information collected through observation, interviews and document analysis will be processed to reveal key themes related to the application of multimodal strategies in literacy learning. This analytical process is expected to reveal how these strategies strengthen students' engagement and understanding, as well as identify the barriers experienced by teachers when implementing them.

Result and Discussion

This study identifies the application of diverse multimodal strategies in the context of vocational literacy education which includes the use of a combination of text, audio, visual, audio-visual and kinesthetic media. The findings show that these strategies are integrated in a variety of materials to address diverse literacy challenges and fulfil different student learning needs. The multimodal strategies in the context of literacy learning used by teachers are based on multimodal elements as follows.

Text Elements

Text as a multimodal strategy in literacy learning refers to the use of writing integrated with other modes as a form of media to convey information. The text used varies according to the learning outcomes that are considered effective and interesting for students to learn and understand the material. The use of text as the basic media for multimodal strategies in literacy learning is quite common in Central Java vocational schools such as digital articles, e-books, infographics and running text. The observation results show that text is used in some materials such as evaluating the text of observation reports read to find information both explicit and implied critically.

The text of the observation report is displayed in the form of a digital article supported by various infographic data. In this lesson, students are asked to capture the meaning contained in the text of the observation report by involving critical analysis. The teacher selects the text by adjusting to the students' level of understanding and appropriate topics, such as reports on environmental observations, social research, or scientific experiments. The text is used as discussion material to identify the information expressed and implied in the text and then find the facts that are considered important. In addition, this observation report text is also used as a medium in identifying new words used in the context of certain science/social topics.

Texts are also utilised in literature learning, namely when discussing novels, poetry, hikayat, and short stories. Documentation of Indonesian literary works is not only physical in the form of books, but also literary works that are available digitally. Some teachers utilise digital literary texts available in several platforms due to the limited literary works available physically in the library. Digital literary text media not only documents Indonesian literary works, but is also utilised as a means to deepen understanding of the rules used in literary texts. Students are taught to interpret the motifs, characters, themes, and values contained in novels, sagas, and short stories so that through literary texts they can train students' ability to think critically. Students are also invited to dissect literary texts in order to exchange views and broaden their perspectives. With the digital literary text media, it can not only master students to understand the material technically, but also increase their interest in reading, critical thinking, creative thinking, and also understand the richness of literary works better.

Another literacy learning that utilises texts in vocational high schools is also found in the material of accurately assessing information and comparing the contents of description texts and negotiation texts. Through the dissection of description and negotiation texts, students are asked to evaluate the information contained in the text and determine its relevance and accuracy. Through careful reading of the texts, students are trained to critically analyse to evaluate

the accuracy and relevance of the information contained in each text. Some schools provide real-world examples where they see descriptive texts and negotiation texts applied in a professional setting through educational videos that include texts and podcast transcripts. This is done to be able to recognise the importance of assessing the information contained in the text and comparing the text to the world of work and everyday communication.

'In the workplace, we are often exposed to various sources of information, be it reports, articles or internal communications. The ability to determine the accuracy and relevance of this information greatly influences effective decision-making.' (01/W)

It is also explained that precise and reliable information can improve the quality of work and help avoid potentially negative mistakes. Whether in professional contexts or everyday communication, these skills not only improve communication effectiveness but also contribute to better decision-making. Thus, education on information literacy and analytical skills should be a major concern in developing the quality of human resources.

Text as part of multimodal does not stand alone. While text serves as the main channel for conveying ideas and information, it is often combined with other modalities such as visual, video, kinesthetic and others. Text is often used, for example, as explanatory text to understand the visual data presented or the video shown. Text also has an important role, for example, when materials using kinesthetic or audio-visual media cannot explain information comprehensively, text acts as an appropriate reference source to overcome this. One teacher also stated that in learning, written text is always needed to help understand the material. The use of various technologies plays an important role and text cannot be separated from these advancements.

Audio Elements

The use of audio modality in literacy learning in vocational high schools has the lowest percentage. Some teachers stated that audio media is less effective in conveying complex information such as information that requires more detailed explanations such as tables or graphs. One of the students also stated that listening to audio is easy to get distracted so that it lacks focus. In line with this, audio is also considered a 'liability' medium. The reason from one teacher stated that it is better to directly use audio-visual media because it is complete with sound and images, rather than audio alone.

Although audio media is considered to have many shortcomings, audio media is still used in learning. One private teacher in a vocational school in Central Java used audio media to listen to biography texts in the form of monologues accurately and critically. The media listened to was a biography recording of Buya Hamka, an Indonesian scholar, writer and politician. The recording was listened to through the teacher's device obtained from downloads on the internet. The reasons why teachers use audio media are mentioned as follows. Audio media is used to train students to focus on what is heard without getting help from other media in understanding information about Buya Hamka's biography.' (02/W)

After listening to the audio, students are also given trigger questions to measure their level of understanding of the audio. Students are also invited to discuss in groups to find the most inspiring aspects and values that are relevant in the context of their lives today. This learning provides a well-rounded experience, allowing students to understand and reflect on the values contained in the life of Buya Hamka.

Visual Elements

Visual media has many uses in literacy learning in schools such as helping to clarify concepts, increasing appeal, and helping to develop language skills holistically. In this study, teachers mostly used visual media to create mind maps displayed on the screen. Indonesian teachers in some schools also used infographics to teach text analysis. Students are given the task of creating infographics that illustrate the themes, settings and conflicts in the stories they read. This activity not only strengthens their understanding of the elements of the story but also improves their design and information synthesis skills. Classroom observations showed that visual students were more engaged and could recall information better. In a different context, the use of slide presentations containing visual excerpts from literary texts complemented by symbolic and metaphorical analyses helped students understand and appreciate the aesthetic and stylistic aspects of the texts more deeply.

The utilisation of visual media is also done through the activity of writing observation results logically and ethically. Teachers ask students to present their reports in the form of ideas into creative formats such as posters, illustrations, flashcards, presentation slides, and others. The presentation of the report by utilising visual media can increase motivation to learn and train students' creativity. In addition, teachers also utilise visual media in writing biography text. The teacher asks students to write an infographic-assisted biography. The teacher provided infographics about the stories of R.A. Kartini and Sapardi Djoko Damono. Then, the student is asked to develop a biography text based on the information contained in the infographic. With the infographic, it can be a guide for students in composing biography text more effectively and structured. The following is an example of an infographic used by teachers taken from the Indonesian Language Book (Revised Edition) published by the Pusat Perbukuan, Kemendikbudristek.

In the anecdote and book review materials, many teachers also utilise visual media. Teachers ask students to write anecdotal texts based on accurate information and refer to valid sources of information in the form of creative media. The creative media suggested by teachers mostly refer to visual media which are considered easier to make at school and still promote students' creativity with simple equipment.

Unlike the anecdote text material, for book reviews, students are asked to write the results of their reviews in the form of images made by utilising various applications such as canva or in the form of power point slides then students are asked to upload them to various social media platforms. The utilisation of visual media in the learning process plays an important role in conveying information, explaining concepts more clearly, and encouraging student engagement. Various types of visual media not only make learning more interesting, but also have the potential to improve students' understanding and memory of the language material taught.

Gbr 5.9 Infografik Senarai Kisah Sapardi Djoko Damono
Sumber: RuoliTirto.id (2020)

Gbr 5.8 Infografik R.A. Kartini
Sumber: Ahmad & Hafidin/Kemendikbudristek (2021)
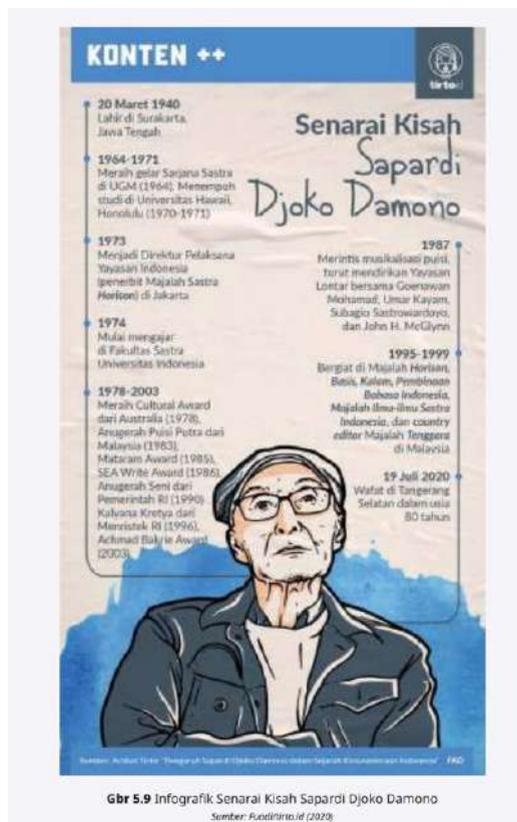
Audio Visual elements

Of the various media used by teachers in literacy learning in vocational high schools, audio visual is the most widely used media. Almost 70 per cent of teachers use audio visuals because they are interesting, easy to use and available. Without having to develop from scratch, audio visual media is already spread across various platforms so teachers only need to use or download it directly. Various materials are presented in the form of audio visuals such as material on observation reports where students are asked to present the results of their reports in the form of audio visual videos and uploaded to digital media. The next material is material that asks students to convey accurate social criticism also utilising in a creative media format based on accurate information and referring to valid sources of information. In this material, students use audio-visual media as a medium to convey the criticism because it is considered interesting and the information to be conveyed can be listened to through audio and there is text support and visualisation of the information. With the combination of audio and visual, this media is considered by teachers and students to be more effective in learning.

In literature learning, audio-visual media is also used to display hikayat impressions in the form of monologues, narrative texts, short stories, and poetry text readings. Through these audio visual shows, students are very eager to listen to the fictional stories that are displayed so that they can help in understanding the course of the story. In learning poetry, audio visual also helps students to be able to see how to recite poetry well and correctly. The purpose of using this media, according to one teacher, is so that students have an overview of poetry recitation from various poets so that it can be a guide to practice good poetry recitation. In addition, this media is also used by students for poetry transfer material in the form of poetry musicalisation. Students were shown a video of poetry musicalisation on You

Tube, then asked to comment on the video. Furthermore, in groups, students are also asked to make audio-visual videos in the form of poetry musicalisation.

Some Indonesian language teachers combine text, audio and visuals in a class project focusing on poetry. Students use multimedia applications to create digital representations of selected poems. They select appropriate images and background music to produce a video that interprets the poem. During a class presentation, they had to explain how these multimodal elements helped to convey the theme and mood of the poem. Evaluation results showed significant improvement in students' analytical and creative skills. An Indonesian teacher also designed a unit where students used a combination of text, video and multimedia presentation to analyse poetry. Students first read the poem, then watched a video featuring a visual interpretation of the poem, and finally, they created a presentation integrating the text, their own audiovisual analysis, and personal reflections on the poem. The results showed significant improvements in students' interpretative and creative abilities. Further analysis of the tasks showed that students not only deepened their understanding of the poetry text but also developed presentation and information technology skills. Based on the results of an interview with one of the teachers, he stated as follows.

> 'Using audio-visual media in poetry learning also helps students develop technology skills. They learn how to use digital tools to search, create and share content, which are essential skills in the modern information age.' (03/W)

The use of audio-visual media in literacy learning in vocational schools provides many benefits, from improving comprehension of the material to attracting diverse student interests. By utilising these media effectively, teachers can create a dynamic, interactive and relevant learning atmosphere, which in turn will improve students' overall literacy skills. The diversity of these tools gives students the opportunity to learn in a more enjoyable and meaningful way.

Kinesthetic Elements

Kinesthetic modality in literacy learning provides opportunities for students to learn through physical movements or activities. Learning activities that utilise kinesthetics usually involve role-playing or drama. They interpret texts through movement so as to stimulate speaking and communication skills. Kinesthetic approaches usually also involve technology to create a more interactive motion experience. These activities make it easier for students to remember information because they are not only mentally but also physically involved, so they play an important role in achieving learning objectives.

The utilisation of movement in literacy learning is done through the material of delivering criticism through a single joke on the phenomena that occur. Kinesthetics can enrich literacy learning so that it does not only focus on reading and writing. Through movement and expression in one-liners, it can make learning more interactive and can help students develop other skills such as reading, critical thinking and communication. Based on observations in one school, students are asked to perform a one-joke show to convey a humorous message so that they can more easily understand the social context that occurs. Students can be invited to write a single comedy script that raises current issues or social phenomena. By incorporating movement in the script, students learn how to convey messages in a fun

and interesting way. After writing the script, students can practice and perform their one-liners in front of the class. In this way, literacy learning becomes not only an informative process but also a fun and relevant one.

In addition to one-liners, most teachers also use a kinesthetic approach to negotiation texts. Students are asked to become a master negotiator through role-playing activities. Students are given the task to play the role of a master negotiator in various contexts of situations to reach a certain agreement. Students are also asked to be able to find solutions that can satisfy both parties by learning also about perspectives from other people's points of view. In role-playing, there is a form of emotional management so expression and intonation also need to be considered. After the activity, the class can have a discussion to evaluate the results of the negotiation. Students can share their experiences, the challenges they faced and the strategies they used. In this way, students not only learn about negotiation theory, but also gain practical experience that can be applied in real situations. This method helps students become more confident, communicative, and adaptive in facing different challenges in social interactions.

> 'In this way, students not only learn about negotiation theory, but also gain practical experience that can be applied in real situations. This method helps students become more confident, communicative, and adaptive in facing different challenges in social interactions.' (04/W)

The use of media in literacy learning according to some vocational high schools, teachers also needs to be combined with one another. The combination of media such as text, images, audio and video are the key to making learning more interesting and making it easier to understand the material better. Students' learning styles also differ based on their own characteristics. There are students who are more responsive using visual media, while others prefer listening or through direct interaction. With a combination of media, teachers can cater to students' learning needs and preferences more inclusively.

Using a combination of media in presenting narrative text in the form of media-assisted monologues in a coherent and creative manner, for example, teachers use a combination of media in the form of interactive media in which there are texts, visuals, audio visuals, and also equipped with educational applications that can attract students' attention and increase students' learning motivation. In addition, when the material of the observation text, there are also teachers who use a combination of media in the form of digital news articles, documentary videos, and podcasts that not only provide theoretical experience to students, but also practical experience because it integrates with actual issues in society.

By utilising various media in literacy learning, students also indirectly learn to use various technological tools. This skill is very important for vocational high schools students who may face a world of work that increasingly requires information technology skills. The use of media in literacy learning in vocational high schools needs to be seen as a holistic approach, where a combination of different types of media can produce a more effective and engaging learning experience. This multimodal approach not only improves students' understanding but also encourages active engagement, caters for a variety of learning styles and prepares students to adapt in an increasingly digitalised world. Therefore, vocational high schools teachers are encouraged to continue developing and exploring various media combinations that can be applied in literacy learning to support student success.

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Multimodal strategy in literacy teaching is an innovative approach that utilises various modes of communication, such as text, visual, audio, audio visual, kinesthetic. This approach aims to create a richer, more relevant and adaptive learning experience to students' needs. In the context of modern education, this strategy plays an important role, especially in helping students understand abstract and complex concepts, improve critical analysis, strengthen long-term memory and prepare them for the challenges of a rapidly changing professional world.

In learning, students often encounter abstract concepts so that multimodal provides a point of view that can facilitate students in understanding the material that is still abstract to be more real. A study conducted by (O'Halloran et al., 2017) proved that the use of multimodal analysis in teaching critical thinking can provide students with an analytical language for systematic analysis of multimodal texts and videos, which is very important in the digital age. In addition, the development of multimodal literacy in higher education shows that image-based tasks can have a positive impact on students' conceptual development (Wünsch-Nagy, 2020).

Multimodal strategies also train students to analyse deeply through various modes of information. By combining various elements, students can explore the material or text more deeply by not only looking at the explicit text, but also the implied messages from social, cultural, and emotional aspects. Such an approach is designed to develop multimodal literacy, students can learn to create and analyse multimodal texts, which expands their analytical skills (Custodio-Espinar & López-Hernández, 2023). Literacy practices that utilise multimodal and technology integration allow students to be able to access new knowledge that can improve memory retention for the better (Edge, 2020).

For vocational students, the ability to adapt to various technologies and media is a must. Not only understanding the material, but students are also asked to be more familiar with modern media for professional needs. This is in line with (Howell et al., 2017) who placed the integration of multimodal arguments in the teaching of writing in secondary schools can improve students' ability to build arguments using digital tools, which is an important skill in the modern professional environment.

For teachers, multimodal strategies provide flexibility in helping to meet individual needs. Teachers can accommodate students' diverse learning needs thus creating a more inclusive learning experience. Teachers should apply different teaching strategies that are tailored to each student's characteristics, including intelligence, learning style, personality, culture and language (Olyffia & Jauhari, 2024). Effective inclusive teaching involves curriculum adaptation, appropriate teaching approaches and classroom management (Putri et al., 2024). For slow learners, accommodations in teaching methods, materials, tasks, time requirements and learning environment management have been shown to be effective. Strategies such as repetition of material, use of simple language, concrete media and utilisation of technology help slow learners understand lessons better (Darwanti et al., 2024).

Based on the results of this study, it can be seen that multimodal strategies in literacy learning can improve understanding of students' literacy activities and skills. This is in line with the following research which states that the application of multimodal strategies in early reading learning significantly improves students' comprehension ability by 20-40% (Maulida & Lestari, 2025). In foreign language learning, multimodal approaches show potential to improve reading speed, vocabulary recognition, and comprehension levels (Dewi et al., 2023). Various digital media,

including interactive multimedia, augmented reality and social media, have been developed based on multimodal literacy theory to accommodate diverse learning styles and increase student engagement (Olvah et al., 2024). In Indonesian language learning, the use of digital technologies such as slide presentations, educational videos and online resources actively engage students with different modes of communication, improving their multimodal literacy skills (Kardika et al., 2023). These findings suggest that multimodal strategies can effectively improve students' literacy skills in various educational contexts.

The integration of multimodal strategies is not just a technical innovation but a strategic move to respond to the demands of the times. With this approach, literacy teaching is no longer just a transfer of knowledge but also a journey that enriches students' understanding, increases their engagement and prepares them for a challenging future.

Conclusion

Based on the findings of the research on multimodal strategies in literacy learning in vocational schools, it shows that these strategies are able to facilitate understanding of the material in a variety of ways. Multimodal strategies in the form of using text, audio, visual, audio-visual, kinesthetic and combination are utilised by teachers in schools to meet the needs of students' learning styles by adjusting to the learning materials. The combination of multimodal elements in literacy learning shows a positive impact on students' critical analytical and creative skills.

This study has several limitations, namely related to the limited research subjects so that the use of multimodal in vocational schools in the Central Java region has not been thoroughly identified. Future research could add more research subjects and focus on the development of training modules for teachers and a deeper exploration of the application of multimodal strategies at different educational levels. Future research could also explore the effect of these strategies on improving students' digital communication skills, which are relevant to the needs of the modern world of work. A wider and systematic integration of multimodal approaches has the potential to create an inclusive, innovative and highly competitive learning environment.

Acknowledgments

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Understanding ESL Undergraduates' Needs for Web-Based Writing Resource

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Abstract: A thorough needs analysis is essential prior to the formulation of learning objectives, the design of instructional materials, and the development of learning materials. This study aims to identify the needs of ESL undergraduates in learning English writing skills. A questionnaire survey was disseminated among 66 ESL undergraduates in semester 2 and above at a public university in Malaysia. Using Dudley-Evans and St John's (1998) model of needs analysis, this study looked into four constructs: Target Situation Analysis (TSA), Present Situation Analysis (PSA), Learning Situation Analysis (LSA), and Means Situation Analysis (MSA). The quantitative data was analysed using the Statistical Package for Social Sciences (SPSS) version 30. It was found that respondents viewed writing skills as critically important for their academic contexts, faced challenges in mastering writing skills, recognised contents and strategies that could help them improve their writing skills, and were generally ready and willing to engage in a web-based writing resource. The result reflects a positive attitude toward integrating technology into their writing development. Hence, this study offers valuable guidance for ESL practitioners in designing, developing, and delivering effective, practical, and contextually relevant writing instruction.

Keywords: Web-based writing module; writing skills; ESL undergraduates; needs analysis

Introduction

Writing is a challenging cognitive task that requires proficiency in several areas, including vocabulary, spelling, format, content, and sentence structure (Abas & Abd Aziz, 2018; Baharudin et al., 2023). Compared to other receptive abilities, it necessitates a more profound comprehension of language and writing standards, making it an essential

skill to acquire. As students write, they must be able to organize their thoughts and material into a logical and well-structured essay (Singh et al., 2020). Writing skills are key to assessing students' achievement in higher education (Baharum et al., 2021). Teachers use student assignments to gauge their understanding and familiarity with the courses they take at university. A well-written essay will lead to a high exam score. Writing disorders encompass handwriting, organization, sentence structure, spelling, and punctuation issues.

The difficulties tertiary students encounter in honing their writing abilities are complex and rooted in institutional frameworks, student views, and educational practices. One of the biggest challenges students face when entering higher education is academic writing. The perceived lack of sufficient knowledge and preparation for successful academic writing presents a significant obstacle. According to research by Arneback et al. (2017), many students struggle to adhere to academic writing conventions, which often prioritize adhering to formatting and structural guidelines over using creativity.

Literature Review

Needs analysis is essential in DDR as it forms the foundation for the entire research and ensures the relevance and validity of the study. This aids the researcher in systematically planning and improving instructional resources by pinpointing gaps and needs in the study process. Moreover, researchers can ascertain learners' existing knowledge, views of learning, learning styles, and interests through the outcomes of requirements analysis. Consequently, a needs analysis is crucial for identifying the learner's requirements, aspirations, and prerequisites (Axmedovna et al., 2019; Destianingsih & Satria, 2017).

The Dudley-Evans and St. John's model (1998)

The Dudley-Evans and St John's (1998) needs analysis model consists of four analytical components: target scenario, present situation, learning situation, and means situation. The Target Situation Analysis (TSA) addresses learners' needs upon course completion. Dudley-Evans and St John (1998). The Present Situation Analysis (PSA) subsequently collects learner data, including their strengths, limitations, talents, and learning experiences (Dudley-Evans & St John, 1998). The Learning Situation Analysis (LSA) emphasizes ways to enhance learners' writing, which is essential for creating an appropriate online module. The Means Situation Analysis (MSA) evaluates learners' preparedness to utilize internet resources to improve their writing abilities.

Web-based Learning

Incorporating technology into writing instruction has emerged as a viable solution for specific issues. Numerous studies have been conducted on web-based learning in different field of studies (Bashori et al., 2022; Cook, 2007; Destianingsih & Satria, 2017; Farah Amirah & Nur Ehsan, 2023; Girard & Pinar, 2011; Nordin et al., 2016). Automated Writing Evaluation (AWE) systems and digital platforms like Google Docs promote collaborative writing and provide instant feedback, improving learners' writing skills (Hoang & Hoang, 2022; Yildiz & Gonen, 2024). Research indicates that these technologies can significantly reduce writing mechanics and organization errors, thereby

enhancing overall writing performance (Yildiz & Gonen, 2024). Furthermore, using electronic portfolios and blogs has increased motivation and self-efficacy in EFL learners, suggesting that technology can significantly contribute to fostering a supportive writing environment (Guo & Li, 2024; Huang, 2016). Informed by the study's context and literature review, this research was conducted as preparatory work to design and develop a supplementary web-based writing module for students. It aims to determine undergraduates' needs for enhancing their writing skills through an online curriculum.

Methodology

Research Design

This paper examines the requirements of students for a comprehensive developmental research initiative. The study incorporates Research and Development Research (DDR) Type 1 (product and tool) as defined by Richey & Klein (2007), to design and develop a web-based writing module for ESL undergraduates. This research consists of three phases: 1) needs analysis, 2) design and development, and 3) implementation and evaluation. The ASSURE model was used as the research framework for all three study phases. ASSURE is an acronym for Analyse, State Objectives, Select Materials, Utilise Materials, Require Learner Response, and Evaluate. The six stages of the ASSURE approach incorporate technology and media to augment student learning (Smaldino et al., 2019).

Therefore, this paper presents the findings of phase one of the project, which involved collecting data on undergraduates' requirements for enhancing their writing skills. This requirements analysis will be conducted according to the paradigm proposed by Dudley-Evans and St John (1998). The analysis encompasses four constructs: aim circumstance, present situation, learning situation, and means situation. The data obtained from this study provides a foundation for the subsequent phase in the design and development of the web-based writing module.

Research Question

1) What are undergraduates' perspectives regarding the significance of developing writing skills (Target situation)?
2) What challenges do undergraduates face in acquiring writing skills (Current situation)?
3) What strategies do undergraduates need to master writing skills in a learning context?
4) What is the current level of online learning readiness among undergraduates (Mean situation)?

Participant

This research utilized purposive sampling, consisting of 66 undergraduates pursuing their first degree at a public institution in Malaysia. The respondents were selected based on the following criteria: 1) undergraduates in semester 2 or higher, 2) individuals who had completed the Malaysian University English Test (MUET) in prior sessions, and 3) voluntary participation. The respondents were identified through an English course during Semester 2 of the 2023/2024 academic session. The responses came from various academic semesters and faculties and had previously undertaken the MUET.

Research Instrument

This study uses an online survey to acquire information for needs analysis. The reason for selecting this type of survey is that it is delivered through a digital platform, which is cost-effective and allows for speedy data collection. The researcher chose Google Forms to facilitate the creation and delivery of the survey. Thus, a series of questionnaires was issued using Google Forms for data gathering in phase one, needs analysis. This requirements analysis questionnaire employs a 4-point Likert scale (1=strongly agree, 2=agree, 3=disagree, 4=strongly disagree). Table 1 presents an overview of the constructs in needs analysis.

Table 1. Overview of Needs Analysis Constructs

Part	Constructs	Sub-construct	Items (n)
I	Target Situation Analysis	Importance of writing skills	10
II	Present Situation Analysis	Problems in mastering English writing skills	13
III	Learning Situation Analysis	Contents for web-based writing module	4
		Activities for web-based writing module	4
IV	Means Situation Analysis	Learner's readiness	13
		TOTAL	**44**

As shown in Table 1, the constructs measured were based on the needs analysis model by Dudley-Evans and St John (1998), which includes the Target Situation Analysis (TSA), Present Situation Analysis (PSA), Learning Situation Analysis (LSA), and Means Situation Analysis (MSA). The questionnaire consisted of 44 questions, further divided into five parts adapted from Farah Amirah & Nur Ehsan (2023), Karmila (2023), and Nurizah (2020).

Part I covered the demographic backgrounds of the respondents (items 1 to 7), Part II addressed the significance of writing skills (items 1 to 10), Part III inquired about the challenges faced by ESL undergraduates in mastering writing skills (items 1 to 13), Part IV explored the preferred content for the web-based writing module (items 1 to 8), and finally, Part V included questions regarding the learners' readiness to utilize a web-based module (items 1 to 13).

Validity and Reliability

An expert in ESL teaching has verified the questionnaire's face and content validity. She possesses a PhD in TESL and is currently an Associate Professor at a public university in Malaysia. She has been teaching for approximately 30 years in the subject of TESL. After the examination, the questionnaire was updated and sent to the respondents later. Cronbach Alpha (α) was used to examine the reliability of the questionnaire. This questionnaire was piloted to 30 undergraduates before the actual research was conducted. A high Cronbach's Alpha coefficient indicates that the items in the instrument are strongly associated and accurately assess the same concept, which is essential for the validity of the research outcomes (Nunnally & Bernstein, 1994). Table 2 shows the . Cronbach Alpha (α) values for the constructs in the questionnaire:

Table 2: Cronbach Alpha (α) values of the questionnaire

Construct	Cronbach's Alpha (α) value		Reliability level
	Pilot test	Actual	
Target Situation Analysis	0.954	0.950	Excellent
Present Situation Analysis	0.948	0.946	Excellent
Learning Situation Analysis	0.896	0.898	Good
Means Situation Analysis	0.923	0.914	Excellent

The reliability testing on the questionnaire yielded a Cronbach's Alpha value (α) of 0.80 and above in both pilot testing (0.954, 0.948, 0.896, 0.923) and the actual research (0.950, 0.946, 0.898, 0.914). This result demonstrates a high level of internal consistency among the respondents' answers in both pilot testing and the actual study. It indicates that the measurement items are reliable, producing stable and consistent outcomes, which enhances the credibility and robustness of the constructs in the research.

Findings

This study utilized an online survey for data collection. The analysis was performed using version 30 of the Statistical Package for Social Sciences (SPSS). Descriptive statistics, including percentages, means, and standard deviations, presented the study findings. All items in the following sections were interpreted according to the scale adapted from Alico & Guimba (2015). Table 3 displays the overall mean score and the interpretation scale of the questionnaire.

Table 3: Mean score and standard deviation of TSA, PSA, LSA and MSA

Needs analysis	Mean (M)	Standard deviation (SD)	Level
Target Situation Analysis (TSA)	3.68	0.449	Very High
Present Situation Analysis (PSA)	2.85	0.690	High
Learning Situation Analysis (LSA)	3.50	0.480	Very High
Means Situation Analysis (MSA)	3.32	0.507	Very High

RQ1: What are undergraduates' perspectives regarding the significance of developing writing skills (Target situation)?

Table 3 displays the overall mean score of the four constructs used to determine learners' needs for a web-based writing module. As reported, three out of four constructs scored 'very high,' while one scored 'high.' For the first construct, TSA, respondents regarded writing skills as critically important for their academic contexts (M=3.68, SD=0.449). They agreed that English writing skills are beneficial in their academic studies, such as writing essays, preparing curriculum vitae, and composing summaries and abstracts in English, writing research articles in English, taking notes in class, and preparing presentation slides in English. In addition, the respondents also concurred that English writing skills are valuable for daily tasks and work, including writing business letters in English, drafting informal texts like emails and short messages on social media, and documenting experiences in English.

RQ2: What challenges do undergraduates face in acquiring writing skills (Current situation)?

Secondly, the 'high' level in the PSA indicates that respondents acknowledged experiencing challenges in mastering writing skills (M=2.85, SD=0.690). Identifying supporting details, developing thesis statements, crafting topic sentences, constructing coherent and cohesive sentences, presenting arguments, and writing body paragraphs and conclusions are some of the issues the respondents encountered in mastering the writing development structure. Additionally, respondents also struggled with aspects of grammar, spelling, sentence construction, and vocabulary. All these elements are essential for mastering writing skills and producing effective written texts. Therefore, a suitable intervention is necessary to address these challenges among ESL undergraduates in mastering writing skills.

RQ3: What strategies do undergraduates need to master writing skills in a learning context?

Thirdly, the 'very high' level in LSA indicated that the undergraduates recognize the contents and strategies that can help them improve their writing skills (M=3.50, SD=0.480). The respondents prefer content presented in slideshows, notes, feedback, and videos in the module. On the other hand, they preferred all four strategies listed in the second category of the third construct, such as rearranging sentences, fill-in-the-blanks, matching, and paragraph writing. In short, students appreciate a variety of learning materials and interactive activities to be included in the web-based writing module.

RQ4: What is the current level of online learning readiness among undergraduates (Mean situation)?

Lastly, the findings reported a 'very high' level of agreement in MSA, indicating that they were generally ready and willing to engage in a web-based writing module (M=3.32, SD=0.507). This high level of readiness reflects a positive attitude toward integrating technology into their writing development, as they want to improve their writing skills anytime and anywhere. As evidence of their readiness, respondents admitted that they maintained a stable internet connection and subscribed to internet data every month on their cell phones, enabling them to tackle challenges in online learning. They also expressed a willingness to utilize web-based learning resources to enhance their writing skills, noting that learning through the website is enjoyable, and they felt competent in using technology for education.

Furthermore, respondents felt more motivated to learn writing skills through web-based platforms than from books; they preferred web-based exercises over paper-based ones and favored using computers to learn English writing skills rather than relying on books. The findings revealed the respondents' positive attitudes toward using technology, specifically web-based writing modules, to enhance their skills. They expressed confidence in navigating online resources for learning and were prepared to adopt online methods for mastering ESL writing skills. Thus, respondents demonstrated high readiness for web-based learning, showcasing strong technological competence, internet access, and willingness to use web-based tools.

In conclusion, respondents regarded writing skills as essential for academic success and prioritized them in meeting academic requirements. Findings regarding the second construct highlighted that respondents faced challenges in mastering writing skills, which may hinder their ability to meet academic expectations, indicating a need for

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appropriate intervention. Additionally, the respondents acknowledged the necessity for well-designed content and effective teaching strategies in the web-based module, incorporating a variety of content types and approaches to address diverse learning styles. Nevertheless, the respondents were generally ready and willing to engage with a web-based writing module, emphasizing the importance of user-friendly platforms, accessible resources, and relevant content. This high readiness reflects positive attitudes toward integrating technology to enhance their writing competency.

Discussions

Writing skills are essential for academic and career advancement among ESL undergraduates. This finding aligns with Karnine et al. (2022) and Axmedovna et al. (2019). In a study conducted by Karnine et al. (2022), polytechnic students regarded English writing as vital for their studies, particularly in preparing lab reports and documents related to their projects. Similarly, the findings of this study revealed that respondents agreed that mastering English writing is crucial for taking notes and preparing presentations in class. Conversely, Axmedovna et al. (2019), who conducted a study on university students majoring in law, found that respondents viewed mastering English writing as important for their career development. Likewise, the respondents in this study acknowledged that mastering English writing is important, such as writing a business letter in English. Therefore, cultivating strong writing skills is essential for undergraduates to achieve success in both academic and professional contexts.

In mastering English writing skills, ESL learners often face challenges in various areas. This study revealed that ESL undergraduates struggled with writing organization, idea development, and writing mechanics. This supports research conducted by (Pitukwong & Saraiwang, 2024) on Thai university students. A questionnaire was administered to gather data on writing challenges and support preferences. The findings indicated that students had difficulty organizing their ideas and understanding writing mechanics. Students expressed positive perceptions toward integrating digital writing tools, such as Paragraph Punch and ProWritingAid, into their writing classes. They found these tools helpful for structuring and organizing their writing, which boosted their confidence and competence in writing tasks. Therefore, it can be concluded that identifying and implementing appropriate interventions is crucial for addressing the writing difficulties faced by ESL undergraduates.

ESL learners are generally ready and willing to engage with technology-based language learning methods. This study found that respondents expressed positive attitudes toward integrating web-based learning into their writing improvement. They conveyed confidence in their ability to utilize online resources for learning and indicated a strong willingness to adopt online strategies to enhance their ESL writing skills. This supports the study by Mohammad et al. (2018) on the students' perception of Google+ in teaching ESL writing skills. The students were motivated and enjoyed the lessons due to the interactivity, which made writing tasks more engaging. Similarly, Guo and Li (2024) and Huang (2016)Huang found in their studies that using portfolios and blogs can boost motivation and self-efficacy in EFL learners, underscoring the crucial role of technology in enhancing the writing experience. Based on the previous studies and the findings from this needs analysis, it can be concluded that the young generation today demonstrates a strong readiness for web-based learning, possessing the necessary technological skills, reliable internet access, and a positive attitude towards utilizing web-based learning tools.

Implications of the Study

This study shows significant value in technology-based language learning strategies for learners and educational stakeholders. ESL learners can benefit from writing through a web-based platform, as it empowers them by fostering independent learning and promoting autonomy. Moreover, the findings may aid educators in planning and designing lessons, as this approach offers a more relaxed and enjoyable experience compared to traditional classroom settings, thus exposing learners to a unique and engaging learning method. In addition, implementing a web-based writing module as a supplementary tool can greatly benefit universities. In line with the Education 4.0 paradigm, higher education institutions are increasingly adopting online technologies and developing relevant applications for language teaching and learning. This shift presents numerous opportunities for students, educators, and institutions. Furthermore, an online learning experience can boost student confidence and employability upon graduation. Additionally, the commercialization of such a module can generate revenue for the university and enhance its national and international reputation. Therefore, integrating technology in writing instruction can benefit many parties, as online learning offers education without boundaries and allows learners to be independent and control their own learning pace.

Conclusions

Before developing a web-based writing module for English as a Second Language undergraduates, this study served as a needs analysis stage. A crucial element in producing educational resources aligned with specific English language learning goals is conducting a requirements analysis. Each needs analysis is unique in research as it reflects the distinct characteristics and individual needs of the learners. Given that learner requirements are constantly changing, it is vital to perform ongoing and periodic needs assessments to ensure that learning materials and instructional methods remain relevant. Additionally, English as a Second Language (ESL) students in higher education are expected to learn the language not only for academic purposes but also to enhance their marketability and improve their job prospects. Consequently, future studies may consider a broader and more diverse sample to identify the needs of English as a Second Language (ESL) undergraduates across multiple public institutions. Furthermore, to gain a deeper understanding of the requirements that English as a Second Language (ESL) learners have regarding language acquisition, future researchers can employ various data collection methods, such as interviews and classroom observations.

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The Relationship between Marharoan Bolon Tradition and Environmental Awareness (Case Study: The Students of a Public Senior High School In Simalungun, North Sumatra)

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Abstract: Awareness of the richness and beauty of nature, culture and local wisdom has begun to fade among the younger generation in this digital era. That is why this study was conducted to determine the level of understanding and concern for their ancestral culture as well as awareness of their environment. The respondents in this study were 71 students of a State High School in Simalungun, North Sumatra. This study aims to find the relationship between the students' awareness of the Marharoan Bolon tradition, a tradition in Simalungun, and the students' awareness of the surrounding environment. The research was done using the quantitative method to measure the students' awareness of Marharoan Bolon tradition and the students' awareness of their physical environment. The results of this research showed that the tendency of the students' awareness of Marharoan Bolon were good (50.55% were aware of Marharoan Bolon tradition and 43.09% were very aware of Marharoan Bolon tradition). The results of this research showed that the tendency of the students' awareness of the environment was good as well (51.98% were aware of the environment and 33.66% were very aware of the environment). Interestingly, both awareness showed a strong relationship whilst both parameters have shown a positive correlation in the statistical results. From the result, we can say that implementing the Marharoan Bolon tradition consistently can raise the students' awareness of surrounding environment in Simalungun.

Keywords: Awareness of Local Culture, Marharoan Bolon Tradition, Environmental Awareness

Introduction

Many Indonesians already know and realize that Indonesia is the only largest archipelagic country and has the greatest

diversity of ethnicities, cultures and customs in the world. Marbun (2018) and Anele (2019) have said in Anele (2021) that considering the diverse makeup of the country, it has been observed that Indonesia's culture diversity possesses the ability to "shape the character and image of its own culture in each region, and is an important part for the formation of image and cultural identity of a region."

However, recently, especially since entering the digital era, it is known that many young generations in Indonesia, especially Generation Z, are starting to forget the cultural traditions of their ethnic groups which are actually part of their identity. This is certainly due to the ease of expanding contact to other parts of the world so that Generation Z prefers to absorb foreign cultures (Dharma et al, 2021). In fact, by forgetting the cultural traditions of our own ethnic groups, we can increase the possibility of threats to our country's sovereignty. Hidapenta & Dewi (2021) said that threats to a nation in this digital era are easier to transform into a new face. It can be interpreted that threats are all efforts that can be made from within or outside the country that can endanger the country's sovereignty, territorial integrity, and national safety. Referring to this understanding, threats can not only be present in military forms such as war or other military contexts, but anything that can threaten the country's sovereignty can be categorized as a threat.

One of the many non-military threats is the emergence of ideologies or thoughts that can damage the mindset and values of the people of a nation. Often the form of the threat is not visible, but its impact can be felt. This kind of danger especially facing the Generation Z is that they may lose sight of their national identity as well as cultural identity. They would rather live by western ideals, which are incompatible with the admirable principles of the indigenous Indonesian culture (Dharma et al, 2021).

This is in line with what Ismelina F.R. et al (2024) said that revitalization of local wisdom values in the development of environmental law is important considering that we have penetrated the industrial era 4.0 that the existence of local wisdom values has begun to be erased slowly by the presence of modern law. This is also in accordance with the statement of Abas (2022) referred to Xu et al (2005), that is frequently occurred that the young generation of indigenous peoples have left the practice of local wisdom through modernization, little by little. This situation will eventually lead to the loss of indigenous wisdom, which is precious and valuable for the protection of natural biodiversity. In fact, by forgetting the cultural traditions of our own ethnic groups, we can increase the possibility of threats to our country's sovereignty. Hidapenta & Dewi (2021) said that threats to a nation in this digital era are easier to transform into a new face. It can be interpreted that a threat is any effort that can be made from within or outside the country that can endanger the country's sovereignty, territorial integrity, and national safety. Referring to this understanding, threats can not only be present in military forms such as war or other military contexts, but anything that can threaten the country's sovereignty can be categorized as a threat. One of the many non-military threats is the emergence of ideologies or thoughts that can damage the mindset and values of the people of a nation. Often the form of this threat is not visible, but its impact can be felt.

This kind of danger especially facing the Generation Z is that they may lose sight of their national identity as well as cultural identity. They would rather live by western ideals, which are incompatible with the admirable principles of the indigenous Indonesian culture (Dharma et al, 2021). This also applies to Generation Z of the Batak ethnic group,

especially in this case, the Simalungun Batak. This is clearly described in Napitu et al (2023) in the recommendation section, it is written "The young generation of Simalungun should continue to care and maintain, as well as protect and uphold and preserve their own cultural heritage." This clearly states that it is true that the young generation of Simalungun has begun to not care about preserving Simalungun culture.

Whilst we care about the preservation of local culture and its environment as the important part of local wisdom, paying attention to the increasing numbers of young generation who do not care about their native culture in Indonesia, it turns out that the Binus academic community cannot just remain silent, especially the character-building lecturers, who educate the Binus students to care about their native cultures. For Binus will be opening its brand-new campus in Medan, and the senior high school students in North Sumatera will be its expected future students, so the research about the awareness of future students' native culture shall be done. In order to obtain the information related to this, this research objective is to get the information about the relationship between the appreciation of Marharoan Bolon tradition and the environmental awareness of students of a public senior high school from Simalungun Atas sub-tribe in Simalungun.

Literature Review

A Brief Summary of Simalungun Tribe

Simalungun culture is generally described in various terms that name the various types of ornaments depicted in their homes and daily necessities. These ornaments illustrate the values of hospitality, the ability to adapt to any social environment, the deliberation system, and the most interesting is, the strong value of mutual cooperation (especially in the family). The Simalungun ethnic group is one of the tribes that inhabits the province of North Sumatra, which settles in Simalungun Regency, Pematang Siantar City and other nearby areas. They also have a very strong kinship system to unite when they are away from home. This kinship system is known as a clan. The original clans of the Simalungun people are Damanik, Saragih, Sinaga, Purba (Napitu et al, 2023).

Describing the Simalungun Regency, Bank Indonesia explained in the northsumatrainvest.id media that the Simalungun Regency is surrounded by eight other regencies i.e. Serdang Bedagai, Deli Serdang, Karo, Tobasa, Samosir, Asahan, Batu Bara, dan Kota Pematangsiantar. Its astronomical location is between 02°36' - 03°18' North Latitude and 98°32 '- 99°35' East Longitude with an area of 4,372.5 km2 at an altitude of 0 - 1,400 meters above sea level where 75 percent of the land is on a slope of 0-15% so that Simalungun Regency is the 3rd largest Regency after Madina Regency and Langkat Regency in North Sumatra and has a fairly strategic location and is located in the Lake Toba-Parapat tourist area.

Lidlle (1992) in Saragih (2021) divides the Simalungun region into two categories, namely Simalungun Bawah and Simalungun Atas. Simalungun Bawah is a relatively flat area, low lying, densely populated and ecologically and geographically part of a cluster of fertile plantations in East Sumatra. Meanwhile, Simalungun Atas is a hilly and mountainous area, without rivers for water transportation and land transportation is generally difficult. This area is relatively less fertile than Simalungun Bawah, and has a cooler climate than Simalungun Bawah. Giting & Hutauruk (2020) mentioned that the Simalungun Atas region is located in the Bukit Barisan mountains bordering Tanah Karo,

Serdang Hulu and Lake Toba. This area has the potential for the development of the marine fisheries, plantations, and horticultural crops sectors, in addition to the tourism sector, considering its location close to Lake Toba. In Hartanto (2021) it is written that there is an assumption that the Simalungun Atas people are indigenous people who adopted horticulture. Saragih (1989) in Hartanto (2021) said that the Simalungun Bawah is mostly inhabited by immigrants who are identical to rice farming or plantations. This is in accordance with the brief statement of Ginting & Hutauruk (2020) which mentions that the Simalungun Bawah area, which includes the kingdoms of Siantar, Tanah Jawa and Panei, is a fertile area and suitable for plantation land. In terms of local language, the Simalungun Atas language is also different from the Simalungun Bawah language (Saragih, 2015). This language difference shows that there has been a cultural difference between Simalungun Atas and Simalungun Bawah.

Marharoan Bolon

Marharoan Bolon is taken from the Batak Simalungun language from the word Marharoan which means work, the word Bolon is big. If the two are combined, then Marharoan Bolon is usually interpreted as working together or mutual cooperation (Damanik, 2018). Marharoan Bolon is often interpreted as one of the dances originating from the Simalungun area, even though Marharoan Bolon itself is one of the most dominant forms of culture in the Simalungun area, because community service (which is usually done together by the local community) is also often referred to as one form of Marharoan Bolon culture. Perhaps because there are many forms of culture that are referred to as part of Marharoan Bolon, many Simalungun people say that Marharoan Bolon is the most dominant culture in Simalungun, especially Upper Simalungun nowadays. This description of Marharoan Bolon is in accordance with the ornaments found in Simalungun culture which depict strong mutual cooperation values (Saragih, 2015).

For this paper is about the local culture awareness and environmental awareness, and both variables are taken from local wisdom, so literature review about local wisdom will be provided. For the process of learning about culture in a group or community theories are needed for discussion and recommendations in this paper, so literature review about cultural psychology and psychology of learning will be provided as well.

Environmental Awareness

Environmental awareness is defined as the comprehension and knowledge of the value of preserving the sustainability of the environment and ecosystems surrounding oneself by people or community groups. According to a study, factors including social values, group influence, and inner desire may also have an impact on environmental awareness in addition to an individual's knowledge and understanding of environmental issues (Pramita et al, 2023). It also known as the science which helps people attain the value, skills, and knowledge required to live sustainably (Enger & Smith, 2013 in Handayani, 2021). Handayani (2021) also said that it can also be interpreted as "a situation where humans understand what is best and necessary for the environment". Environmental awareness is exceptionally critical in environmental management and the protection of living creatures, and it may grant a more effective impact when executed (Handayani, 2021).

Local Wisdom

Sneed (2019), Service et al (2014) and Lanini et al (2019) said in Abas et al (2022) that indigenous people have a long history of being directly and intimately dependent on their land for sustenance. Furthermore, unlike most of modern culture, they tend to perceive nature as existing to serve humans, as opposed to having a reciprocal connection with it.

Abas (2022) noted that the thought processes, intuitions, and traditions of indigenous communities are commonly referred to as local wisdom or local knowledge. Local wisdom can be defined generally as the fundamental understanding developed through harmonious coexistence with nature, which is intertwined with the community's culture and is gathered and transmitted through generations. This kind of wisdom is from experiences or truth gained from life (Von der Porten et al (2019) in Abas (2022)). This does not contradict with Hamid et al (2024) in Afandi & Kharisma (2024), that is local wisdom as a way of life and knowledge and various life strategies in the form of activities that the local community carries out to meet their needs. That is how important local wisdom is, so that Hasan et al (2024) said in Afandi & Kharisma (2024) that it is shall be preserved and integrated into education. Although Arifiani et al (2019) and Osawa (2023) have said in Lestari et al (2024), that local wisdom and practices that have been part of society for centuries have been demonstrated to promote sustainability. Unfortunately, indigenous peoples and their lands faced enormous threats. They were facing pressure from intrusion into infrastructure, agriculture, mining, logging and other activities that also threaten biodiversity (Abas, 2022). Fatimah et al., 2020 and Lubowiecki-Vikuk et al., 2021 strengthen by Maspul, 2023 said in Lestari et al 2024, that socializing and internalizing local wisdom support the layout of extra holistic and sustainable answers that enable monetary increase that stays in concord with environmental preservation and cultural sustainability. This is also in accordance with what Sudiasmo & Muspita (2020) said that local wisdom in the form of social institution is related directly with environmental conservation as well as preservation of natural resources. This is also in line in what Royo & Ballesta-Garcia (2019) said in Habiba & Wulandari (2024) that "the environment has a great influence on human life".

In a multicultural country like Indonesia, the value of local cultural wisdom plays an important role in strengthening national identity in the international world so that it is a characteristic of a nation. The existence of local culture and the value of its wisdom is able to strengthen the commitment of the Indonesian people to foster a sense of love for the homeland to every citizen, including Generation Z. Indonesian local culture is one of the main high-valued resources of the Indonesian people, so it is very important to maintain it (Dharma et al, 2021).

Wylie's words in Berry (1999) written in Nauly and Francisca (2015) about self-concept ("self-concept means the knowledge or beliefs that an individual has about himself") and identity are also important to be stated here. They agreed that, in contrast to self-concept, identity usually contains a sense of attachment that an individual has to the identity itself (Aboud; Hocoy; Keefe, in Berry 1999, in Nauly & Fransisca, 2015). Also referring to Tajfel (1982) in Nauly & Fransisca (2015), cultural identity is not just a self-concept that includes a person's knowledge of their membership in a group or social group, but also relates to the values and emotional feelings attached to that membership.

Cultural Psychology

For the development of knowledge is getting faster, so there were many theories about cultural psychology. The definition is "cultural psychology is a designation for the comparative study of the way culture and psyche make each other up", referring to what Shweder & Sullivan (1993) said in Santamaria et al (2019). For the objective of cultural psychology is "to understand how the processes of human development are created and transformed in culture and, in turn, are constrained by culture (Valsiner, 2009 in Santamaria et al, 2019). This is, of course, in line with what Santamaria et al (2019) said, i.e. "the main aim of a Cultural Psychology is centered on understanding how the mind is related to cultural, social, institutional, and historical context." We also can take the assumption of Santamaria et al (2019), i.e. "socio-cultural research should combine the development of theoretical concepts about mind and culture with methodologies to study them" to strengthen the theories about cultural psychology.

Psychology of Learning

In arrange to abbreviate the composing handle, we would like to hop the theory of the Psychology of Learning to Learning Strategy. Learning techniques can be depicted as strategies that understudies utilize to secure information. This incorporates strategies for honing memory as well as more successful ponder and test-taking strategies (Rad, 2012). There's one vital for compelling learning, named as double coding. Double coding depicted as combining words with visuals. Actualizing this procedure makes understudies can draw two neurons and clarify how one communicates with the other through synaptic crevice (Weinstein et al, 2018).

Method

Respondents Selection and Data Collection

As mentioned above, this research objective is to get the illustration about the relationship between the understanding about the Marharoan Bolon culture and the environmental awareness of the students in a particular State High School in Simalungun, North Sumatera. It has approximately 200-300 students for 3 grades, and the respondents for this research were from the first grade students and the number of respondents who participated in this research were 71 persons, which were chosen from the Simalungun Atas sub-tribe. The premise for choosing the Simalungun Atas sub-tribe was based on the theory mentioned before that the Simalungun Atas people are the indigenous people of Simalungun tribe. So they shall have good understanding about the Marharoan Boron tradition.

The responses in the form of chosen scales would be the illustration of the understanding of the Marharoan Boron tradition and the environmental awareness of the chosen respondents.

For the Marharoan Bolon tradition understanding, the questionnaire was given in papers, self-construct from theories about culture and values generally (Asni & Fadjri (2019) and Lukman et al (2022) also adapted from 1 questionnaire about Batak culture (Nauly & Fransisca, 2015). The number of items in this questionnaire is 10. Similar with the first questionnaire, the questionnaire about environmental awareness was given in papers and adapted from Khoiri et al (2021) and Sra (2020). The items of referred questionnaire adapted also selected to suit the natural conditions in Simalungun Atas. The number of items in this questionnaire is also 10, so each of the questionnaires got 710 answers

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from 71 students. The sentences in the items for both questionnaires are in the positive nuances. The tendencies of chosen behaviors about the understanding of the Marharoan Bolon tradition and environmental awareness were measured by Likert scale divided by five scales on tendency towards conformity in agree-disagree levels. They are 1 for strongly disagree, 2 for disagree, 3 for neutral, 4 for agree and 5 for strongly agree. For the items in the questionnaire are in the positive nuances, so the preferable choices to show the good behaviors for multiculturalism in this research are the scales of 4 and 5.

Data Processing and Providing

After the results of the questionnaire filling were already available, the data were processed statistically using the SPSS to ensure that the questionnaire has been valid and reliable to measure the behavior of understanding of Marharoan Bolon tradition and environmental awareness. After the validity and the reliability have been confirmed, the data for number of each scale chosen will be easier to be obtained to get the illustration.

The data provided in a table showing the number of scales chosen from the whole answers provided and each scale chosen. Apart from the number of selected scales, the table also shows the percentage of each selected scale from the total selected scales. The percentages of scale chosen data will be the basis for discussion and drawing conclusions as the final result for illustration of how good the understanding of the Marharoan Bolon tradition and the environmental awareness of the students of that particular school are and the relationship between them (Kemmis, S., & McTaggart, R. (1982), (2000) and Kusamah, W. & Dwitagama, D. (2009)).

Results

The results of the answers for both questionnaires can be seen in the tables and figures below:

Table 1. Amount and Percentage of Scale Choices for Understanding the Marharoan Boron Tradition

Scale Choices	Amount of Answers	Percentage (%)
1	3	0.41
2	7	0.98
3	35	4.91
4	359	50.55
5	306	43.09
Total	710	100.00

As we can see the results in the table above, the students' tendencies were choosing the scale 4 and 5. The questionnaire is valid (corrected item total-correlation = 0.5292) and reliable (cronbach alpha = 0.8125). For the questionnaires are in the form of positive nuances, the expected tendency is going towards conformity of agree. This tendency leads to scale 4 and 5 as the preference choices. For the scale 4 is chosen by 50.55% of the population (a little more than 50%), scale 5 is 43.09% (less than 50%), and there are still choices for the scale 3 (4.91%, much less than 10%), the illustration of measured behavior looks good.

The illustration of the performance can be seen more clearly from the graphic in Figure 1.
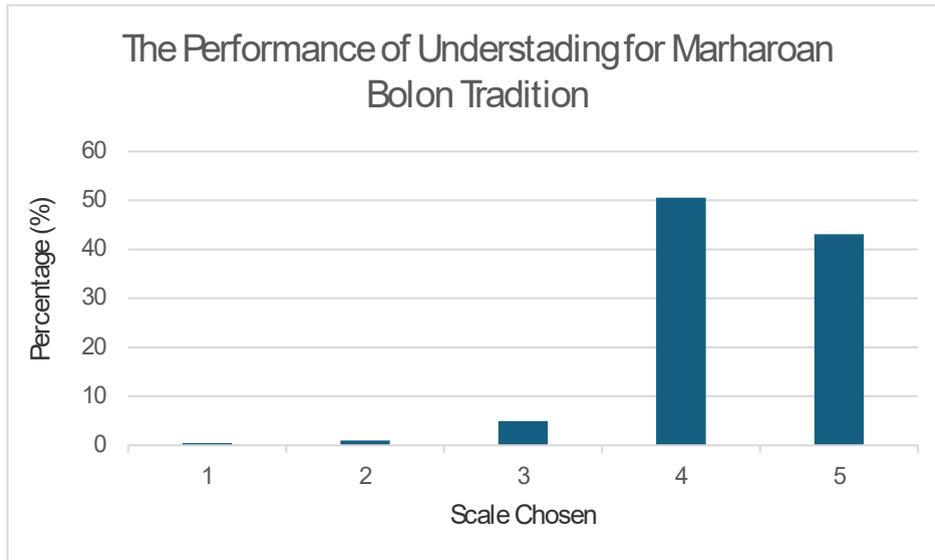
Figure 1. The Illustration for the Performance of The Students' Understanding of Marharoan Bolon Tradition

Table 2. Amount and Percentage of Scale Choices for Environmental Awareness

Scale Choices	Amount of Answers	Percentage (%)
1	4	0.56
2	12	1.69
3	86	12.10
4	369	51.98
5	239	33.66
Total	710	100.00
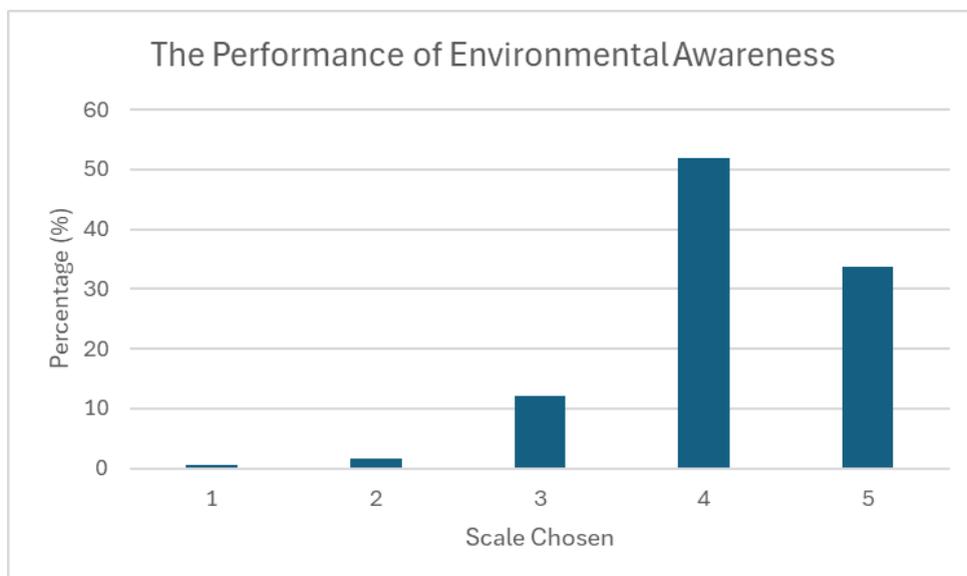
Figure 2. The Performance of The Students' Environmental Awareness

As we can see the results in the table above, the students' tendencies were choosing the scale 4 and 5. The questionnaire is valid (corrected item total-correlation = 0.5908) and reliable (cronbach alpha = 0.8536). For the questionnaires are in the form of positive nuances, the expected tendency is going towards conformity of agree. This tendency leads to scale 4 and 5 as the preference choices. For the scale 4 is chosen by 50.55% of the population (a little more than 50%), scale 5 is 33.66% (less than 50%), and even though there are still chooses for the scale 3 (12.10%, a little more than 10%), the illustration of measured behavior still looks good.

The results of statistical calculations for the relationship between the two variables have shown that "correlation is significant at the 0.01 level (2-tailed)" and "correlation is significant at the 0.05 level (2-tailed)" (detail of the calculations is in the separate file). Those statements have shown that both variables have positive correlations to each other.

Discussion

For the first questionnaire is in the form of positive nuances, so the expected responses are in the scale of 4 and 5. As we can see an illustration about the results that the tendencies of the students for understanding of Marharoan Bolon tradition are good (mostly in the scale 4 and a little more in the scale 5 than scale 3). Referring to theories in Nauly & Fransisca (2015) stated before, the students have quite good cultural identity that helps building their self-concepts. Referring to Valsiner in Santamaria (2019), the values from Simalungun Atas culture are still in the personalities of the students, for the culture of Simalungun Atas still has a lot of influence on their psychological development. This is also in line with theories in Afandi & Kharisma (2024) and Lestari et al (2024) about taking actions for the sustainability of the local wisdom through the next generations although there are still obstacles and challenges in the Generation Z in the digital era as Abas (2022) said in his research.

As well as the first questionnaire (for understanding the Marharoan Bolon tradition), the result for the second questionnaire is also good (mostly in the scale 4 and a little more in the scale 5 than scale 3). Whilst the second questionnaire is about the environmental awareness, referring to Sudiasmo & Muspita (2020) that physical environment is a part of local wisdom, the environmental awareness of the students highly probably also formed while increasing the level of understanding and internalizing the values of Marharoan Bolon culture.

As Generation Z is the successor of Generation X and/or Y (mostly the parents of them), we assume that the process of psychology of learning process (Learning to Learning Strategy) has run quiet effectively. Whilst the Generation X and Y are not as high as their parents (Baby Boomers) in internalizing values of native tradition ability, but they still can learn together in internalizing values of the native tradition to be the indigenous society of local culture using the Learning-to-Learning Strategy process.

Referring the theories of cultural psychology in Santamaria et al (2019) about values of particular culture in people's memories and minds, the values of native traditions can still be instilled in people's memories and minds using a particular way of education that use the Learning-to-Learning Strategy process.

Conclusion

From several particular values of Marharoan Bolon, the students can also improve their other values, not just teamwork (if we refer the narrow meaning of gotong royong) but also the value of environmental awareness. The illustration of this research has strengthened the statement of Habiba & Wulandari (2024) in their research. A group of people (in this research, high school students), if given a good understanding of a tradition, will be able to practice the values contained within it well. A tradition that is usually known for only one good value, if studied further, could discover several other very good values.

Recommendations

As Pane et al (2024) said in their research it is very important to increase the quantity and quality of the character education quantitatively and qualitatively, as early as possible. Also referring to Rad (2012) & Weinstein et al (2018) in Pane et al (2024), as long as students can acquire knowledge, the learning process can occur. This is in line with the Learning-to-Learning Strategy process. So, the local content education that Kurikulum Merdeka has implemented must be continued.

There have been efforts for the younger generation of this tribe to continue to preserve their culture, for example the establishment of a traditional school foundation by the Sihaporas indigenous community which originates from the Batak Simalungun tradition. The purpose of establishing this traditional school foundation is to provide education about customs and culture to the younger generation, in order to maintain and preserve the inherited culture and also as a sign that they are truly indigenous people who have cultural values from the heritage of their ancestors (Manik et al, 2024). This kind of traditional school shall be maintained to preserve the richness of our traditional cultures.

For we are in the digital era nowadays, we can try the social media usage to attract the youth generations, especially Generation Z and Alpha, as well as the next generation, of course. For Binus University is opening on 2025 in Medan, North Sumatera, the Generation Z and Alpha can learn more about knowledge for digital matters to produce materials of local wisdom to be socialized in social media.

Acknowledgements

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Appendix

Our research data can be found at the following link:

https://docs.google.com/forms/d/e/1FAIpQLSeoBrIf280OGHx8w9j4xXQZMyiV4F7XYBe-
i2nUIPzFDmaASg/viewform?usp=sharing&ouid=106993880888497321751

Contributor:

1. **Lead Author – Murty Magda Pane**
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   • **Duties:**

- Formulating the research problem and objectives.
- Developing the theoretical framework and literature review.
- Determining the quantitative method to be used in the study, including questionnaire design.
- Creating tables, charts, and data visualizations based on SPSS results.
- Writing the introduction, literature review, methodology, and main discussion sections.
- Coordinating with other team members to ensure the smooth progress of the research process.

2. **Second Author – Jamson Siallagan**
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   • **Duties:**

- Assisting in analyzing the research results, particularly interpreting the obtained quantitative data.
- Overseeing data collection from Bina Nusantara University student respondents.
- Analyzing data using IBM SPSS and preparing the results for the final report.
- Systematically compiling and summarizing the questionnaire results.
- Entering data into IBM SPSS for analysis.
- Assisting in data processing by running the required statistical tests.

The Relationship between Local Content Education and Environmental Awareness (Case Study: The Students of a Public Senior High School in Simalungun, North Sumatra)

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Abstract: Cultural diversity in a place can cause the original culture in that place to fade, even disappear. This is feared to have happened to the Simalungun Bawah sub-tribe, where there has been a lot of mixing of people from various ethnicities in the area since long ago. In this digital era, of course, this is more feared to happen to the younger generation of this sub-tribe. The respondents in this study were 75 students of a Public High School in Simalungun, North Sumatra. This study aims to find the relationship between students' awareness of the importance of local content education learning and students' environmental awareness. The results of this research showed that the tendency of the students' awareness of the importance of local content education learning was good (53.88% respondents have aware the importance of the local content education and 34.16% were more aware the importance of the local content education). The results of this research showed that the tendency of the students' awareness of the environment was good as well (48.54% were aware of the environment and 45.06% were very aware of the environment). Interestingly, both awareness showed a strong relationship whilst both parameters have shown a positive correlation in the statistical results. From the result, we can say that carrying the local content education appropriately and consistently can raise the students' awareness of surrounding environment in Simalungun.

Keywords: Cultural Diversity, Local Content Education, Environmental Awareness

Introduction

Numerous Indonesians and people in the world as of now know and realize that Indonesia is the as it were biggest archipelagic nation and has the most noteworthy differences of ethnicities, societies and traditions within the world.

Marbun (2018) and Anele (2019) have said in Anele (2021) that considering the different cosmetics of the nation, it has been watched that Indonesia's culture differing qualities has the capacity to shape the character and picture of its claim culture in each locale, and is an vital portion for the arrangement of picture and social personality of a region. In any case, particularly since entering the computerized period, it is known that numerous youthful eras in Indonesia, particularly Era Z, are beginning to disregard the social conventions of their ethnic bunches which are really portion of their personality nowadays. This can be certainly due to the ease of growing contact to other parts of the world so that Era Z inclines toward to retain remote societies (Dharma et al, 2021). In reality, by overlooking the cultural traditions of our claim ethnic bunches, we are able increment the plausibility of dangers to our country's sway. Hidapenta & Dewi (2021) said that dangers to a country in this advanced time are less demanding to convert into a unused confront. It can be deciphered that dangers are all endeavors that can be made from inside or exterior the nation that can imperil the country's sway, regional keenness, and national security. Alluding to this understanding, dangers can not as it were be show in military shapes such as war or other military settings, but anything that can debilitate the country's sway can be categorized as a danger.

One of the numerous non-military dangers is the rise of belief systems or contemplations that can harm the attitude and values of the individuals of a country. Regularly the shape of the risk isn't obvious, but its effect can be felt. This kind of threat particularly confronting the Era Z is that they may lose locate of their national personality as well as social personality. They would or maybe live by western standards, which are inconsistent with the splendid standards of the innate Indonesian culture (Dharma et al, 2021).

This can be in line with what Ismelina F.R. et al (2024) said that revitalization of neighborhood shrewdness values within the advancement of natural law is vital considering that we have entered the mechanical period 4.0 that the presence of nearby intelligence values has begun to be eradicated gradually by the nearness of cutting-edge law. Usually too in agreement with the articulation of Abas (2022) alluded to Xu et al (2005), that's regularly happened that the youthful era of innate people groups have cleared out the hone of nearby intelligence through modernization, small by small. This circumstance will inevitably lead to the misfortune of innate intelligence, which is precious and valuable for the assurance of common biodiversity. In reality, by overlooking the social conventions of our claim ethnic bunches, we are able increment the plausibility of dangers to our country's sway. Hidapenta & Dewi (2021) said that dangers to a country in this computerized period are simpler to convert into a modern confront. It can be deciphered that a risk is any exertion that can be made from inside or exterior the nation that can imperil the country's sway, regional judgment, and national security. Alluding to this understanding, dangers cannot as it were be present in military shapes such as war or other military settings, but anything that can debilitate the country's sovereignty can be categorized as a risk. One of the numerous non-military dangers is the rise of belief systems or contemplations that can harm the attitude and values of the individuals of a country. Regularly the shape of this danger isn't obvious, but its affect can be felt in the society, especially in the Generation X and Baby Boomers.

This kind of peril particularly confronting the Generation Z is that they may lose locate of their national personality as well as social personality. They would or maybe live by western beliefs, which are incongruent with the honorable standards of the innate Indonesian culture (Dharma et al, 2021). This too applies to Generation Z of the Batak ethnic bunch, particularly in this case, the Simalungun Batak. This is often clearly described in Napitu et al (2023) within

the suggestion area, it is composed "The youthful era of Simalungun ought to proceed to care and keep up, as well as secure and maintain and protect their possess social legacy." This clearly states that it is genuine that the youthful era of Simalungun has started to not care almost protecting Simalungun culture.

For we care around the conservation of neighborhood culture and its environment as the critical portion of nearby intelligence, paying consideration to the expanding numbers of youthful era who don't care approximately their local culture in Indonesia, it turns out that the Binus scholastic community cannot fair stay quiet, particularly the character-building speakers, who teach the Binus undergraduate to care approximately their local societies. For Binus will be operating its brand-new campus in Medan, and the senior high school students in North Sumatera will be its anticipated future understudies, so the investigate almost the mindfulness of future students' local culture shall be worn. Out arrange to get the information related to this, this inquire about objective is to induce the data approximately the relationship between the appreciation of local culture and traditions as well as the environmental awareness of the students of a public senior high school from Simalungun Bawah sub-tribe in Simalungun.

Literature Review

A Brief Summary of Simalungun Tribe

Simalungun culture is by and large depicted in different terms that title the different sorts of adornments delineated in their homes and day by day necessities. These decorations outline the values of neighborliness, the capacity to adjust to any social environment, the consideration framework, and the foremost curiously is, the solid esteem of mutual participation (particularly within the family). The Simalungun ethnic gather is one of the tribes that possesses the area of North Sumatra, which settles in Simalungun Regency, Pematang Siantar City and other adjacent zones. They moreover have an awfully solid connection framework to join together when they are absent from domestic. This connection framework is known as a clan. The first clans of the Simalungun people are Damanik, Saragih, Sinaga, Purba (Napitu et al, 2023). Nowadays those clans are in the Simalungun Atas sub-tribe and there are more varied clans in the Simalungun Bawah sub-tribe.

Portraying the Simalungun Regency, Bank Indonesia clarified within the northsumatrainvest.id media that the Simalungun Regency is encompassed by eight other regencies i.e. Serdang Bedagai, Store Serdang, Karo, Tobasa, Samosir, Asahan, Batu Bara, dan Kota Pematangsiantar. Its galactic area is between 02°36' - 03°18' North Scope and 98°32 '- 99°35' East Longitude with an range of 4,372.5 km2 at an elevation of - 1,400 meters over ocean level where 75 percent of the arrive is on a slant of 0-15% so that Simalungun Regency is the third biggest regency after Madina Regency and Langkat Regency in North Sumatra and features a decently key area and is found within the Lake Toba-Parapat traveler region.

Lidlle (1992) in Saragih (2021) separates the Simalungun locale into two categories, specifically Simalungun Bawah and Simalungun Atas. Simalungun Bawah may be a moderately level zone, moo lying, thickly populated and environmentally and geologically portion of a cluster of rich plantations in East Sumatra. In the interim, Simalungun Atas could be a sloping and hilly region, without streams for water transportation and arrive transportation is for the most part troublesome. This region is moderately less ripe than Simalungun Bawah, and contains a cooler climate

than Simalungun Bawah. Giting & Hutauruk (2020) said that the Simalungun Atas locale is found within the Bukit Barisan mountains bordering Tanah Karo, Serdang Hulu and Lake Toba. This range has the potential for the advancement of the marine fisheries, plantations, and green crops divisions, in expansion to the tourism division, considering its area near to Lake Toba. In Hartanto (2021) it is composed that there's an presumption that the Simalungun Atas individuals are indigenous individuals who received cultivation. Saragih (1989) in Hartanto (2021) said that the Simalungun Bawah is for the most part occupied by migrants who are indistinguishable to rice cultivating or manors. Usually in agreement with the brief explanation of Ginting & Hutauruk (2020) which notices that the Simalungun Bawah zone, which incorporates the kingdoms of Siantar, Tanah Jawa and Panei, could be a fertile area and appropriate for manor arrive. In terms of local dialect, the Simalungun Atas dialect is additionally distinctive from the Simalungun Bawah language (Saragih, 2015). This dialect distinction appears that there has been a social contrast between Simalungun Atas and Simalungun Bawah.

Local Content Education

Indonesia is worldwide known as a nation with a tall innate populace with an assessed 40-70 million individuals, of which 20 million are individuals of AMAN (Innate People groups Organization together of the Archipelago) (Manik, 2024). Indigenous people groups are standard law communities or conventional communities, who have lived for eras in a certain topographical range and are bound by social character, solid ties to the arrive, and the domain and characteristic assets in their standard regions (Paralegal, 2019 in Manik, 2024).

It is very much realized by the generations before the Generation Z, that history is a mirror and also a character builder of a nation. As a result of the events that occurred, a culture emerged that would be repeatedly continued by generations even though its authenticity was not the same, because there would always be a shift in the cultural process itself. However, for the love and concern for the ancestral culture that has been presented to us, we will present it again to the next generation so that the ancestral heritage is not lost (Manalu, 2021 in Manik, 2024).

Triana (2017) said in Kaltsum & Habiby (2019) that the values and local knowledge of local content are categorized into three components: 1) cultural local content, 2) social local content, and 3) physical local content. For Pratama & Sumardi (2022) used the theory of contextual teaching & learning (CTL) to be implemented in the local content education, so a brief of theory about the CTL will be written here. Berns and Erickson (2001) in Pratama & Sumardi (2022) stated that "contextual teaching and learning (henceforth CTL) is a teaching and learning concept that can help teacher relates subject content material to the real view or world situations". CTL moreover propels learners to put through their information, and those applications to their genuine lives as individuals of the family, citizens, and specialists for locks in the difficult work for learning requires. CTL made a difference to students in connecting the substance they have learned to their life settings in which that substance may be utilized. Students can also discover the meaning within the preparation of learning themselves (Pratama & Sumardi, 2022).

For this paper is about the local culture awareness and environmental awareness, and both variables are taken from local wisdom, so literature review about local wisdom will be provided. For the process of learning about culture in a

group or community theories are needed for discussion and recommendations in this paper, so literature review about cultural psychology and psychology of learning will be provided as well.

Environmental Awareness

Environmental awareness can be defined as the comprehension and structured collected information of the values of protecting the maintainability of the environment and ecosystems encompassing oneself by individuals or community bunches. According to a study, components counting social values, bunch impact, and inward crave may moreover have an effect on environmental awareness in expansion to an individual's information and understanding of natural issues (Pramita et al, 2023). It moreover known as the science which makes a difference individuals achieve the value, abilities, and knowledge required to live economically (Enger & Smith, 2013 in Handayani, 2021). Handayani (2021) also said that it can also be interpreted as "a situation where humans understand what is best and necessary for the environment". Environmental awareness is especially basic in environmental management and the preservation of living creatures, and it may give a more successful effect when executed (Handayani, 2021).

Local Wisdom

Sneed (2019), Benefit et al (2014) and Lanini et al (2019) said in Abas et al (2022) that indigenous people have a long history of being specifically and personally subordinate on their arrive for food. Moreover, unlike most of present-day culture, they tend to see nature as existing to serve people, as contradicted to having a complementary association with it. Abas (2022) had an opinion that the thought processes, intuitions, and traditions of indigenous communities are commonly alluded to as local wisdom or local knowledge. Local wisdom can be defined in other words as for the most part as the elemental understanding created through concordant coexistence with nature, which is entwined with the community's culture and is assembled and transmitted through eras. This kind of wisdom is from encounters or truth picked up from life (Von der Porten et al (2019) in Abas (2022)). This does not negate with Hamid et al (2024) in Afandi & Kharisma (2024), that the local wisdom can be stated as a way of life and information and different life techniques within the shape of activities that the neighborhood community carries out to meet their needs. That is how critical local wisdom is, so that Hasan et al (2024) said in Afandi & Kharisma (2024) that it is should be protected and coordinated into education. In spite of the fact that Arifiani et al (2019) and Osawa (2023) have said in Lestari et al (2024), that local wisdom and hones that have been portion of society for centuries have been illustrated to advance maintainability. Shockingly, indigenous people groups and their lands confronted colossal dangers. They were confronting weight from interruption into foundation, farming, mining, logging and other exercises that moreover debilitate biodiversity (Abas, 2022). Fatimah et al., 2020 and Lubowiecki-Vikuk et al., 2021 reinforce by Maspul, 2023 said in Lestari et al 2024, that socializing and internalizing the local wisdom back the format of additional all-encompassing and economical answers that empower money related increment that remains in harmony with environmental conservation and social supportability. This can be too in agreement with what Sudiasmo & Muspita (2020) said that the local wisdom within the frame of social institution is related directly with environmental preservation as well as conservation of common resources. This is often also in line in what Royo & Ballesta-Garcia (2019) said in Habiba & Wulandari (2024) that "the environment has a great influence on human life".

In a multicultural nation like Indonesia, the value of local cultural wisdom plays an vital part in fortifying national personality within the universal world so that it may be a characteristic of a country. The presence of local culture and the value of its wisdom is able to fortify the commitment of the Indonesian people to cultivate a sense of cherish for the homeland to each citizen, especially in counting to the Generation Z. Indonesian local culture is the one of the major treasures of the Indonesian people, so it is exceptionally vital to preserve it (Dharma et al, 2021). Wylie's words in Berry (1999) composed in Nauly and Francisca (2015) approximately self-concept ("self-concept implies the knowledge or beliefs that an individual has about himself") and identity are too vital to be stated here. They concurred that, in differentiate to self-concept, identity as a rule contains a sense of connection that an person needs to the identity itself (Aboud; Hocoy; Keefe, in Berry 1999, in Nauly & Fransisca, 2015). Moreover, alluding to Tajfel (1982) in Nauly & Fransisca (2015), cultural identity is not only a self-concept that incorporates a person's knowledge of their participation in a gather or social gather, but moreover relates to the values and enthusiastic sentiments joined to that enrollment.

Cultural Psychology

Whilst the advancement of knowledge is getting faster, so there were numerous ideas and theories in the area of cultural psychology. Generally, its definition is "cultural psychology is a designation for the comparative study of the way culture and psyche make each other up" (Shweder & Sullivan (1993) in Santamaria et al (2019)). According to Valsiner (2009) in Santamaria (2019), the main purpose of cultural psychology is "to understand how the processes of human development are created and transformed in culture and, in turn, are constrained by culture". Those theories are in line with what Santamaria et al (2019) said, i.e. "the main aim of a Cultural Psychology is centered on understanding how the mind is related to cultural, social, institutional, and historical context." Those theories are supporting the assumption of Santamaria et al (2019), i.e. "socio-cultural research should combine the development of theoretical concepts about mind and culture with methodologies to study them". We can assume that those written theories have strengthen the general understanding of cultural psychology.

Psychology of Learning

In orchestrate to shorten the composing handle, we would like to bounce the hypothesis of the Psychology of Learning-to-Learning Strategy. Learning procedures can be delineated as procedures that understudies utilize to secure data. This joins procedures for sharpening memory as well as more effective consider and test-taking procedures (Rad, 2012). There's one crucial for compelling learning, named as twofold coding. Twofold coding delineated as combining words with visuals. Actualizing this strategy makes students or learner can draw two neurons and clarify how one communicates with the other through synaptic hole (Weinstein et al, 2018).

Method

Respondents Selection and Data Collection

As mentioned above, this research objective is to get the illustration about the relationship between the understanding about the local content education based on Batak Simalungun Culture and the environmental awareness of the students

in a particular State High School in Simalungun, North Sumatera. It has approximately 200-300 students for 3 grades, and the respondents for this research were from the first-grade students and the number of respondents who participated in this research were 75 persons, which were chosen from the Simalungun Bawah sub-tribe. The premise for choosing the Simalungun Bawah sub-tribe was based on the theory mentioned before that "the Simalungun Bawah is for the most part occupied by migrants who are indistinguishable to rice cultivating or manors". So, the Simalungun Bawah people consists of more varied clans, so they are not really the indigenous people of Simalungun tribe. So they shall have good education about the local wisdom of the Simalungun traditions.

The responses in the form of chosen scales would be the illustration of the understanding of the local content education and the environmental awareness of the chosen respondents. For the local content education understanding, the questionnaire was given in papers, self-construct from theories about local content education from CTL generally (Pratama & Sumardi (2022)), Lukman et al (2022) and Kaltsum & Habiby (2019). It is also adapted from 1 questionnaire about Batak culture (Nauly & Fransisca, 2015). The number of items in this questionnaire is 5. Similar with the first questionnaire, the questionnaire about environmental awareness was given in papers and adapted from Khoiri et al (2021) and Sra (2020). The items of referred questionnaire adapted also selected to suit the natural conditions in Simalungun Bawah, it is adapted and separated into two types questionnaires, one is for environmental awareness and the other is for natural conservation awareness. For this research the questionnaire used is for the environmental awareness. The number of items in this questionnaire is also 5, so each of the questionnaires got 750 answers from 75 students. The sentences in the items for both questionnaires are in the positive nuances. The tendencies of chosen behaviors about the understanding of the local content education and environmental awareness were measured by Likert scale divided by five scales on tendency towards conformity in agree-disagree levels. They are 1 for strongly disagree, 2 for disagree, 3 for neutral, 4 for agree and 5 for strongly agree. For the items in the questionnaire are in the positive nuances, so the preferable choices to show the good behaviors for multiculturalism in this research are the scales of 4 and 5.

Data Processing and Providing

After the results of the questionnaire filling were already available, the data were processed statistically using the SPSS to ensure that the questionnaire has been valid and reliable to measure the behavior of understanding of local content education and environmental awareness. After the validity and the reliability have been confirmed, the data for number of each scale chosen will be easier to be obtained to get the illustration.

The data provided in a table showing the number of scales chosen from the whole answers provided and each scale chosen. Apart from the number of selected scales, the table also shows the percentage of each selected scale from the total selected scales. The percentages of scale chosen data will be the basis for discussion and drawing conclusions as the final result for illustration of how good the understanding of the local content education and the environmental awareness of the students of that particular school are and the relationship between them (Kemmis, S., & McTaggart, R. (1982), (2000) and Kusamah, W. & Dwitagama, D. (2009)).

Results

The results of the answers for both questionnaires can be seen in the tables and figures below:

Table 1. Amount and Percentage of Scale Choices for Understanding the Local Content Education

Scale Choices	Amount of Answers	Percentage (%)
1	0	0
2	14	1.86
3	76	10.12
4	404	53.88
5	256	34.16
Total	750	100.00

As we can see the results in the table above, the students' tendencies were choosing the scale 4 and 5. The questionnaire is valid (corrected item total-correlation = 0.6646) and reliable (cronbach alpha = 0.8182). For the questionnaires are in the form of positive nuances, the expected tendency is going towards conformity of agree. This tendency leads to scale 4 and 5 as the preference choices. For the scale 4 is chosen by 53.88% of the population (a little more than 50%), scale 5 is 34.16% (less than 50%), and there are still choices for the scale 3 (10.12%, a little more than 10%), the illustration of the measured behavior still looks good. The illustration of the performance can be seen more clearly from the graphic in Figure 1.

Figure 1. The Illustration for the Performance of The Students' Understanding of Local Content Education

Table 2. Amount and Percentage of Scale Choices for Environmental Awareness

Scale Choices	Amount of Answers	Percentage (%)
1	0	0
2	6	0.8
3	42	5.6
4	364	48.54
5	338	45.06
Total	750	100.00

As we can see the results in the table above, the students' tendencies were choosing the scale 4 and 5. The questionnaire is valid (corrected item total-correlation = 0.592) and reliable (cronbach alpha = 0.7626). For the questionnaires are in the form of positive nuances, the expected tendency is going towards conformity of agree. This tendency leads to scale 4 and 5 as the preference choices. For the scale 4 is chosen by 48.54% of the population (a little less than 50%), scale 5 is 45.06% (a little less than 50%), and even though there are still chooses for the scale 3 (5.6%, much less than 10%), the illustration of measured behavior looks good.

Figure 2. The Performance of The Students' Environmental Awareness

The results of statistical calculations for the relationship between the two variables have shown that "correlation is significant at the 0.01 level (2-tailed)" and "correlation is significant at the 0.05 level (2-tailed)" (detail of the calculations is in the separate file). Those statements have shown that both variables have positive correlations to each other.

Discussion

For the first questionnaire is in the form of positive nuances, so the expected responses are in the scale of 4 and 5. As we can see an illustration about the results that the tendencies of the students for understanding of local content

education are good (mostly in the scale 4 and a little less than it is for the scale 5, and followed by scale 3). Referring to theories of CTL in Pratama & Sumardi, strengthen with theories in Kaltsum & Habiby, looks like the local content education has run good. It looks like the students have already had quite good cultural identity that helps building their self-concepts, just like Nauly & Fransisca (2015) have said. Referring to Valsiner in Santamaria (2019), the values from Simalungun Bawah culture are still in the personalities of the students, for the culture of Simalungun Bawah still has a lot of influence on their psychological development. This is also in line with theories in Afandi & Kharisma (2024) and Lestari et al (2024) about taking actions for the sustainability of the local wisdom through the next generations although there are still obstacles and challenges in the Generation Z in the digital era as Abas (2022) said in his research. These findings have proven that the education of local content has run quite effectively to the students.

As well as the first questionnaire (for understanding the local content education), the result for the second questionnaire is also good (mostly in the scale 4 and a little more in the scale 5 than scale 3). Whilst the second questionnaire is about the environmental awareness, referring to Sudiasmo & Muspita (2020) that physical environment is a part of local wisdom, the environmental awareness of the students highly probably also formed while increasing the level of understanding and internalizing the values of Simalungun Bawah culture through the local content education.

As Generation Z is the successor of Generation X and/or Y (mostly the parents of them), we assume that the process of psychology of learning process (Learning to Learning Strategy) has run quiet effectively. Whilst the Generation X and Y are not as high as their parents (Baby Boomers) in internalizing values of native tradition ability, but they still can learn together in internalizing values of the native tradition to be the indigenous society of local culture using the Learning-to-Learning Strategy process.

Referring the theories of cultural psychology in Santamaria et al (2019) about values of particular culture in people's memories and minds, the values of native traditions can still be instilled in people's memories and minds using a particular way of education that use the Learning to Learning Strategy process.

Conclusion

From several particular values of Simalungun Bawah culture, the students can also improve their other values, in this case, the value of environmental awareness. The illustration of this research has strengthen the statement of Habiba & Wulandari (2024) in their research. A group of people (in this research, high school students), if given a good understanding of a tradition, will be able to practice the values contained within it well. A tradition that is usually known for only one good value, if studied further, could discover several other very good values.

Recommendations

As Pane et al (2024) said in their research it is very important to increase the quantity and quality of the character education quantitatively and qualitatively, as early as possible. Also referring to Rad (2012) & Weinstein et al (2018)

in Pane et al (2024), as long as students can acquire knowledge, the learning process can occur. This is in line with the Learning-to-Learning Strategy process. So the local content education that Kurikulum Merdeka has implemented must be continued.

The traditional school foundation by the Sihaporas indigenous community which originates from the Batak Simalungun tradition is a good example of educating native traditions to young generation. In this digital era that the threats and challenges have become more terrifying, maintaining and preserving our own inherited culture have become more important. This kind of traditional school shall be maintained to preserve the richness of our traditional cultures.

For we are in the digital era nowadays, we can try the social media usage to attract the youth generations, especially Generation Z and Alpha, as well as the next generation, of course. For Binus University is opening on 2025 in Medan, North Sumatera, the Generation Z and Alpha can learn more about knowledge for digital matters to produce materials of local wisdom to be socialized in social media.

Acknowledgements

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Appendix

Our research data can be found at the following link:

https://docs.google.com/forms/d/e/1FAIpQLSeoBrIf280OGHx8w9j4xXQZMyiV4F7XYBei2nUIPzFDmaASg/view
form?usp=sharing&ouid=106993880888497321751

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- Formulating the research problem and objectives.
- Developing the theoretical framework and literature review.
- Determining the quantitative method to be used in the study, including questionnaire design.
- Creating tables, charts, and data visualizations based on SPSS results.
- Writing the introduction, literature review, methodology, and main discussion sections.
- Coordinating with other team members to ensure the smooth progress of the research process.

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- Assisting in analyzing the research results, particularly interpreting the obtained quantitative data.
- Overseeing data collection from Bina Nusantara University student respondents.
- Analyzing data using IBM SPSS and preparing the results for the final report.
- Systematically compiling and summarizing the questionnaire results.
- Entering data into IBM SPSS for analysis.
- Assisting in data processing by running the required statistical tests.

The Relationship between Local Content Education and Natural Conservation Awareness (Case Study: The Students of a Public Senior High School in Simalungun, North Sumatra)

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Abstract: The preservation of natural conservation and local culture has been increasingly encouraged lately. One of the main reasons is to improve the performance of the tourism industry. One of the popular tourist destinations in Indonesia is Lake Toba, which is located in North Sumatra. Therefore, it is not surprising that the Government pays attention to the development of society in the North Sumatra region to support the progress of its tourism industry. Building a tourism industry cannot be separated from building the community in the tourism area, including its young generation. The respondents in this study were 75 students of a Public High School in Simalungun, North Sumatra. This study aims to find the relationship between students' awareness of the importance of local content education learning and students' natural conservation awareness. The results of this research showed that the tendency of the students' awareness of the importance of local content education learning was good (53.88% respondents have aware the importance of the local content education and 34.16% were more aware the importance of the local content education). The results of this research showed that the tendency of the students' natural conservation awareness was good as well (47.46% were aware of the environment and 44.26% were very aware of the environment). Interestingly, both awareness showed a strong relationship whilst both parameters have shown a positive correlation in the statistical

results. From the result, we can say that carrying the local content education appropriately and consistently can raise the students' awareness of surrounding environment in Simalungun.

Keywords: natural conservation, local content education, natural conservation awareness

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Introduction

Numerous Indonesians and people in the world as of now know and realize that Indonesia is the as it were biggest archipelagic nation and has the most noteworthy differences of ethnicities, societies and traditions within the world. Marbun (2018) and Anele (2019) have said in Anele (2021) that considering the different cosmetics of the nation, it has been watched that Indonesia's culture differing qualities has the capacity to shape the character and picture of its claim culture in each locale, and is an vital portion for the arrangement of picture and social personality of a region. In any case, particularly since entering the computerized period, it is known that numerous youthful eras in Indonesia, particularly Era Z, are beginning to disregard the social conventions of their ethnic bunches which are really portion of their personality nowadays. This can be certainly due to the ease of growing contact to other parts of the world so that Era Z inclines toward to retain remote societies (Dharma et al, 2021). In reality, by overlooking the cultural traditions of our claim ethnic bunches, we are able increment the plausibility of dangers to our country's sway. Hidapenta & Dewi (2021) said that dangers to a country in this advanced time are less demanding to convert into a unused confront. It can be deciphered that dangers are all endeavors that can be made from inside or exterior the nation that can imperil the country's sway, regional keenness, and national security. Alluding to this understanding, dangers can not as it were be show in military shapes such as war or other military settings, but anything that can debilitate the country's sway can be categorized as a danger.

One of the numerous non-military dangers is the rise of belief systems or contemplations that can harm the attitude and values of the individuals of a country. Regularly the shape of the risk isn't obvious, but its effect can be felt. This kind of threat particularly confronting the Era Z is that they may lose locate of their national personality as well as social personality. They would or maybe live by western standards, which are inconsistent with the splendid standards of the innate Indonesian culture (Dharma et al, 2021).

This can be in line with what Ismelina F.R. et al (2024) said that revitalization of neighborhood shrewdness values within the advancement of natural law is vital considering that we have entered the mechanical period 4.0 that the presence of nearby intelligence values has begun to be eradicated gradually by the nearness of cutting-edge law. Usually too in agreement with the articulation of Abas (2022) alluded to Xu et al (2005), that's regularly happened that the youthful era of innate people groups have cleared out the hone of nearby intelligence through modernization,

small by small. This circumstance will inevitably lead to the misfortune of innate intelligence, which is precious and valuable for the assurance of common biodiversity. In reality, by overlooking the social conventions of our claim ethnic bunches, we are able increment the plausibility of dangers to our country's sway. Hidapenta & Dewi (2021) said that dangers to a country in this computerized period are simpler to convert into a modern confront. It can be deciphered that a risk is any exertion that can be made from inside or exterior the nation that can imperil the country's sway, regional judgment, and national security. Alluding to this understanding, dangers cannot as it were be present in military shapes such as war or other military settings, but anything that can debilitate the country's sovereignty can be categorized as a risk. One of the numerous non-military dangers is the rise of belief systems or contemplations that can harm the attitude and values of the individuals of a country. Regularly the shape of this danger isn't obvious, but its affect can be felt in the society, especially in the Generation X and Baby Boomers.

This kind of peril particularly confronting the Generation Z is that they may lose locate of their national personality as well as social personality. They would or maybe live by western beliefs, which are incongruent with the honorable standards of the innate Indonesian culture (Dharma et al, 2021). This too applies to Generation Z of the Batak ethnic bunch, particularly in this case, the Simalungun Batak. This is often clearly described in Napitu et al (2023) within the suggestion area, it is composed "The youthful era of Simalungun ought to proceed to care and keep up, as well as secure and maintain and protect their possess social legacy." This clearly states that it is genuine that the youthful era of Simalungun has started to not care almost protecting Simalungun culture.

For we care around the conservation of neighborhood culture and its environment as the critical portion of nearby intelligence, paying consideration to the expanding numbers of youthful era who don't care approximately their local culture in Indonesia, it turns out that the Binus scholastic community cannot fair stay quiet, particularly the character-building speakers, who teach the Binus undergraduate to care approximately their local societies. For Binus will be operating its brand-new campus in Medan, and the senior high school students in North Sumatera will be its anticipated future understudies, so the investigate almost the mindfulness of future students' local culture shall be worn. Out arrange to get the information related to this, this inquire about objective is to induce the data approximately the relationship between the appreciation of local culture and traditions as well as the environmental awareness of the students of a public senior high school from Simalungun Bawah sub-tribe in Simalungun.

Literature Review

A Brief Summary of Simalungun Tribe

Simalungun culture is by and large depicted in different terms that title the different sorts of adornments delineated in their homes and day by day necessities. These decorations outline the values of neighborliness, the capacity to adjust to any social environment, the consideration framework, and the foremost curiously is, the solid esteem of mutual participation (particularly within the family). The Simalungun ethnic gather is one of the tribes that possesses the area of North Sumatra, which settles in Simalungun Regency, Pematang Siantar City and other adjacent zones. They moreover have an awfully solid connection framework to join together when they are absent from domestic. This connection framework is known as a clan. The first clans of the Simalungun people are Damanik, Saragih,

Sinaga, Purba (Napitu et al, 2023). Nowadays those clans are in the Simalungun Atas sub-tribe and there are more varied clans in the Simalungun Bawah sub-tribe.

Portraying the Simalungun Regency, Bank Indonesia clarified within the northsumatrainvest.id media that the Simalungun Regency is encompassed by eight other regencies i.e. Serdang Bedagai, Store Serdang, Karo, Tobasa, Samosir, Asahan, Batu Bara, dan Kota Pematangsiantar. Its galactic area is between 02°36' - 03°18' North Scope and 98°32 '- 99°35' East Longitude with an range of 4,372.5 km2 at an elevation of - 1,400 meters over ocean level where 75 percent of the arrive is on a slant of 0-15% so that Simalungun Regency is the third biggest regency after Madina Regency and Langkat Regency in North Sumatra and features a decently key area and is found within the Lake Toba-Parapat traveler region.

Lidlle (1992) in Saragih (2021) separates the Simalungun locale into two categories, specifically Simalungun Bawah and Simalungun Atas. Simalungun Bawah may be a moderately level zone, moo lying, thickly populated and environmentally and geologically portion of a cluster of rich plantations in East Sumatra. In the interim, Simalungun Atas could be a sloping and hilly region, without streams for water transportation and arrive transportation is for the most part troublesome. This region is moderately less ripe than Simalungun Bawah, and contains a cooler climate than Simalungun Bawah. Giting & Hutauruk (2020) said that the Simalungun Atas locale is found within the Bukit Barisan mountains bordering Tanah Karo, Serdang Hulu and Lake Toba. This range has the potential for the advancement of the marine fisheries, plantations, and green crops divisions, in expansion to the tourism division, considering its area near to Lake Toba. In Hartanto (2021) it is composed that there's an presumption that the Simalungun Atas individuals are indigenous individuals who received cultivation. Saragih (1989) in Hartanto (2021) said that the Simalungun Bawah is for the most part occupied by migrants who are indistinguishable to rice cultivating or manors. Usually in agreement with the brief explanation of Ginting & Hutauruk (2020) which notices that the Simalungun Bawah zone, which incorporates the kingdoms of Siantar, Tanah Jawa and Panei, could be a fertile area and appropriate for manor arrive. In terms of local dialect, the Simalungun Atas dialect is additionally distinctive from the Simalungun Bawah language (Saragih, 2015). This dialect distinction appears that there has been a social contrast between Simalungun Atas and Simalungun Bawah.

Local Content Education

Indonesia is known worldwide as a country with a high population of indigenous culture with anestimation of 40-70 million people, of which 20 million are people of AMAN (Natural Individuals bunches Organization together of the Archipelago) (Manik, 2024). Indigenous people bunches are standard law communities or ordinary communities, who have lived for times in a certain geological extend and are bound by social character, strong ties to the arrive, and the space and characteristic resources in their standard districts (Paralegal, 2019 in Manik, 2024).

It is exceptionally much realized by the generations some time recently the Generation Z, that history could be a reflect additionally a character builder of a country. As a result of the occasions that happened, a culture risen that would be more than once proceeded by generations indeed in spite of the fact that its genuineness was not the same, since there would continuously be a move within the social handle itself. In any case, for the love and concern for the

hereditary culture that has been displayed to us, we are going display it once more to another generation so that the genealogical legacy isn't misplaced (Manalu, 2021 in Manik, 2024).

Triana (2017) said in Kaltsum & Habiby (2019) that the values and local knowledge of local content are categorized into three components:

1) cultural local content, 2) social local content, and 3) physical local content. For Pratama & Sumardi (2022) utilized the hypothesis of relevant educating & learning (CTL) to be executed within the local content education, so a brief of hypothesis approximately the CTL will be composed here. Berns and Erickson (2001) in Pratama & Sumardi (2022) expressed that "contextual teaching and learning (henceforth CTL) is a teaching and learning concept that can help teacher relates subject content material to the real view or world situations". CTL besides moves learners to put through their data, and those applications to their veritable lives as people of the family, citizens, and masters for locks within the troublesome work for learning requires. CTL made a contrast to students in interfacing the substance they have learned to their life settings in which that substance may be utilized. Students can moreover find the meaning inside the planning of learning themselves (Pratama & Sumardi, 2022).

For this paper is about the local content education and natural conservation awareness, and both variable are taken from local wisdom, so literature review about local wisdom will be provided. Unlike the environmental awareness, the natural conservation awareness does not have a particular study, especially in the behavioral science. Frequently, this kind of behavior equated with the environmental awareness. So the theory provided in this paper for natural conservation awareness will be equated with the environmental awareness as well, but the questionnaire will be differentiated between the two. For the process of learning about culture in a group or community theories are needed for discussion and recommendations in this paper, so literature review about cultural psychology and psychology of learning will be provided as well.

Environmental Awareness

Environmental awareness can be defined as "the comprehension and structured collected information of the values of protecting the maintainability of the environment and ecosystems encompassing oneself by individuals or community bunches". There is a study said that components counting social values, bunch impact, and inward crave may moreover have an affect on environmental awareness in expansion to an individual's information and understanding of natural issues (Pramita et al, 2023). It moreover known as the science which makes a difference individuals achieve the value, abilities, and knowledge required to live economically (Enger & Smith, 2013 in Handayani, 2021). Handayani (2021) also said that it can also be interpreted as "a situation where humans understand what is best and necessary for the environment". Environmental awareness is especially basic in environmental management and the preservation of living creatures, and it may give a more successful effect when executed (Handayani, 2021).

Local Wisdom

Indonesia is known worldwide as a country with a high population of indigenous culture with an estimation of 40-70 million people, of which 20 million are people of AMAN (Natural Individuals bunches Organization together of the

Archipelago) (Manik, 2024). Indigenous people bunches are standard law communities or ordinary communities, who have lived for times in a certain geological extend and are bound by social character, strong ties to the arrive, and the space and characteristic resources in their standard districts (Paralegal, 2019 in Manik, 2024).

It is exceptionally much realized by the generations some time recently the Generation Z, that history could be a reflect additionally a character builder of a country. As a result of the occasions that happened, a culture risen that would be more than once proceeded by generations indeed in spite of the fact that its genuineness was not the same, since there would continuously be a move within the social handle itself. In any case, for the love and concern for the hereditary culture that has been displayed to us, we are going display it once more to another generation so that the genealogical legacy isn't misplaced (Manalu, 2021 in Manik, 2024).

Triana (2017) said in Kaltsum & Habiby (2019) that the values and local knowledge of local content are categorized into three components: 1) cultural local content, 2) social local content, and 3) physical local content. For Pratama & Sumardi (2022) utilized the hypothesis of relevant educating & learning (CTL) to be executed within the local content education, so a brief of hypothesis approximately the CTL will be composed here. Berns and Erickson (2001) in Pratama & Sumardi (2022) expressed that "contextual teaching and learning (henceforth CTL) is a teaching and learning concept that can help teacher relates subject content material to the real view or world situations". CTL besides moves learners to put through their data, and those applications to their veritable lives as people of the family, citizens, and masters for locks within the troublesome work for learning requires. CTL made a contrast to students in interfacing the substance they have learned to their life settings in which that substance may be utilized. Students can moreover find the meaning inside the planning of learning themselves (Pratama & Sumardi, 2022).

Sneed (2019), Benefit et al (2014) and Lanini et al (2019) said in Abas et al (2022) that indigenous people have a long history of being particularly and by and by subordinate on their arrive for nourishment. Additionally, not at all like most of display day culture, they tend to see nature as existing to serve individuals, as negated to having a complementary affiliation with it.

Abas (2022) had an supposition that the thought forms, instincts, and conventions of inborn communities are commonly insinuated to as local wisdom or local knowledge. Local wisdom can be interpreted in other words as for the foremost portion as the basic understanding made through concordant coexistence with nature, which is weaved with the community's culture and is collected and transmitted through times. This kind of wisdom is from experiences or truth picked up from life (Von der Porten et al (2019) in Abas (2022)). This does not invalidate with Hamid et al (2024) in Afandi & Kharisma (2024), that the local wisdom can be expressed as a way of life and data and distinctive life procedures inside the shape of exercises that the local community carries out to meet their needs. That is how basic local wisdom is, so that Hasan et al (2024) said in Afandi & Kharisma (2024) that it is ought to be ensured and facilitated into education. In show disdain toward of the reality that Arifiani et al (2019) and Osawa (2023) have said in Lestari et al (2024), that local wisdom and sharpens that have been parcel of society for centuries have been outlined to development practicality. Shockingly, indigenous people bunches and their lands stood up to colossal threats. They were going up against weight from interference into establishment, cultivating, mining, logging and other works out that in addition weaken biodiversity (Abas, 2022). Fatimah et al., 2020 and Lubowiecki-Vikuk et al., 2021 fortify by

Maspul, 2023 said in Lestari et al 2024, that socializing and internalizing the local wisdom back the arrange of extra all enveloping and conservative answers that engage cash related increase that remains in concordance with natural preservation and social supportability. This may be as well in assention with what Sudiasmo & Muspita (2020) said that the local wisdom inside the outline of social institution is related specifically with natural conservation as well as conservation of common assets. This is often frequently too in line in what Royo & Ballesta-Garcia (2019) said in Habiba & Wulandari (2024) that "the environment has a great influence on human life".

In a multicultural country like Indonesia, the value of local cultural wisdom plays an crucial portion in bracing national identity inside the widespread world so that it may be a characteristic of a nation. The existenec of local culture and the value of its wisdom is able to invigorate the commitment of the Indonesian individuals to develop a sense of cherish for the country to each citizen, particularly in tallying to the Generation Z. Indonesian local culture is the one of the major treasures of Indonesia as a nation, so it is uncommonly imperative to protect it (Dharma et al, 2021).

Wylie has said in Berry (1999) and composed in Nauly and Francisca (2015) regarding of self-concept ("self-concept implies the knowledge or beliefs that an individual has about himself") and identity are as well imperative to be expressed here. They concurred that, in differentiate to self-concept, identity as a rule contains a sense of connection that an person needs to the identity itself (Aboud; Hocoy; Keefe, in Berry 1999, in Nauly & Fransisca, 2015). Moreover, alluding to Tajfel (1982) in Nauly & Fransisca (2015), cultural identity is not only a self-concept that incorporates a person's knowledge of their cooperation in a assemble or social assemble, but additionally relates to the values and eager estimations joined to that enrollment.

Cultural Psychology

Since the progress yet evolution of science is growing rapidly, so there were numerous thoughts and theories in the area of cultural psychology. Generally, the definition of cultural psychology is "a designation for the comparative study of the way culture and psyche make each other up" (Shweder & Sullivan (1993) in Santamaria et al (2019)). According to Valsiner (2009) in Santamaria (2019), the main purpose of cultural psychology is "to understand how the processes of human development are created and transformed in culture and, in turn, are constrained by culture". Those theories are in line with what Santamaria et al (2019) said, i.e. "the main aim of a Cultural Psychology is centered on understanding how the mind is related to cultural, social, institutional, and historical context." Since Santamaria et al (2019) have assumed that "socio-cultural research should combine the development of theoretical concepts about mind and culture with methodologies to study them", so we can assume that those written theories have strengthen the general understanding of cultural psychology as well.

Psychology of Learning

In coordinate to abbreviate the composing handle, we would like to bounce the speculation of the Psychology of Learning-to-Learning Strategy. Learning procedures can be understood as procedures that understudies utilize to secure data. This joins procedures for sharpening memory as well as more effective consider and test-taking procedures (Rad, 2012). There's one crucial for compelling learning, named as twofold coding. Twofold coding

delineated as combining words with visuals. Actualizing this strategy makes learner can draw two neurons and clarify how one communicates with the other through synaptic hole (Weinstein et al, 2018).

Method

Respondents Selection and Data Collection

As mentioned above, this research objective is to get the illustration about the relationship between the understanding about the local content education based on Batak Simalungun Culture and the natural conservation awareness of the students in a particular State High School in Simalungun, North Sumatera. It has approximately 200-300 students for 3 grades, and the respondents for this research were from the first-grade students and the number of respondents who participated in this research were 75 persons, which were chosen from the Simalungun Bawah sub-tribe. The premise for choosing the Simalungun Bawah sub-tribe was based on the theory mentioned before that "the Simalungun Bawah is for the most part occupied by migrants who are indistinguishable to rice cultivating or manors". So the Simalungun Bawah people consists of more varied clans, so they are not really the indigenous people of Simalungun tribe. So, they shall have good education about the local wisdom of the Simalungun traditions.

The responses in the form of chosen scales would be the illustration of the understanding of the local content education and the natural conservation awareness of the chosen respondents. For the local content education understanding, the questionnaire was given in papers, self-construct from theories about local content education from CTL generally (Pratama & Sumardi (2022)), Lukman et al (2022) and Kaltsum & Habiby (2019). It is also adapted from 1 questionnaire about Batak culture (Nauly & Fransisca, 2015). The number of items in this questionnaire is 5. Similar with the first questionnaire, the questionnaire about environmental awareness was given in papers and adapted from Khoiri et al (2021) and Sra (2020). The items of referred questionnaire adapted also selected to suit the natural conditions in Simalungun Bawah, it is adapted and separated into two types questionnaires, one is for environmental awareness and the other is for natural conservation awareness. For this research the questionnaire used is for the natural conservation awareness. The number of items in this questionnaire is also 5, so each of the questionnaires got 750 answers from 75 students. The sentences in the items for both questionnaires are in the positive nuances. The tendencies of chosen behaviors about the understanding of the local content education and natural conservation awareness were measured by Likert scale divided by five scales on tendency towards conformity in agree-disagree levels. They are 1 for strongly disagree, 2 for disagree, 3 for neutral, 4 for agree and 5 for strongly agree. For the items in the questionnaire are in the positive nuances, so the preferable choices to show the good behaviors for multiculturalism in this research are the scales of 4 and 5.

Data Processing and Providing

After the results of the questionnaire filling were already available, the data were processed statistically using the SPSS to ensure that the questionnaire has been valid and reliable to measure the behavior of local content education and natural conservation awareness. After the validity and the reliability have been confirmed, the data for number of each scale chosen will be easier to be obtained to get the illustration. The data provided in a table showing the number of scales chosen from the whole answers provided and each scale chosen. Apart from the number of selected scales,

the table also shows the percentage of each selected scale from the total selected scales. The percentages of scale chosen data will be the basis for discussion and drawing conclusions as the final result for illustration of how good the understanding of the local content education and the natural conservation awareness of the students of that particular school are and the relationship between them (Kemmis, S., & McTaggart, R. (1982), (2000) and Kusamah, W. & Dwitagama, D. (2009)).

Results

The results of the answers for both questionnaires can be seen in the tables and figures below:

Table 1. Amount and Percentage of Scale Choices for Understanding the Local Content Education

Scale Choices	Amount of Answers	Percentage (%)
1	0	0
2	14	1.86
3	76	10.12
4	404	53.88
5	256	34.16
Total	750	100.00

As we can see the results in the table above, the students' tendencies were choosing the scale 4 and 5. The questionnaire is valid (corrected item total-correlation = 0.6646) and reliable (cronbach alpha = 0.8182). For the questionnaires are in the form of positive nuances, the expected tendency is going towards conformity of agree. This tendency leads to scale 4 and 5 as the preference choices. For the scale 4 is chosen by 53.88% of the population (a little more than 50%), scale 5 is 34.16% (less than 50%), and there are still choices for the scale 3 (10.12%, a little more than 10%), the illustration of the measured behavior still looks good.

The illustration of the performance can be seen more clearly from the graphic in Figure 1.

Figure 1. The Illustration for the Performance of The Students' Understanding of Local Content Education+

Table 2. Amount and Percentage of Scale Choices for Natural Conservation Awareness

Scale Choices	Amount of Answers	Percentage (%)
1	0	0
2	2	0.26
3	60	8
4	356	47.46
5	332	44.26
Total	750	100.00

As we can see the results in the table above, the students' tendencies were choosing the scale 4 and 5. The questionnaire is valid (corrected item total-correlation = 0.5972) and reliable (cronbach alpha = 0.771). For the questionnaires are in the form of positive nuances, the expected tendency is going towards conformity of agree. This tendency leads to scale 4 and 5 as the preference choices. For the scale 4 is chosen by 47.46% of the population (a little less than 50%), scale 5 is 44.26% (a little less than 50%), and even though there are still chooses for the scale 3 (8%, less than 10%), the illustration of the measured behavior looks good.

Figure 2. The Performance of The Students' Environmental Awareness

The results of statistical calculations for the relationship between the two variables have shown that "correlation is significant at the 0.01 level (2-tailed)" and "correlation is significant at the 0.05 level (2-tailed)" (detail of the calculations is in the separate file). Those statements have shown that both variables have positive correlations to each other.

Discussion

For the first questionnaire is in the form of positive nuances, so the expected responses are in the scale of 4 and 5. As we can see an illustration about the results that the tendencies of the students for understanding of local content education are good (mostly in the scale 4 and a little less than it is for the scale 5, and followed by scale 3). Referring to theories of CTL in Pratama & Sumardi, strengthen with theories in Kaltsum & Habiby, looks like the local content education has run good. It looks like the students have already had quite good cultural identity that helps building

their self-concepts, just like Nauly & Fransisca (2015) have said. Referring to Valsiner in Santamaria (2019), the values from Simalungun Bawah culture are still in the personalities of the students, for the culture of Simalungun Bawah still has a lot of influence on their psychological development. This is also in line with theories in Afandi & Kharisma (2024) and Lestari et al (2024) about taking actions for the sustainability of the local wisdom through the next generations although there are still obstacles and challenges in the Generation Z in the digital era as Abas (2022) said in his research. These findings have proven that the education of local content has run quite effectively to the students.

As well as the first questionnaire (for understanding the local content education), the result for the second questionnaire is also good (mostly in the scale 4 and a little more in the scale 5 than scale 3). Whilst the second questionnaire is about the natural conservation awareness, referring to Sudiasmo & Muspita (2020) that physical environment is a part of local wisdom, the natural conservation awareness of the students highly probably also formed while increasing the level of understanding and internalizing the values of Simalungun Bawah culture through the local content education. In other words, the cultural learning (from local content education) which contains many touches of the surrounding nature, the learning about the importance of preserving nature is most likely included in it.

As Generation Z is the successor of Generation X and/or Y (mostly the parents of them), we assume that the process of psychology of learning process (Learning to Learning Strategy) has run quiet effectively. Whilst the Generation X and Y are not as high as their parents (Baby Boomers) in internalizing values of native tradition ability, but they still can learn together in internalizing values of the native tradition to be the indigenous society of local culture using the Learning-to-Learning Strategy process.

Referring the theories of cultural psychology in Santamaria et al (2019) about values of particular culture in people's memories and minds, the values of native traditions can still be instilled in people's memories and minds using a particular way of education that use the Learning-to-Learning Strategy process.

Conclusion

From several particular values of Simalungun Bawah culture, the students can also improve their other values, in this case, the value of natural conservation awareness. The illustration of this research has strengthened the statement of Habiba & Wulandari (2024) in their research. A group of people (in this research, high school students), if given a good understanding of a tradition, will be able to practice the values contained within it well. A tradition that is usually known for only one good value, if studied further, could discover several other very good values.

Recommendations

Pane et al (2024) have said in their research that it is very important to increase the quantity and quality of the character education quantitatively and qualitatively, as early as possible. Referring to Rad (2012) & Weinstein et al (2018) in Pane et al (2024), as long as students can acquire knowledge, the learning process can occur. This is in line with the

Learning-to-Learning Strategy process. So the local content education that Kurikulum Merdeka has implemented must be continued.

The traditional school foundation by the Sihaporas indigenous community which originates from the Batak Simalungun tradition is a good example of educating native traditions to young generation. For maintaining and preserving our own inherited culture have become more important nowadays. This kind of traditional school shall be maintained to preserve the richness of our traditional cultures.

The social media usage to attract the youth generations, especially Generation Z and Alpha, as well as the next generation can be tried. Generation Z and Alpha can learn more about knowledge for digital matters to produce materials of local wisdom to be socialized in social media.

If the learning education activities as mentioned above is implemented quite effectively, many good values can be learned and internalized together

Acknowledgements

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Appendix

Our research data can be found at the following link:

https://docs.google.com/forms/d/e/1FAIpQLSeoBrIf280OGHx8w9j4xXQZMyiV4F7XYBei2nUIPzFDmaASg/view
form?usp=sharing&ouid=106993880888497321751

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   • **Duties:**

   - Formulating the research problem and objectives.

   - Developing the theoretical framework and literature review.

   - Determining the quantitative method to be used in the study, including questionnaire design.

   - Overseeing data collection from Bina Nusantara University student respondents.

   - Creating tables, charts, and data visualizations based on SPSS results.

   - Writing the introduction, literature review, methodology, and main discussion sections.

   - Coordinating with other team members to ensure the smooth progress of the research process.

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   - Systematically compiling and summarizing the questionnaire results.

   - Entering data into IBM SPSS for analysis.

   - Assisting in data processing by running the required statistical tests.

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   Managing formatting and publication in accordance with the standards required by journals or academic institutions.

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Navigational Strategies employed by University Students in a Learning Management System (LMS)

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Abstract: The digital environment in higher institutions presents unique challenges that require students to develop digital literacy to cope with online demands. Therefore, the ability to read effectively online is important in enhancing reading performance among students. This study explored navigational strategies employed by university students in a learning management system (LMS). A mixed method approach of collecting data was conducted within a 14-week semester. Data were collected through an online survey on the perceived used of navigational strategies among 73 students. Out of which, 8 students were purposively selected to be a part of qualitative data collection on navigational strategies. This was conducted through individual screen recordings that captured students' on-screen activities while navigating online reading materials. Descriptive and content analysis were performed through SPSS and NVivo software, respectively. Cohen Kappa analysis revealed an almost perfect score, indicating the findings were reliable. The screen recordings revealed that students used mixed overview strategies the most, followed by serial overview and serial navigational strategies when navigating online. The findings concluded the need to teach students online reading strategies such as navigational strategies and metacognitive awareness to make learning more efficient and structured. The implications outlined in this study suggest future research to refine how these strategies can be effectively assessed among different groups of students with different educational backgrounds and contexts.

Keywords: Navigational Strategies, Learning Management System, University Students, Science and Technology

Introduction

Students in institutes of higher learning are required to read massive amounts of online materials, spend long hours on the internet and complete online tasks on a regular basis. This leads to the need to listen, read, and comprehend online materials that are relevant to their field of study. When students browse the internet for knowledge, a lot of reading and listening takes place. These movement through pages of hypertext in an online environment is described

as navigation (Lawless & Schrader, 2008). Navigation allows the reader to select and sequence pages to create their own understanding by assessing online materials. If readers are unable to navigate appropriately through online environments they may fail to locate relevant information (Hahnel et al., 2016). This will lead to incomplete knowledge. Therefore, effective navigation is an important predictor of online reading comprehension and knowledge acquisition.

When reading on the internet, learners sometimes utilize cognitive and metacognitive reading strategies. However, another type of reading strategy that should become a part of reading are navigational strategies (Maslawati, 2011; Ruhil Amal et al., 2017). Navigational strategies refer to the act of scrolling up and down web pages, clicking hyperlinks, moving between pages or links, moving the cursor in a linear or non-linear manner, reloading and highlighting texts (Dail, 2004). Successful online reading and learning goals are closely related to navigational strategies and behavior (Naumann 2015; Salmerón & García 2011). When students are reading for comprehension, it is essential that they have efficient navigational strategies to handle the vast amount of information so that they can construct a logical connection of the information being read without being distracted and become lost in cyberspace (Salmerón et al., 2018).

Literature Review

Studies on navigational strategies usually identify navigation indicators. Navigation indicators are usually obtained from log-files that record student's interaction with online platforms where they measure navigational activity such as frequency of task-relevant page visits. Task-relevant pages refer to: 1) pages consisting of information for task completion set by the author, and 2) pages that require to be passed through to access needed information. Hence, task relevant navigation includes the act of choosing task-relevant pages. Two indicators are often used to represent task-relevant navigation: 1) total page visits, and 2) total pages visited uniquely. The first indicator counts the total page visits and revisits of the relevant pages while the second indicator counts the number of visit once. This represents the extensiveness of the reader's selection of the relevant page. Although empirical studies have shown the positive outcomes of task-relevant navigation, the current study wishes to add to literature on task-relevant navigation based on navigational strategies coined by Protopsaltis (2008).

According to Protopsaltis (2008), navigational strategies also known as hypertext strategies, consist of serial, serial overview, mixed strategy and mixed overview strategies. These four strategies differ in the way readers navigate within an online environment. Serial strategies are used by readers who read in a linear manner from top to bottom according to the presentation order. These readers select links as soon as they see them. Similarly, serial overview strategies use the same principle for reading in a linear manner but different scanning processes. Readers scan documents either before or during the reading process and the reader chooses which document to proceed with in a serial manner. Another strategy is the mixed strategy, where reading involves either reading in a random order and/or in sequence, making it 'mixed'. While mixed overview strategies reflect readers who scan online text before or during reading but who read in either an arbitrary or linear order. Protopsaltis (2008), found that students used mixed overview strategies the most when navigating online. Although the study also looked at the influence of hyperlink selection, it found three factors that influenced navigation strategies: 1) coherence, 2) personal interest, and 3) link

position. When reading online, the study concluded that students relied on familiar strategies used in reading traditional materials because students do not have the relevant schemata. Thus, they relied on existing schemata and reading processes such as scanning texts.

Similarly, Ruhil Amal et al. (2017), found that students relied on existing schemata to 'scan' online text, before and during online reading, which is similar to the reading strategies used with traditional materials. The study examined the navigational strategies used by S & T students based on the navigational strategies proposed by Protopsaltis (2008) and found that students used mixed overview navigational strategies the most, where they read in both linear and random fashion. Students transferred traditional reading strategies, such as reading in a linear manner, but they were not entirely dependent on them. In addition, Ruhil Amal et al. (2017) hypothesized that Connectivism was found in her study because students were able to construct knowledge across networked learning communities and technologies. They were able to make connections between concepts, ideas, and knowledge when they were navigating through an online reading platform. Collectively, these studies outlined the critical need for students to utilize both reading and online reading strategies to navigate successfully in an online environment.

Methodology

This study employed a mixed method approach of data collection that consist of narrative analysis and survey. The researcher used random sampling for the data collection method. A total of 73 students randomly joined the survey, which had been posted using Google Form for one week. Of the respondents enrolled in science and technology programs at the university, 37% were Year 1 students, 51% were Year 2 students, and the rest were Year 3 and 4 students.

Data Collection

Screen recordings were captured to evaluate and analyze navigational patterns or strategies used by students while completing online tasks. This was recorded using an online screen recording software named Webinaria. Webinaria was downloaded on each of the 8 students' computers prior to the class activity. Analysis of the 8 students' screen recordings revealed ways in which students used these online tools and the processes they deployed to complete the assigned tasks. Codes were applied to the screen recordings based on Protopsaltis (2008) navigational reading strategies analysis. They were categorized according to serial strategy, serial overview strategy, mixed strategy, and mixed overview strategy.

On average, each recording lasted 38 minutes based during a 50-minute lesson from the second lab hour. Hence, a total of 8 screen recordings were viewed, analyzed, and discussed. Analysis on navigational strategies is discussed twice. For the first analysis, the lesson was for Week 6: Process Explanations: Directional Process. This consists of a narrative analysis of Page 1 on Reading Comprehension: strategies and skills. The analysis for this was divided into Page 1 (a) and (b) and Page 2 & 3 because the students were required to complete two tasks. The purpose of describing the analysis in this manner was to avoid confusion. Table 1is a narrative analysis on navigational strategies recorded from activity Page 1 (a) & (b) in iREAD according to strategy patterns coined by Protopsaltis (2008).

Findings and Discussion

Navigational Patterns

In a study that used screen-capture software, the researcher examined students' online searching behavior and found that students used their Web experiences and searching outcomes to search for scientific information (Tu et al., 2008). Students who were advanced and constructivist-oriented had better outcomes with open-ended tasks. Although the main objective of the study was to look at the correlation between epistemological beliefs, web experiences, web searching strategies and searching outcomes, the study used Camtasia Recorder to record information-searching process that students instigated using Yahoo! The on screen activities observed were web searching strategies used by students through 5 indicators modified from a different study (Tu et al., 2008). However, the aim for the current study was to record the navigational strategies and/ patterns of students while navigating in iREAD.

Table 1. Navigational patterns for Page 1 by student H and T

Std	Page 1 (a)	Strategy type	Page 1 (b)	Strategy type
H	Based on the first screen recording, Student H **read instructions at the beginning** of the main page. Movement of the cursor on the key points indicated that he read the instructions carefully before starting off with the activities. On page 1, he **read in accordance to the layout** and completed the task without jumping to another web page or/ nodes. He was seen as a careful reader that **read in sequence** and confident in highlighting the points. He used *serial strategy* at the beginning of his online task.	Serial (read according to layout; in sequence)	However, as he was going to comment in the **discussion page**, he jumped back up to the previous notes to formulate ideas. This does not imply that he used a 'mixed' way of reading because he is merely **making a reference to the previous notes**. He only returns to previous notes for ideas to include in the discussion page. Hence, he was still considered as using *serial* strategy here.	Serial (read in linear manner)
T	He began his first task by reading the instructions and then moved on to begin his highlighting task. All his highlighted points were done in *serial manner*. **He did not check his work nor did he scan the page**	Serial (read in serial manner)	In order to complete the **discussion page** activity, Student T consistently referred to the previous notes on reading comprehension strategies and skills in order for him to get ideas. Although he typed his comments in the discussion page numerous times, **he did not post his comment but instead jumped onto page 2** and started to read diligently as his cursor was seen to go through the text line by line.	Serial (read notes in order)

Based on Table 1, Student H started reading in sequence while doing activity (a). He did not jump to other web pages as he completed both task (a) & (b) in sequential order. Throughout Page 1 activity, Student H used serial strategy in reading online materials. Similarly, Student T was reading in a serial manner as he immediately completed the task after reading the instructions. He did not check his work, nor did he scan the page, making his navigational pattern a serial strategy in completing both task (a) and (b). Hence, only Student H and T used *serial* strategy in navigating online within Page 1 activity. Table 2 illustrates navigational patterns of Student G and J.

Table 2. Navigational patterns for Page 1 by student G and J

Std	Page 1 (a)	Strategy type	Page 1 (b)	Strategy type
G	At the **beginning** of the screen recordings, Student G seemed to be reading instructions and completing highlighting task in **a linear manner without scanning** the page. He only **reread the instructions after highlighting** the 11th point. As the cursor moved on to the reading comprehension skills, he scrolled to read the instructions, scrolled back down to continue reading and completed the assigned task. This pattern was seen halfway through the first activity, showing that he used serial strategy to navigate online. However, he then changed his strategy and was seen to be s**creening the other points, changing his mind** about the work by **rereading** the instructions. This form of *mixed overview strategy* depicted that he **often at times rechecked his work** for accuracy both at random and in order. Moreover, he seemed unsure because he was seen to return to the first key stage (finding main idea) and re highlighted his work. He then completed his highlighting task by **reading back and forth in order to understand text.** However, he did not go to other links/ websites for support.	Mixed overview (scanned the text later on and reread texts)	Before he began his **next task** which is posting a comment in the discussion page, he scrolled down the page to **read others' postings**. This is considered as an act of **scanning the text** before doing the activity. After reading the instructions he then started typing fluidly about the differences between reading strategies and reading skills. There was a constant act of **rechecking his sentences**, editing and retyping it. He was found to scroll up to previous notes on reading comprehension strategies and skills for reference and made use of support for spelling corrections. This indicated that he used *mixed overview strategy* in navigating online.	Mixed overview (scanned at the beginning and rechecked sentences)
0++ +++ +	Student J started the activity by **scanning the page and reading the instructions**. Just after highlighting the first point, he referred back to the reading instructions and then only continued highlighting the points, reading in a serial manner. Due to some technical glitches, he had to open a new tab but fortunately for him, all the highlighted points were still there so he continued to highlight the 10th point onwards. He changed his pattern when he briefly read the instructions again and continued highlighting. This is considered as *mixed overview strategy* because he **read in both serial and random manner and scanned the text during reading**. The page was hanged for about five times and made it difficult for him to stay on his page. He had to login again several times but was able to resume where he left off. Although he had to **refresh his page up until five times**, he managed to complete the task on reading comprehension strategies. However, he did not do reading	Mixed overview (scanned and reread instructions)	He then moved onto the next activity on **page discussion**. He read the main instructions again but faced similar problem (had to login several times) and had to open a new tab and started to **skim the points in reading comprehension strategies**. He typed, **paused and retyped several times**. At the same time, he scrolled down to view others postings maybe to get some general idea and continued to complete his posting. Upon completing this, he published his posting. For this part of the task he was still using *mixed overview* navigational strategy.	Mixed overview (Scan the points and retypes several times)

comprehension skills task probably because he lacked understanding of the required task (to highlight and annotate).

For Student G, in both activity Page 1 (a) & (b) he scanned the activity and read instructions. Although Student G started off reading in a linear manner, he continuously reread the online materials in both linear and random order. This was considered as mixed overview navigational strategy. Similarly, Student J showed the same navigational pattern as Student G because at numerous times he referred to the instructions and scanned the activities. This too was considered as mixed overview navigational strategy. Thus, only Student G and Student J were using *mixed overview* navigational strategies in completing Page 1 (a) and (b). Table 3 illustrates navigational patterns by Student K and L.

Table 3. Navigational patterns for Page 1 by student K and L

Std	Page 1 (a)	Strategy type	Page 1 (b)	Strategy type
K	Student K began reading the **first activity** systematically, reading from top to bottom as the screen recording revealed that he read line by line and **took time to read instructions** first before starting the highlighting activity. He completed the highlighting task using *serial strategy* in an online environment but only **rereads instructions** to make sure of the required task at hand. Upon completing reading comprehension strategies and skills activity, he scrolled the page up to only double check his work.	Serial (read systematically)	As he moved on to the next activity on the **discussion page**, he read the instructions, **scrolled up and down the previous activities for reference** and started typing his opinion. However, **paused and read other people's postings** and then resumed typing his opinions. He completed this task using *mixed overview* strategy as he **read in both random and serial manner in order to post a comment** on the discussion page.	Mixed overview (consistently scrolled up and down)
L	At the **beginning** of the screen recording, Student L read the instructions on the main page very quickly and immediately started to highlight the first point until the 11th point. He then **skimmed the points he highlighted** quickly and started reading comprehension skills. Here, he was seen to be **reading very carefully as the cursor moved from line to line. He read each point but always referred back to the reading instructions**. Throughout this activity, Student L used *serial strategy* when he was completing his task, taking the time to read from line to line and completed the highlighted activity.	Serial (read from beginning until the end and from line to line	He moved on with the **page discussion** activity but referred back to the previous notes for ideas. He consistently referred to notes to add his ideas and made amendments. This is considered as *mixed overview* navigational strategy as he read in both serial and random order while scanning the page.	Mixed overview (read in both serial and random order)

For Student K and L, they completed activity 1 (a) in a serial manner. For instance, Student L read the instructions and completed the activity according to the layout of the activity. He read from line to line showing a consistency reading in a linear way. Student K did the same, navigating in a serial manner by reading line by line and reading the activity carefully. However, both Student K and L changed their navigational pattern as they were completing task

(b). In task (b), they were using mixed overview navigational strategy because they were seen to read in both serial and random order. They also scanned the online materials to get an overview of the task. Hence, they were using *serial strategy* for task (a) and *mixed overview strategy* for task (b). Table 4 depicts navigational patterns by Student E and A.

Table 4. Navigational patterns for Page 1 by student E and A

Std	Page 1 (a)	Strategy type	Page 1 (b)	Strategy type
E	Based on the screen recordings, Student E was **previewing** the homepage to get an overview of the reading task. He took the time to read the main page and reading instruction as the cursor was seen to be moving line by line at the reading instructions. There was an act of **scrolling the page to see the length** of the reading task but completed the highlighting task in an **orderly manner**. As he moved on to **the next task**, which was to read and highlight reading comprehension skills, he was seen to highlight the first point but goes back to refer to the instruction. He then highlighted the second point until the fourth point to only change his navigational pattern again **where he went back to point** 3 (finding supporting details) to **reread the point** for reference. This pattern was considered as reading in **a random order**. However, he continued to highlight points 5 – 10 in a serial manner, where each time he highlighted a point, he would refer to the previous points that was highlighted to **recheck** the points. It can be concluded that he used *mixed overview strategy* for this activity	Mixed overview (previewed and scrolled the page)	For the **discussion page** task, Student E **reread the points he highlighted previously** trying to find ideas or clues on how to complete the task. After numerous times **typing, pausing and rereading** the points in a random order, he managed to complete and submit his comment. **Then only he started to read others postings**. This showed that student E did not refer to others postings in order to write his own ideas. Although he did not scan the text but he was consistently reading in serial and random manner. This is considered as mixed strategy.	Mixed (reread without scanning)
A	Student A scanned the page and read the instructions for both reading comprehension strategies and skills. She **read in a detailed manner** for the first **part of the task and** skimmed up and down each point. Although there were few technical glitches, where she had to refresh the page a few times, she however highlighted the points in a serial manner. Her constant act of **checking** her work and **rereading** the instructions depicted that she read in both serial and random manner and was considered to be using *mixed overview* navigational strategy as she also **scanned the document** at the beginning of the activity.	Mixed overview (scanned read in linear at first before reading in random manner)	She skipped the reading comprehension skills activity and moved on to **discussion page activity**. In discussion page, she **scrolled up to cite ideas in order to post comments**. As she typed her ideas, she was also checking and amending them. This strategy is considered as *mixed strategy*	Mixed (continuously referred to previous texts)

Another navigational strategy that was identified was a combination of mixed overview strategy and mixed strategy. The difference between these two strategies is the fact that mixed overview strategy involves the act of scanning the text before reading. Based on the screen recordings, Student E previewed the online text to get an overview of the

reading task. Student E referred to the instructions occasionally and reread his points. This pattern was considered as reading in a random manner. The same pattern appeared for Student A, who read instructions at the beginning and scanned the reading task. She skimmed the text by scanning up and down each point. As both Student E and A progressed on to Page 1 (b), both the students were using mixed strategy. Both Student E and A did not scan the text but read in random order making this a mixed strategy. Thus, there was an equal use of mixed overview and mixed navigational patterns among the two students.

Based on the screen recording analyses, there seems to be great use of mixed overview navigational strategy where students were "scanning the page during reading" "reading in random and in order" and "previewing the page". At the same time, there was a also a great use of serial strategy when students "read in a detailed manner", "read from line to line" and "read in sequence". However, in total, majority of the navigational strategy was mixed overview. Table 4.10 summarizes the navigational patterns made by students on Page 1 (a) and (b).

Table 5. Summary of navigational patterns on Page 1 (a) & (b)

Student	Page 1 (a)	Page Page 1 (b)
H and T	Serial	Serial
G and J	Mixed Overview	Mixed Overview
K and L	Serial	Mixed overview
E and A	Mixed overview	Mixed

As illustrated in Table 5, there is a combination of navigational strategy patterns among the students. These familiar strategies consist of serial and mixed overview strategies. This implies that students read in a manner familiar to them even in an online environment.

Navigational patterns were also observed for Page 2 (At the factory: From bean to bar) and Page 3 (Reading comprehension: GPS) activities in iREAD. Narrative analysis on the navigational strategies is described in Table 6.

Table 6. Navigational patterns for Page 2 & 3 by student E, L and J

Std	Page 2	Strategy type	Page 3	Strategy type
E	As he moved on to **page 2**, **he scanned the passage and scrolled back up** to read the instructions. He **then increased the font size** of the article. This is interesting to note as he may found difficulties in reading online material of a smaller font. For this activity, he was able to highlight and annotate in a serial manner for all the key stages in making chocolate. However, he was considered to be using *mixed overview strategy* as he was consistently perusing through his work **to check his annotations and made corrections multiple times**.	Mixed overview (reread instructions, scanning)	On **page 3**, Student E was **previewing the text** by scrolling up and down the page to only end the screen recording session. Hence, Student E was dominated by the use of *mixed overview strategy*.	Mixed overview (previewed the text)
L	As he moved on to **page 2**, he **read the instructions line by line** and then started to highlight the first point and annotated the idea. This pattern of	Mixed overview (reread and reading in	On Page 3, Student L **scanned the text** and the questions. He then read the instructions. This showed that the student did not	Mixed overview (scanned and reread)

highlighting and annotating simultaneously was seen throughout this part of the activity in a linear manner. However, he suddenly changed his pattern by going back to point 11 and editing the annotation he made. After the 12th point he decided to scan the paragraph and continue reading. In addition, after the 16th point and annotation made, he rechecked his entire work and made corrections to the previous annotations he made. This proved that Student L used *mixed overview strategy* while navigating online Although he completed the required task, he did not manage to complete page 3. *Mixed overview strategy* appeared to dominate his navigational patterns.	random manner)	have a prior idea on what he was supposed to do. He then moved on to complete the activity but always referring to the reading text in order to answer the questions. This is considered as reading in random order.	
J	On to **page 2**, he skimmed the entire page and then started reading. After highlighting the main objective of the activity, he then speed read the passage. Then only he started to read in a linear way highlighting the key stages of making chocolates. He then **read in a random way** when he returned to some of the previous highlighted points, changed the highlighter color and continued reading. He failed to annotate the key stages of making chocolates probably because he could not stay focused due to the technical glitches. In addition, he did not attempt page 3 either. Throughout the screen recordings, he used *mixed overview* navigational strategies the most.	Mixed Overview (scan and read in random)	Did not complete task	

Based on the screen recordings, Student E, L and J used mixed overview strategy when navigating through the activity on Page 2. For example, Student E scrolled up and down to view the passage and took time to increase the size of the webpage. For Student L, he was consistently checking his work and made changes numerous times. This was one major indication that he used mixed overview strategy when reading online materials. Student J on the other hand read in a serial manner at the beginning but then continued reading in a random order. For example, Student J kept returning to previous highlighted points and changing the sentence. Table 7 demonstrates navigational patterns by Student H and K.

Table 7. Navigational patterns for Page 2 & 3 by student H and K

Std	Page 2	Strategy type	Page 3	Strategy type
H	On **page 2** however, he was seen to **read the instructions and quickly scanned the length** of the reading passage. This implied that he used *serial overview strategy*. He is	Serial overview (scan & read sequentially)	However, on **page 3**, Student H clicked on to the page and quickly scanned the length of the text **to only jump back to page 2** to add comments to all the previous	Mixed overview (Scan, rechecked work

Std	Page 2	Strategy type	Page 3	Strategy type
	considered as a serious reader because he completed the tasks required sequentially		highlighted key stages. This then indicated he used a *mixed overview strategy* towards the end of his work. Overall, he was careful to not make mistakes, rechecked his work, was confident in highlighting the points and elaborated the comment part.	multiple times)
K	As he moved on to **page 2,** he **read the instructions and scanned** the entire passage before he started with the first task. This also showed that he used *serial overview* strategy because he **scanned the text but read in a serial manner**. He only changed his pattern of navigating online initially after highlighting the first key stage, where he intended to annotate the first key stage as the cursor remained idle at the comment box for nearly two minutes but he did not post a comment	Serial Overview (scan the text before reading it sequentially)	On Page 3, Student K **scrolled the entire page** to get an overview of the text. He did not read the instructions but straight away started to read and highlight parts of the reading text. He completed reading the text in a serial manner. However, as he started to answer the reading comprehension questions he started to **read in a random order, highlighting the reading text and scrolling down** to answer the questions.	Mixed overview (scan the text and read in random order)

Student H and K used serial overview navigational strategy. For example, student K scanned the text and then read in a serial manner. Similarly, Student H quickly scanned the length of the text and then completed the tasks sequentially. Hence, both students used serial overview navigational strategies in reading EST online materials. Table 4.13 describes navigational patterns by Student A, G and T.

Table 8. Navigational patterns for Page 2 & 3 by student A, G and T

Std	Page 2	Strategy type	Page 3	Strategy type
A	At the beginning of **page 2**, she was reading in a serial manner and highlighted the points as she was reading. However, as she was facing some technical glitches, she had to highlight some of the points several times. There were also instances where she **went back to change the color of the points she highlighted earlier on.** This showed that she read in **random order and because they were no scanning involved** while reading, she is considered to be using *mixed* strategy	Mixed (read in random order without scanning)	She then moved on to **page 3** and scanned the page for an **overview of the reading task.** The cursor showed that she was **skimming** the text from line to line. She started to answer the reading comprehension questions in a serial manner but then jumps back to read the passage to answer question 4. However, she then clicked back to page 1 without completing page 3. The manner in which she answered is very rushed and is not diligent in answering her questions. She does not check her work and sped read. The strategy she used here is considered as *mixed overview strategy*.	Mixed overview (scan and read quickly)
G	As he moved on to **page 2**, he read instructions and immediately highlighted the passage, reading in a linear manner. This was seen throughout the last part of the activity although he **referred to the instructions again** before beginning to comment on the first stage (first	Mixed (mixture or reading sequentially and randomly)	As Student G attempted **Page 3**, he **scanned the text** first before reading it but failed to answer the reading comprehension.	Mixed overview (scan)

	critical step). He attempted to paraphrase all the highlighted key stages in his own words while making amendments along the way. At numerous times he went to check on his work for this activity and made amendments where needed. This is considered as using *mixed* strategy because reading then occurred randomly although at the beginning reading was in a serial manner.			
T	He managed to highlight the main processes involved in making chocolates in a *serial manner* **not jumping onto other hyperlinks** at all. However, he only annotated one key stage that was highlighted and failed to complete the task.	Serial (read in linear manner)	Although throughout activity 1 & 2 Student T read in a serial manner, he changed his pattern when he moved onto Page 3. He **consistently referred to the reading passage and scrolled down the page** to complete the reading comprehension questions. This is because the activity consistently required the need to refer to the reading text to complete the task.	Mixed overview (consistently read in random)

For student A and G, they used mixed navigational strategy when navigating online. This showed that they did not scan the page to get a general idea of what the text was about. However, throughout Page 2, they both read in random order. Only Student T was using serial strategy as he read in a serial manner. He read all the activities in a serial manner not jumping to other hyperlinks. However, he was the only student that did not do the activity on Page 3.

Further analysis revealed that all the students used mixed overview navigational strategy in completing the reading comprehension task on Page 3. In general, it is safe to say that Page 3 required the students to scan the page, scroll up and down the web page to obtain answers for the questions. Students needed to refer to the passage, consistently making this mixed overview navigational strategies. Table 9 is a summary of the navigational patterns on Page 2 and 3.

Table 9. Summary of navigational patterns on Page 2 & 3

Student	Page 2	Page 3
E, L and J	Mixed overview	Mixed overview
H and K	Serial overview	Mixed overview
A and G	Mixed	Mixed Overview
T	Serial	Mixed overview

When readers are able to avoid distractions and become lost in cyberspace, they are able to read efficiently because they construct a coherent representation of an issue. Based on the screen recordings Student H and K used serial overview strategy when navigating online, while Student E, L and J were using mixed overview strategy. For Student A and G, they used mixed navigational strategy when navigating online. This showed that they did not scan the page to get a general idea of what the text is about.

Overall, majority of the students used of mixed overview navigational strategies. This is an indication that in online environments, majority of the students read in the same manner when reading traditional texts. This consist of using

reading strategies such as: 1) scanning that included reading in both linear and random order (mixed overview), and 2) reading in a linear manner that included scanning (serial overview). This has proven that even in a controlled environment, where text selection was based on readability index and of domain-specific texts (i.e S & T), students were still reading in both linear and random order.

For the second part of the analysis, the output was obtained from a survey containing 20 questions that were posted and answered by 73 students. The survey is on the navigational strategies employed by students in a Learning Management System (LMS). Navigational strategies on the web encompass actions such as scrolling through pages, clicking on hyperlinks, and moving the cursor in both linear and non-linear patterns. Linear navigation guides users through content in a specific sequence, while non-linear navigation allows users to explore content in a more flexible manner (Katuk and Zakaria, 2015). There are four types of navigational strategies: serial, serial overview, mixed, and mixed overview. The mean score is classified into five categories i.e. Very Low (1.00-1.50); Low (1.51-2.50); Moderate (2.51-3.50); High (3.51-4.50); Very High (4.51-5.00) (Domingo and Casanova, 2022). The mean score for each strategy is shown in the Table 10.

Table 10. Mean Score for Navigational Strategies

Indicators	Mean	Classification
Serial Strategy	4.10	High
Serial Overview Strategy	4.08	High
Mixed Strategy	4.00	High
Mixed Overview Strategy	4.09	High
Overall Mean	**4.07**	**High**

Scale: Very Low (1.00-1.50); Low (1.51-2.50); Moderate (2.51-3.50); High (3.51-4.50); Very High (4.51-5.00)

The findings for each strategy are deliberated below.

Serial Strategy

The serial strategy is a linear, sequential way to browsing and processing content. This indicates that the reader moves through the material in a methodical manner, usually beginning at the top of a webpage or document and working downward, reading, or scanning each portion in order. The score for serial strategy obtained by the respondents is presented in Table 11.

Table 11. Mean Score for Serial Strategy

Indicators	Mean	Classification
I read in a detailed way from the beginning up to the end.	4.08	High
I select the links carefully as soon as I see them.	4.25	High
I cross-reference information from lecture notes and information from the educational materials.	4.12	High
I read in a serial/linear way.	4.01	High
I survey each chapter by reading the introductory and concluding paragraphs, headings, subheadings, visual captions, review questions, etcetera.	4.04	High

Overall Mean	**4.10**	**High**

Scale: Very Low (1.00-1.50); Low (1.51-2.50); Moderate (2.51-3.50); High (3.51-4.50); Very High (4.51-5.00)

There are five indicators used in this strategy with an overall mean of 4.10. Among four strategies, this shows the highest mean which indicates that most of the students navigate in a linear manner. Most of the students carefully select links (mean of 4.25). This is followed students cross-referencing information (mean of 4.12), read in detailed (mean of 4.08), survey each chapter (mean of 4.04), and read in a serial or linear way (mean of 4.01). This finding suggests that students engaging in the serial or linear reading strategy exhibit a structured and deliberate approach to online reading. Their higher preference for carefully selecting links indicates an emphasis on relevance and focus (Mercer, 2019). The subsequent indicators reflect complementary behaviours such as cross-referencing, detailed reading, and systematic navigation through chapters. This strategy demonstrates a balanced combination of efficiency and thoroughness in their reading practices.

Serial Overview Strategy

The serial overview strategy in navigational strategies for reading online materials refers to a structured approach in which the reader scans or reviews the major sections or headings of a document or webpage sequentially to gain a broad understanding of the content before delving deeper into specific sections. The score for this strategy obtained by the respondents is presented in Table 12.

Table 12. Mean Score for Serial Overview Strategy

Indicators	Mean	Classification
I can get it first before or during reading.	3.79	High
I try to guess the content of the online text by clicking hyperlinks.	3.70	High
I scan the online text to get a basic idea of whether it will serve my purposes.	4.16	High
I adjust my reading speed according to what information I look for online.	4.33	High
I read back and forth to get the information I need online.	4.41	High
Overall Mean	**4.08**	**High**

There are five indicators used in this strategy with an overall mean of 4.08. Most of the students read back and forth to get information when they read online (mean of 4.41). They also adjust their reading speed (mean of 4.33), scan text to get basic ideas (mean of 4.16), get first before or during reading (mean of 3.79), and guessing content by using hyperlinks (mean of 3.70). This finding shows systematic scanning through a text to grasp its structure and main ideas before engaging in detailed reading. Reading strategies will increase reading rate, hence it enhances comprehension and efficiency, potentially saving time during the reading process (Rahimi and Babaei, 2021).

Mixed Strategy

The mixed strategy in navigational strategies for reading online resources refers to a versatile approach that mixes several navigations and reading tactics based on the reader's objectives, content kind, and structure. This strategy enables the reader to adapt dynamically, choosing between serial (linear) and non-linear (selective) methods to

efficiently process information. The score for this strategy obtained by the respondents is presented in Table 13.

Table 13. Mean Score for Mixed Strategy

Indicators	Mean	Classification
I read randomly and /or sequentially.	3.93	High
I read slowly and carefully to ensure I understand the information I read online.	4.16	High
I read different topics related to the subject by clicking the tabs on the computer.	4.16	High
I read slowly and carefully to understand what I read online.	4.18	High
I mark parts of a video (i. e make a note of a specific point in the video timeline so you can add a note to it or easily find that point in the video later).	3.58	High
Overall Mean	**4.00**	**High**

Scale: Very Low (1.00-1.50); Low (1.51-2.50); Moderate (2.51-3.50); High (3.51-4.50); Very High (4.51-5.00)

There are five indicators used in this strategy with an overall mean of 4.00. Most of the students read slowly and carefully to understand what they read online (mean of 4.18). Then, two indicators show that the students read slowly and carefully to ensure they understand the information, and read different topics related to the subject (mean of 4.16). They also read randomly and/or sequentially (mean of 3.93), and mark parts of video to ease them to revisit (mean of 3.58). Careful reading passages or materials promotes better comprehension of online material and improve understanding among readers (Manurung et al., 2024).

Mixed Overview Strategy

The mixed overview strategy in the navigational strategies of reading online content is a versatile approach in which the reader blends overview techniques (such as skimming or scanning) with selective, in-depth inquiry. This method allows the reader to first obtain a general comprehension of the content's structure and core ideas, before delving deeper into specific portions of interest or importance. The score for this strategy obtained by the respondents is presented in Table 14.

Table 14. Mean for Mixed Overview Strategy

Indicators	Mean	Classification
I read and scan the text in both linear and random order.	3.88	High
I go back and forth in the outline text to find relationships and then read the text carefully to find the relationships of the ideas presented.	4.18	High
I synthesize what I read or watched (i.e. combine information to see how it all fits together).	4.15	High
I cross-reference information from the lecture notes and assigned educational online materials.	4.15	High
When reading online, I look for different sites covering both sides of the topic.	4.10	High

Overall Mean	**4.09**	**High**

Scale: Very Low (1.00-1.50); Low (1.51-2.50); Moderate (2.51-3.50); High (3.51-4.50); Very High (4.51-5.00)

There are five indicators used in this strategy with an overall mean of 4.09. Most of the students go back and forth the outline (mean of 4.18). Then, two indicators show that the students synthesize the content, and do cross-reference between lecture notes and online materials (mean of 4.15). They also look for different sites (mean of 4.10), and read and scan text in both linear and random order (mean of 3.88). The findings in this strategy also significant with Domingo and Casanova (2022) where students choose to read back and forth in order to understand the materials they read. Re-reading difficult passages can also improve comprehension of online texts (Anderson, 2003)

Conclusion

The pedagogical implication derived from the current study is the need for learners to be equipped with a multitude of online reading strategies that included metacognitive knowledge for them to become proficient readers. These are important as it enables a person to decide the nature of the tasks and how to approach it. It also allows a person to prioritize tasks and use various strategies to achieve the desired goals.

Based on the findings, a few possible research suggestions are identified. Findings from the study provide a starting point for identifying approaches to reading online in an ESP blended course at tertiary level. However, more research is needed to extend knowledge in this field. For example, it might be more interesting to look deeper into different demographic profiles such as comparing reading strategies based on gender, achievement level, English proficiency level and age. This could lead to reducing academic gaps especially in the field of ESP.

Acknowledgements or Notes

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Advancing Good Citizenship in the Next Generation: The Role of Character Building-Civic Education at A Private University in Indonesia

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Abstract: Good citizens play crucial role in building a nation. Civics education is essential to develop the character of the nation's future generations. This qualitative study aims to explore students' perceptions of how Character Building-Civics (or generally known as Civics Education) in BINUS University prepares them to become good citizens. Data were collected through an open-ended qualitative survey. Participants in this study were students who took Character Building-Civics course. They reported that Character Building-Civics made them realize the significance of youth as agents of change in developing the country. According to the participants, some key topics in Character Building-Civics include social values and norms, the rights and obligations of citizens, national integration, digital literacy and citizenship, and active participation as global citizens. Students found that writing reflections at the end of each session helped them understand the topic being discussed, increase their awareness of social and global issues, recognize the importance of critical thinking and problem-solving skills, and identify positive actions they have already taken or need to begin to be good citizens. For example, addressing global issues, reducing plastic usage, and campaigning for waste reduction, especially plastic waste.

Keywords: Character, Citizens, Civic Education, Higher Education, Indonesia

Introduction

It is widely known that investment in education including in higher education is one of the significant factors that can influence civic engagement. Education for civic/citizenship has been incorporated into higher education as a means of cultivating "citizens who are socially responsible, respectful of others, and knowledgeable about the democratic government system". (Subcommittee 2011, 21 in Boontinand, 2021). Education should harmoniously promote the identity of a good person and a good citizen (Ayane & Mihiretie, 2024). According to Matthews (2006), education should, on the one hand, assist students in becoming more self-reliant, gaining the capacity to make their own well-informed judgments, and reflecting on their needs, wants, choices, and behaviors. However, education should also help students improve their ability to actively participate in community affairs and equip them with social roles, duties, and responsibilities (Pykett et al., 2010 & Westheimer & Kahne, 2004). Higher education promotes the upkeep and growth of a caring society, which boosts capital and enables us to understand citizenship consciousness and reap its benefits in every progressive society with the proper manner (Pring, 2016; Rehman & Naz, 2022). Saphiro and Brown

(2018) argue that effective civics education can provide students with the knowledge, skills, and disposition necessary to become informed and engaged citizens. "High quality civics education can impact civic behavior" (Saphiro & Brown, 2018, p. 11).

Several viewpoints have been used to theorize the ideas of citizenship and civic/citizenship education. Three main schools of citizenship—liberal, communitarian, and civic republican—with roots in various political traditions were distinguished by Beiner (1995). Individual rights, entitlements, and identities are the focus of liberal citizenship; collective cultural or ethnic identification is the focus of communitarian citizenship; and civic identity and participation in a political community are the focus of civic republican citizenship. Citizenship education encourages participation and the acquisition of skills in teamwork, critical thinking, deliberation, and decision-making. Three citizenship orientations—personally responsible, participative, and justice-oriented—that emerge from various democratic education initiatives in the US were also recognized by Westheimer and Kahne (2004).

Scholars argued that civic and citizenship education, as well as democracy and citizenship, are conceptualized and practiced differently in Asia than they are in the West. As Lee (2004) pointed out, in Asian countries, the idea of citizenship is founded on morality, the growth of the individual's individuality, and the interaction between the individual and the community.Dalton (2008) identifies four components of citizenship, which he defines as "a set of norms of what people think people should do as good citizens", autonomy (the freedom to form one's own opinions), public participation, acceptance of the rule of law and commitment to social orders, and our relationship to others. From the four components, he then categorizes them into two dimensions or types of good citizens: engaged (showing social and welfare concerns for others, participating in politics, voluntary organizations, and an associational life) and duty-based (fulfilling formal obligations, such as voting and serving in the military).

According to Villalobos, Morel, and Treviño (2016) any concept of good citizenship is made up of the interaction of two definitions. On the one hand, it entails a certain idea of membership, or community belonging. The notion of citizenship entails political, social, cultural, and legal components, as demonstrated by Stokke (2017), making it a contentious topic in and of itself. However, a philosophical stance on the expected behavior and beliefs of citizens (the "public good") is always included by the definition of good citizenship. Ayane and Mihiretie (2024) argue that a good citizen refers to an individual's obligations to society that develop as a result of socialization, including education.

According to a study on how citizenship education affects students' citizenship, citizenship education delivered through the school curriculum and pedagogy is more successful in fostering political attitudes than citizenship education delivered outside of the classroom or through extracurricular activities (Geboers et al., 2013). Whiteley (2014), citizenship education in England aided secondary school pupils in gaining political awareness, political participation, and efficacy.

Through the viewpoints of the students, this study seeks to investigate how BINUS University's Character Building-Civics course aids them in the development of good citizens. This research aims to respond to the following query: How do students in the Character Building-Civics course perceive the course's contribution to their growth as good

citizens?

Method

Research Context

Character Building-Civics Course

Character Building-Civics is one the mandatory Character-Building courses in BINUS University, Indonesia. The course aims to prepare students to become responsible citizens, develop their nationalism, and act as global citizens by developing social awareness, adaptability, and collaboration skills. The course integrates project-based learning and mini research on Sustainable Development Goals (SDG) issues.

Participants

The participants of this study were 16 students in the four classes of Character Building-Pancasila course in the Even semester of 2023-2024 academic year. The participants were selected through purposive sampling. This student sample represents male and female students.

Data collection

Online survey featuring open-ended questions was posted on the Learning Management System (LMS) to collect qualitative data and were subsequently examined using descriptive analysis techniques.

Data analysis

The collected responses were coded to identify commonalities and differences in students' perspectives regarding Character Building-Civics and how the course is beneficial for students' development into good citizens.

Results

The findings are presented below. When asked what they learned in Character Building-Civics course students reported that throughout the course they deepened their understanding of different dimensions of citizenship, democracy, human rights, and active involvement in community and national development.

Below is a student's response to the question.

> During the Character Building-Civics, I gained a lot of new knowledge that deepened my understanding of various aspects of citizenship. We learned about the important role of citizens and our rights and obligations. The focus of our discussions were topics such as democracy, human rights, and active participation in nation building. In addition, knowledge of the history and our constitution and law enforcement has also strengthened my understanding.

Another student reported this regarding what he learned in Character Building-Civics class:

> Through Character Building-Civics, I learned many concepts related to citizenship, starting from social norms and values, the State constitution, rights and obligations, democracy, nationalism, to global issues. In addition to learning the theories, through reflections, group presentations, and final projects, I also

learned to strengthen my soft skills, in terms of communication, critical thinking, time   management, and other soft skills.

The following is another student's response:

> During Character Building-Civics class, I gained a deep understanding of the importance of character in national and state life. The material presented was very rich, starting from an understanding of human behavior that is influenced by norms and values, to how we as citizens have great responsibilities through understanding our rights and obligations. In addition, digital literacy is the focus in facing the current technological era. This class also encourages a sense of pride in the identity as an Indonesian citizen and the importance of contributing in real ways, both in academic and non-academic fields. The integration of the Sustainable Development Goals (SDGs) and project-based learning opened my eyes into the global challenges that we must face together.

Another student stated this in her response:

> This course taught me that we should take pride in being Indonesian citizens, and that such pride must be followed by our contributions to society. The inclusion of the Sustainable Development Goals (SDGs), which were consistently emphasized in Character Building-Civics class also made me aware that there are major global issues that cannot be ignored. As the younger generation responsible for shaping the nation's future, we must also pay attention to these global challenges and take action to address them. No matter how small our steps may be, believe that every small step is necessary to create meaningful and lasting change.

When asked about how Character Building–Civics course contributes to shaping students into responsible citizens, most students reported that the course made them realize the important role of the younger generation in national development. The younger generation is the successor who carries on the legacy of the nation's founding fathers. Character Building-Civics has inspired the students to participate more actively in community and to help bring about constructive changes in the environment. For the younger generation to actively engage in community and nationhood, some students reported that it is critical that they comprehend local and global issues.

A student responded this to the question:

> Character Building-Civics class made me realize the important role of the younger generation in national development. The younger generation is the successor who has a great responsibility in continuing the struggle and progress of the country. With knowledge of history, law, politics, and a strong understanding of the values of democracy and human rights we can become agents of positive change. The energy, creativity, and enthusiasm of the younger generation can be directed to create innovations, and solutions to various national problems. This awareness motivates me to be more actively involved in social and community activities, and to contribute to creating positive changes in the surrounding environment. It is also important for the younger generation to understand local and global problems to actively participate in community and nationhood.

Another student stated this on his reflection:

Character Building-Civics has taught me a lot regarding the crucial role that citizens play in building and upholding national values. I gained a deeper understanding of various aspects of citizenship, including our rights and responsibilities as citizens of the nations and globally, and how we can contribute positively to society. And most importantly, the SDG, the goals in which, we, as the people, should fight for, change and prosper in accordance with goals that will help providing the good cause the world currently needs.

This Character Building-Civics class has truly opened my eyes to the importance of the role of our generation in nation-building. We were taught that as young people, we are not just successors but are also responsible to change parts of our nation and world that needs it. This class emphasized that every action and decision we make now will impact the future of our country.

A student reported this:

In Character Building: Civics class, I learned how a country functions effectively and what it takes to be a responsible citizen. Each session was designed to build students' understanding of civic duties and social roles. The course strengthened my sense of nationalism, patriotism, tolerance, and respect for others, while emphasizing the values of Pancasila to foster a harmonious and supportive society. Through final project (group work), I developed communication, collaboration, and critical thinking skills. I was also encouraged to be a responsible citizen, student, peer, and community and society member. The integration of the Sustainable Development Goals raised my awareness of global responsibilities, helping me grow as a global citizen.

When asked about which topics in Character Building-Civics they found important and interesting, students found Wawasan Nusantara as the National Outlook, national resilience, digital Literacy and digital Citizenships, values and social norms, the rights and obligations of citizens, and participating as global citizens as particularly important.

A student's choice of the most important and interesting topics are as follow:

For me, the most interesting and important topic to apply in daily life is 'Wawasan Nusantara' (Archipelagic Insight). It's not only theoretically important but also highly relevant in fostering awareness and pride in Indonesia's cultural, geographic, and ethnic diversity. This perspective encourages respect for differences, unity in diversity, and the importance of protecting national sovereignty. Applying it in everyday life strengthens my national identity and sense of belonging.

Another student's choice is national resilience:

For me, the most interesting and relevant topic is national resilience. Understanding this concept helps explain how a country can survive and grow amid internal and external challenges. It covers political, economic, social, cultural, and defence aspects. I learned how individuals can contribute by promoting unity, supporting economic independence, and strengthening national defence. Applying this in daily life means

helping maintain stability, security, and adapting to technological changes that may affect national integrity.

A student found participation as global citizens as particularly important.

> The most interesting topic for me was the last one, which was about participation as a global citizen. I became more open-minded about what is happening in various parts of the world. This topic has opened my eyes about the importance of a sense of humanity.

Another student reported digital literacy and citizenship as the most important and interesting topic.

> The most interesting topic for me is digital literacy and citizenship because it is the topic that is most relevant to today's society and is applied in everyday life.

For a student, the most important and interesting topic in Character Building-Civics course is social norms and values.

> The most important and interesting topic to apply in daily life for me is about values and norms. Understanding values and norms is not only important in the theory, but also in daily life practice, because values and norms are guidelines that help us interact with others and make ethical decisions. For example, the value of honesty teaches us to always be honest in every situation, while social norms such aspoliteness in speaking regulate how we communicate with others. Applying values and norms in daily life will certainly help shape my character to be even better.

In response to a question about the role of writing reflection at the end of every session, students reported that writing reflections offered a chance to link the theories into practice.

A student wrote this in her reflection:

> Writing reflection at the end of each session really helped me to better understand the topics discussed. By reflecting on what I had learned, I was able to evaluate my understanding and identify areas for improvement. This reflection also provided an opportunity to relate theory to practice, thinking about how the materials could be applied in everyday life. This made the learning process more meaningful and relevant, and helped me to continue to grow and learn from experience.

Another student stated this in her response to the question about reflection:

> Writing a reflection at the end of each lesson certainly helps me understand the topic being discussed. For example, after writing a self-reflection on Wawasan Nusantara (Indonesian National Outlook), I realized how important it is to understand Wawasan Nustantara, considering that Indonesia is located very strategic geographically.

Below is a student's answer as his response to the question about writing reflections:

> Writing reflections are very helpful in understanding the topics discussed. For example, after learning

about "Law Enforcement in Indonesia", I realized how important a fair and transparent legal system is to maintain stability and justice in a society.

Discussion

This study attempts to explore students' views on how Character Building-Civics facilitate students to develop into good citizens. The findings that show students' perceptions that the course they deepened their understanding of different dimensions of citizenship, democracy, human rights, and active involvement in community and national development are aligned with Lee (2004) who stated that the concept of citizenship in Asian nations is based on morality, the development of the individual's uniqueness, and the relationship between the individual and the community. The findings also resonate with the objectives of Civic Education as described by Coopmans, van der Veen and Daas (2024) that "Civic Education helps students develop a broad set of so-called citizenship competences, often referred to as knowledge, skills and attitudes related to democratic conduct, socially responsible behaviour and the ability to deal with differences and conflicts."

Character Building-Civic course in BINUS University equips students to become responsible citizens with a strong sense of nationalism and global awareness by fostering social consciousness, adaptability, and teamwork skills. Participating students reported that Character Building-Civics course has made them more aware of their rights and obligations as citizens, the significance of their role in the nation building and civic duties, and law enforcement. This aligns with the view of Ayane and Mihiretie (2024), Hu (2023), and Pykett et al. (2010) who describe the qualities of good citizen(s) as an individual or group adhering to civic duties, social responsibilities, roles, and obligations, and obeying the laws of a state they belong.

Participating students revealed that their comprehension of democratic and human rights principles, which are essential for them to become the agents of change, has improved as a result of taking Character Building-Civics course. This finding is in accordance with Braskamp (2011) who assert that higher education provides students with information, abilities, and skills they need to invest in their democratic future. Universities are frequently seen as vital community assets that can be used to further democratic ideals and fortify democratic procedures (Cook & Nation, 2016). More specifically, it is believed that the primary goal of the modern research university is to advance democracy (Harkavy, 2005).

This study reveals the importance of writing reflection for undergraduate students. Students who participated in this study reported that writing a reflection at the conclusion of each session significantly improved their understanding of the subjects covered. By considering how the materials might be used in daily life, reflections also offered a chance to connect theory into practice which increased the learning process. Through the development of transferable abilities like autonomy, metacognition, critical evaluation, and self-awareness, reflection can indirectly boost students' achievement. Higher education should support the use of reflection writing as a tool to help students become ready for life beyond college because of these advantages as well as the priceless insight it provides instructors into students' experiences (Boutet, Vandette, & Valiquette-Tessier, 2017).

Conclusion

Students perceive that Character Building-Civics course at BINUS University help them recognize their important role as citizens and prepare them to be good citizens and future leaders who contribute as the agents of change in the nation's development. Some key topics in Character Building-Civics include social values and norms, the rights and obligations of citizens, Wawasan Nusantara (our national outlook), national integration, digital literacy and citizenship, and active participation as global citizens. Writing reflections needs to become a practice in universities. By writing reflections at the end of each session, students can look back on what they have learned and identify areas where they still need reinforcement or improvement. Writing reflections is also believed to strengthen understanding of the subject that has just been discussed.

Recommendation

Since this study is based on qualitative method and data with a limited number of samples or participants, the findings of this study may not be generalizable to different contexts. Therefore, a study applying a quantitative method involving a large number of samples or participants is recommended. Furthermore, future studies should examine the role of higher education institutions in supporting democracy in Indonesia through Civics Education.

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Open Data Statement

All data generated and analyzed during this study are openly available in this repository: ICRES 2025.

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Faculty Awareness-Driven Database for Medical Simulation Training

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Abstract: Simulation-based education plays a vital role in medical training by providing a safe and controlled environment for developing clinical competencies. Despite substantial investments in simulation infrastructure, many institutions report underutilization of available resources due to limited faculty awareness and fragmented access to information. This study presents the development and implementation of a web-based database content manager aimed at addressing these barriers. Designed for use at the Medical University of Varna, the platform offers structured, searchable, and pedagogically relevant information about existing simulators, grouped into five main categories: high-fidelity simulators, complex task trainers, basic task trainers, software-based simulators, and standardized patients. Users can navigate the database using keyword searches or department-specific filters, facilitating rapid and targeted discovery of relevant tools. Each simulator entry includes descriptions, multimedia resources, and associated training scenarios. Additionally, the platform incorporates an administrative interface that tracks user interactions, offering exportable analytics data to inform resource planning and support strategies. Unlike commercial platforms focused on logistics and inventory management, this tool was developed specifically to assist educators in selecting appropriate simulation resources. By improving access to structured information, the system fosters more consistent and effective integration of simulation into curricula, ultimately enhancing the quality of medical education.

Keywords: Medical education, Simulation training, Web-based database, Faculty awareness, Simulation technology

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Introduction

Simulation-based education has become a cornerstone of modern medical training, offering a safe and structured environment where students can translate theoretical knowledge into practical skills (Salimova et al., 2023). Through this method, learners can rehearse clinical procedures, enhance decision-making, and improve team communication - without compromising patient safety (Elendu et al., 2024). Moreover, simulation supports the development of non-technical competencies such as leadership, situational awareness, and professional behavior, which are critical for clinical effectiveness.

In parallel with this pedagogical shift, simulation technologies have undergone rapid development, both in terms of technical sophistication and scope of application. The expansion of available resources, including high-fidelity mannequins, virtual platforms, and task trainers, has increased the complexity of managing simulation-based curricula. These technological advancements have expanded the potential for interdisciplinary training, enabling realistic collaboration between different healthcare specialties within simulated environments. Efficient integration into teaching requires not only physical access to simulators, but also systematic coordination of usage, maintenance, and alignment with learning objectives.

To meet these demands, academic institutions have established simulation centers with dedicated teams responsible for their organization and oversight. These centers are expected to ensure optimal utilization of resources and contribute to the continuous improvement of teaching practices through simulation (Chernogorova et al., 2024). The role of simulation centers has evolved beyond logistics, encompassing educational design, evaluation of learning outcomes, and strategic development of simulation policies within institutions. However, despite substantial investments, available technologies often remain underused due to factors such as limited instructor training, insufficient visibility of available tools, and administrative burdens.

One critical issue that frequently emerges is the lack of centralized and accessible information regarding the simulators and training scenarios. High-fidelity simulators, for example, often require specialized onboarding or certification before use, which discourages spontaneous integration into coursework. Conversely, simpler devices like task trainers - used for catheterization or injection practice - may be readily available, but instructors may not be aware of their existence or educational value. Existing software platforms for simulation center management tend to be tailored to large institutions with complex administrative workflows. These systems prioritize scheduling, equipment tracking, and reporting, but often lack features that directly support faculty in planning or customizing educational content (Medical Simulation Center Management Software/SimBoost Unlimited, 2025). As a result, educators may find it challenging to identify the most suitable simulator for a specific learning objective or to integrate simulation-based activities into their curricula efficiently.

This observation led to the development of a structured, interactive, and pedagogically oriented simulator database aimed at addressing existing gaps in information accessibility. By offering instructors timely and comprehensive access to simulator-related data, such a system is expected to increase the visibility and actual use of available technologies in simulation-based teaching. The present article describes the rationale, design, structure, and

implementation of a digital simulator database content manager developed at the Medical University of Varna, intended to support educators in planning and integrating simulation into their curricula.

Method

The development of the database was carried out by a multidisciplinary team within the framework of an institutional project at the Medical University of Varna. The team included technical staff from the Simulation Center, who were responsible for systematically classifying the available simulation equipment into clearly defined categories, based on complexity, functionality, and intended educational use. Additionally, faculty members from the Department of anaesthesiology, emergency and intensive care contributed clinical expertise by reviewing each training scenario. Their role was to assess the pedagogical value of each scenario and to determine the most appropriate academic department (discipline) for its use. A key member of the team from the Department of medical equipment, electronic and information technologies in healthcare provided technical insights into integrating the simulation equipment into the platform. This collaborative process informed the implementation of a department-specific filter in the platform, significantly improving the relevance and usability of the system for academic staff.

The database content manager was developed as a secure online platform, accessible exclusively from the university's internal network via IP-based restrictions. This design ensures controlled access and protects any sensitive or institution-specific information related to simulation equipment and training materials. The platform's front-end was implemented using standard web technologies - HTML for structural markup, CSS for layout and styling, and JavaScript for dynamic content and interactivity. To optimize responsiveness and cross-device compatibility, the interface integrates libraries such as Bootstrap, enabling consistent performance across various screen sizes and user devices.

The back-end architecture is built on a PHP-based framework that adheres to the Model-View-Controller (MVC) design pattern. This structure separates the presentation layer (View), business logic (Controller), and data management (Model), which facilitates system maintenance, modularity, and scalability for future updates or feature extensions. Data storage is handled by a MySQL engine, chosen for its robustness, speed, and ability to process large volumes of structured information efficiently (see Figure 1).
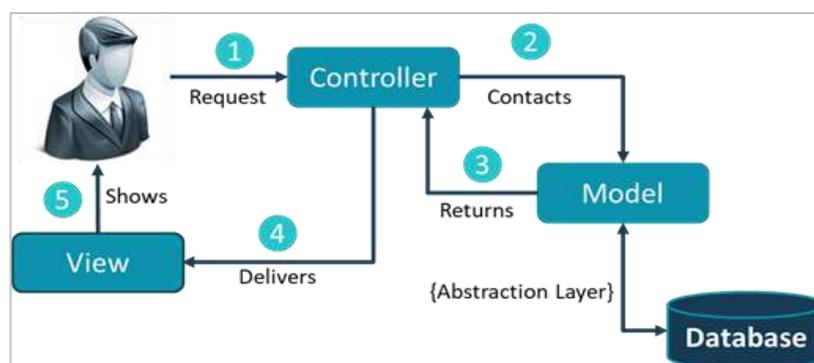
Figure 1. Block diagram of the developed database content manager's architecture

Results

As a result of the collaborative work and iterative development process, the platform provides structured access to the simulation resources of the Medical University of Varna. The simulators are classified into five categories:

- *High-fidelity simulators*: Technologically advanced systems that replicate real-life physiological responses and scenarios with a high degree of realism.
- *Complex task trainers*: Computer-assisted devices that allow practice of specific medical procedures with feedback mechanisms.
- *Basic task trainers*: Manual models for practicing fundamental clinical skills, typically without integrated software or performance feedback.
- *Software-based simulators*: Virtual learning platforms and applications used for simulated clinical decision-making and procedural training.
- *Standardized patients*: Real or virtual actors trained to simulate clinical conditions for communication and diagnostic training.

When logging into the system, users begin by selecting one of the five simulator categories (see Figure 2). From there, they navigate to a specific simulator within that category and then select from its associated training scenarios.

Figure 2. Screenshot of the main simulator categories in the database interface

Each simulator entry includes detailed information, such as:

- Images and Videos: Visual previews to familiarize users with the simulator's appearance and usage.
- Available functions: Descriptions of key features and capabilities.
- Training scenarios: A list of predefined scenarios tailored for the specific simulator.
- Scenario descriptions: Detailed pedagogical outlines with objectives, recommended use cases, and learning outcomes.

This detailed information allows faculty to efficiently identify suitable simulators for their teaching needs and better understand how each device fits into different instructional contexts (see Figure 3).
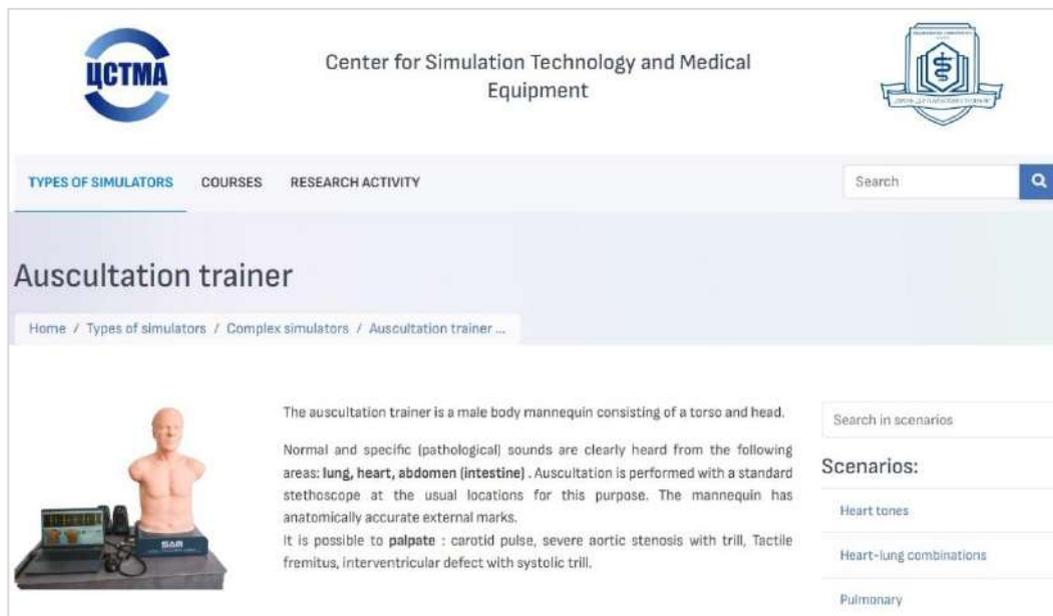
Figure 3. Screenshot of the database page with detailed simulator information, including images, functions, and associated training scenarios

To further improve accessibility, the platform incorporates two key search tools:

- Department filter - Enables users to find simulators that are relevant to specific academic or clinical departments. This feature is especially helpful for faculty seeking discipline-specific training tools, reducing the time spent browsing through unrelated resources.

- Keyword search - Allows users to quickly locate simulators or scenarios by entering terms related to simulator features, training objectives, or medical procedures. This function enhances precision and efficiency when searching for specific educational content.

The entire platform is designed around a clear and efficient four-step workflow:

1. Simulator type selection - The user selects one of the five simulator categories.
2. Simulator selection - Within the selected category, a specific simulator is chosen.
3. Scenario selection - A relevant scenario is selected from those associated with the chosen simulator.
4. Scenario details - Full pedagogical and functional information is reviewed before use.

To support administrative needs, the platform includes a dedicated interface for staff at the Simulation Center. This interface allows internal tracking of usage data, including:

- Total number of simulators;
- Their physical locations;
- Frequency of simulator selection by faculty;
- Search behavior by keyword or department.

Although the system does not generate formal analytics reports, all data can be exported in Excel format. These insights help the Simulation Center monitor resource utilization, identify emerging faculty interests, and inform future investments or training initiatives.

Discussion

The development of the database represents a significant step toward enhancing faculty awareness and the utilization of medical simulators at the Medical University of Varna. This platform addresses several key barriers that have limited the effective use of simulation technologies in healthcare education. Previous studies have highlighted issues such as low faculty awareness of existing simulators (Alshehri et al., 2023), lack of structured information about available tools (Bienstock & Heuer, 2022), and perceptions of simulation as overly complex or difficult to integrate (Pezel et al., 2021). In response to these challenges, the platform provides a centralized, user-friendly resource that presents standardized information about the simulators currently available at the university. Each entry includes details on the simulator's technical features, educational uses, supported competencies, and alignment with training programs. By making this information easily accessible in one place, the platform enables instructors to quickly identify which simulators are most relevant to their teaching goals, thereby promoting more informed and confident integration of simulation into the curriculum.

An important aspect of the platform's development was the systematic categorization of the simulation equipment into five distinct types: high-fidelity simulators, complex task trainers, basic task trainers, software-based simulators, and standardized patients. This categorization was particularly significant because there was no established standard for classifying simulators, leading to inconsistent naming across different institutions and publications. In practice, similar devices are often labeled inconsistently - for example, the same simulator may be referred to as both a "mid-fidelity simulator" and a "task trainer," depending on context. To address this ambiguity, we proposed a categorization model grounded in the technical characteristics and educational use cases of each device type. This approach not only brings internal consistency to the platform but also enhances clarity for instructors seeking appropriate tools for their specific teaching objectives. The development of this model has been described in detail in a separate publication, which provides a broader theoretical justification and discussion of its applicability across healthcare education settings (Zanev et al., 2024).

Furthermore, the database includes detailed descriptions of the functionalities and technical parameters of each simulator. By providing comprehensive information, it enhances users' understanding of the available features and helps address the issue of underutilization of simulation tools, a challenge previously highlighted in the literature (Jin et al., 2022). By clarifying the fidelity, interactivity, and assessment capabilities of each simulator, the platform may further support educators in aligning technological resources with specific pedagogical objectives. In addition, it offers a valuable orientation tool for newly appointed faculty members, enabling them to quickly familiarize themselves with the simulation technologies available at the university and to integrate them more effectively into their teaching practice.

An important feature of the platform is its ability to provide up-to-date information about the available simulators. In dynamic educational environments, where new equipment is regularly acquired and existing simulators are enhanced through software updates or additional training scenarios, it is unrealistic to expect faculty members to independently track these changes. By systematically updating the database, the simulation center ensures that educators have timely access to the latest capabilities of each simulator. For example, newly added scenarios may extend the educational

relevance of a simulator beyond its original use case, enabling instructors from other departments to adopt it for different learning objectives. Similarly, firmware or software upgrades can introduce new functionalities that were previously unavailable. In this way, the database serves as a dynamic reference point, supporting continuous alignment between simulation resources and evolving curricular needs. The inclusion of information on the availability of assessment functionalities - whether formative or summative - also supports the growing emphasis on simulation as a tool for both learning and evaluation, a trend increasingly highlighted in the literature (Elendu et al., 2024). By highlighting these aspects, the database can guide educators in integrating simulation into broader assessment strategies.

In addition, several publications have emphasized the need for faculty development to enhance the use of simulation technologies (Dleikan et al., 2020; Al-Ghareeb & Cooper, 2016). In this context, the platform already integrates a "Courses" module, which will facilitate the professional development of educators. Once the simulation center begins organizing courses, this module will become active and will offer structured training for both university students and external participants, including medical residents, specialists, and faculty members. This integration will support the continuous improvement of teaching practices and ensure that educators remain well-versed in the latest simulation technologies. Moreover, it will contribute to the implementation of a structured development plan for faculty and staff - an area often identified as a challenge in the management of simulation centers (Moyer et al., 2016).

Unlike existing commercial platforms, which are often expensive and primarily tailored to the administrative management of simulation centers - offering features such as scheduling tools, inventory control, and maintenance tracking - this database was developed specifically to support educators. This key distinction is grounded in our observation of the gap in accessible, pedagogically-oriented resources that assist teaching staff in identifying and selecting appropriate simulation tools. Rather than replicating functionalities found in administrative platforms, our initiative focuses on providing structured, comparative information that is directly relevant to curriculum planning and instructional design.

At the same time, the platform incorporates lightweight administrative tools that serve a complementary purpose. By enabling administrators at the simulation center to monitor how educators interact with the platform - such as which simulators are most frequently selected, what keywords are used in searches, or how selection varies by department - the system offers indirect insight into current educational priorities and awareness levels. These usage data, available through exportable Excel summaries, can inform targeted outreach and support strategies. For instance, if search patterns reveal limited interest in a specific category of simulators, this may indicate a need for additional faculty training or promotional efforts. In this way, the platform not only supports educators directly, but also provides decision-makers with evidence-based cues for improving simulator integration across faculties.

Despite its contributions, the current study has several limitations. The database was developed and piloted within a single institutional context, which may limit the generalizability of its structure and functionalities to other academic environments with different curricula, simulation inventories, or digital infrastructures. Moreover, the system relies on periodic manual updates by the simulation center staff, which raises concerns regarding long-term sustainability and the accuracy of information unless institutional support is consistently maintained. The evaluation of the platform

was primarily focused on technical deployment and initial usability; however, its actual impact on teaching practices, simulator utilization patterns, and educational outcomes has not yet been systematically measured. Additionally, while the platform was designed to enhance educator access to information, it does not yet integrate training modules or interactive tutorials, which could further support users with limited prior exposure to simulation technologies. These constraints underscore the need for further validation of the platform in diverse academic settings, sustained institutional commitment to data maintenance, and broader investigation into its pedagogical impact.

Conclusion

This work aims to address a significant gap in the management and utilization of medical simulation resources, which are critical for enhancing healthcare education. Despite the increasing reliance on simulation-based training in curricula, many institutions lack a cohesive system that allows educators to easily identify, compare, and select appropriate simulation tools for specific learning objectives. The platform developed in this project provides a centralized and accessible resource for faculty members, enabling them to efficiently explore available simulators and training scenarios across multiple specialties and levels of complexity. By offering detailed, up-to-date information on technical specifications, functionalities, and educational applications, the platform empowers educators to make informed decisions when selecting tools that best align with their pedagogical goals. This not only saves time but also promotes more consistent and evidence-informed use of simulation across teaching programs.

In addition to benefiting faculty, the platform plays a vital role in the management of simulation resources within the center. It facilitates more transparent and data-driven coordination between academic and administrative staff, reducing inefficiencies and ensuring that underused or outdated equipment is identified. By generating statistical data and usage reports, the platform provides administrators with valuable insights into resource utilization patterns, faculty preferences, and emerging trends in simulation needs. These insights support more effective decision-making regarding simulator acquisitions, scenario development, and overall resource allocation. Moreover, they can guide strategic planning for faculty development and capacity-building initiatives. Ultimately, this ensures that the simulation center can continually adapt to the evolving demands of medical education, thereby enhancing both the quality and accessibility of training.

Recommendations

To ensure the sustained effectiveness and continuous improvement of the platform, the following actions are recommended:

1. *Enhance scenario descriptions*: While the current scenario descriptions are informative, providing more detailed instructions and pedagogical guidance for instructors would further enhance the platform's usability and effectiveness in student training.

2. *Conduct a post-implementation survey*: To assess the impact of the platform on faculty awareness and simulator usage, a follow-up survey should be conducted after full implementation. This survey would measure changes in faculty engagement with the platform and track any increases in the frequency of simulator utilization. A comparison of these results with the baseline data collected prior to implementation would provide valuable

insights into the platform's effectiveness and areas for improvement.

3. *Expand search features*: To further optimize user experience, additional search filters could be introduced, such as the ability to search by specific medical specialties, training levels, or even by the types of skills targeted. This would allow users to more precisely match simulators and scenarios to their specific teaching and learning objectives.

4. *Implement regular updates*: Regular updates to the simulator database based on faculty feedback and usage data would help ensure that the platform remains current and aligned with the evolving needs of medical education. This will also enable the integration of new simulators, scenarios, and features that emerge over time.

By implementing these recommendations, the platform would further enhance its capacity to support faculty, streamline the selection of relevant simulators, and contribute to the ongoing improvement of medical simulation training at the university.

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The Significance Influence of Servant Leadership and Lecturer Competence in Delivering Project Base Learning on Pancasila Student Profiles Building Through Blended Learning

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Abstract: Each country has criteria for the graduate profile which wants to achieve through the provision of its education. Likewise, Indonesia, through the Ministry of Education and Culture, has declared the Pancasila student profile as the expected graduate profile. The provision of education, of course, cannot be separated from the fact of the rapid progress of science and technology currently characterized by VUCA (Volatility, Uncertainty, Complexity, and Ambiguity). This fact means that learning can no longer be carried out with just one learning model. Blended learning is a necessity to be implemented in a learning system, which of course requires the implementation of blended learning. Therefore, this research aims to show how much the influence of servant leadership and lecturer competence in delivering project base learning in Pancasila education on the formation of Pancasila student profiles through blended learning. This research was designed using quantitative methods by distributing questionnaires to Bina Nusantara University students in Jakarta who had taken the Pancasila Education course. From the results of data processing, it is known that servant leadership and lecturer competence in delivering project base learning and Pancasila education has a very significant influence on the formation of Pancasila student profiles through blended learning. So, it can be concluded that the more servant leadership and more competent of the lecturer in delivering project base learning in Pancasila education is the greater the influence on forming the profile of Pancasila students through blended learning, and vice versa.

Keywords: Servant Leadership; Lecturer Competence; Project Base Learning; Pancasila Student Profile; Blended Learning

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Introduction

In this era of scientific and technological progress characterized by VUCA (Volatility, Uncertainty, Complexity, and Ambiguity), learning can no longer be carried out only with one system or model. Learning must be more interactive and collaborative, making students as the learning resource. For this reason, a mixed learning system is needed, better known as blended learning. Blended learning is not enough to only be done in the classroom, but also needs to be supported by learning outside of the classroom, both offline and online. Wikipedia offers a definition of blended learning or hybrid learning as an educational approach that combines online educational materials and online interaction opportunities with traditional place-based classroom methods. According to Thorne, blended learning is a mixed system that combines two components and methods at once. The combination of these methods is e-learning and multimedia (Thorne, 2003). Meanwhile, the learning carried out takes the form of virtual classes, video streaming, online animated texts, and so on. According to Dwiyogo, blended learning is learning that is combined or mixed in nature. This method comes by combining face-to-face learning with technology-based learning (Dwiyogo, 2021). According to Rusman, blended learning is a combination of two main elements. These two elements are classroom and online learning, or learning using the internet and website-based networks. Apart from that, there are several media technologies that are applied in this learning. For example, email, video streaming, virtual classes, and so on (Rusman, 2011).

Apart from that, blended learning also requires interaction or collaboration between students and lecturers through online activities in the Discussion Forum format where lecturers invite students to explore certain topics through interaction in online discussion forums. Blended learning also assumes that learning is carried out independently through assignments both individually and in teams. For this reason, considering that Pancasila education must also support the achievement of Pancasila student profiles, in this research we want to highlight how or to what extent lecturer servant leadership and lecturer competence, especially in delivering collaborative and project-based learning and Pancasila education, have a significant influence on the formation of the profile. Pancasila students in learning with a mixed system or blended learning.

Currently, Pancasila education is one of the mandatory curriculum subjects in Indonesia, so it needs to be implemented not only with a classical tutorial system, but also with project-based learning, where students are invited to learn to work together in working on projects. Therefore, the lecturer In delivering Pancasila educational learning, you are required to master project-based learning which requires collaborative learning. As is known, education in Indonesia aims to develop the potential of students to become human beings who have the skills, desires and good morals as stated in the National Education System Law. According to Idris et.al., education prepares students to become individuals who have knowledge, skills, attitudes, values and behavior that will have a positive impact on students' daily lives in society (Idris et al., 2012).

Servant Leadership

Servant leadership is a new field of research for scholars (van Dierendonck, 2011), which combines motivation to serve and lead (Coetzer et al., 2017; Sujudi & Komariah, 2020). Both are harmoniously united to support and strengthen each other. Servant Leadership is unique in its explicit focus on serving, empowering, developing followers by authenticity, interpersonal acceptance, humility, stewardship by providing direction (Hoch et al., 2016; Giolito et al., 2020). The dimensions of serving and leading are combined for the achievement of organizational prosperity (Ragnarsson et al., 2018). The characteristics of this leadership are listening, empathizing, persuading, receiving services and actively developing the potential of followers (Obi et al., 2020; Robbins & Judge, 2015).

According to Parris & Peachey (2013), servant leadership has the main motivation to serve its followers. For Poli (2011) servant leadership is a process of mutual relations between leaders and followers, the leader first appears as an actor serving the needs of his followers and finally, he gets recognition and is accepted as a leader. Meanwhile, Yukl (2020) defined servant leadership as a matter of helping others to achieve common goals by empowering, consistent collective work, and facilitating individual development with the long-term health and well-being of followers. In other words, servant leadership is a leadership style that is oriented and prioritizes the growth and development of followers in order to achieve common goals.

Previous studies have shown that servant leadership has a significant effect on follower performance outcomes (Goh & Low, 2010; Leroy, Palanski, & Simons, 2012; Saleem, Zhang, Gopinath, & Adeel, 2020). This can happen because the influence of servant leadership is obtained through services that emphasize the ideal relationship of leaders and followers (van Dierendonck, 2011). Servant leadership promotes personal growth of followers, emphasizing integrity, individual morality, responsibility to the organization, to followers, society and other stakeholders (Kantharia, 2012; Ling et al., 2017).

This study adapted the ideas and thoughts of Liden et al. (2014) and Northouse (2016) by taking two important elements in formulating and understanding the concept and theory of servant leadership. First, behaviors - the essence of the servant leadership process is its seven behaviors, namely: prioritizing followers, helping followers grow successful, empowering, behaving ethically, conceptualizing, emotional healing, and creating value for society. Second, outcomes - impacts that will occur are increased performance and growth of followers, organizational performance and social impact.

Based on these descriptions, it can be briefly formulated that servant leadership is a type of leader who has finished with his own affairs, is altruistic, inspirational and contains moral protection. The fruit of this leadership is the welfare of followers with high individual, group and organizational performance. In this study, what is meant by servant leadership is the ability of Binus University leaders to conceptualize, heal emotionally, prioritize followers, help followers grow and succeed, behave ethically, empower and create value for society.

Servant leadership is able to provide and create a conducive atmosphere, deep, friendly, intimate, equal, selfless, tolerant, and trust-based relationships make followers feel valued, and have confidence in their potential so that

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followers are enthusiastic about working with full of motivation. They will serve each other, support each other and work together to achieve an institution goal. This happy experience in itself will encourage and increase students to build Pancasila Student Profile as because the lecturer as the role model of it.

Lecturer Competence

However, the effectiveness of learning is influenced by the lecturer's competence in delivering courses so that they can truly carry out collaborative and interactive learning between students and lecturers. According to Spencer and Spencer, competence includes motives, traits, self-concept, knowledge and skills. It is these fundamental characteristics that lead to effective performance in a job. (Spencer & Spencer, 2007) Competency thus also concerns the ability of lecturers to carry out their duties based on their skills, knowledge and attitudes towards work (Irawati et al., 2022). Michael Zwell defines competence as an enduring trait that determines performance, including initiative, influence, teamwork, innovation, and strategic thinking. Competence is also often described as a combination of knowledge, skills and attitudes (Zwell, 2000).

Susilo expands competence by considering it as a person's ability to achieve which includes elements such as imagination, knowledge, experience, emotions, passion, character, attitudes, skills and health. (Susilo & Sarkowi, 2018) Simamora defines competence as the skills, knowledge and abilities required for active work performance. (Simamora, 2015) Steven and Mary Ann explain that competence involves skills, knowledge, talents, values, direction and personal characteristics that contribute to superior performance (McShane et al., 2010).

Competency is very important for work performance in all fields, and work competency standards are needed to determine the required abilities (Benawa & Silverius Lake, 2019). For lecturers, it is important to internalize and have pedagogical competence, personal competence, social competence and competence. professional competence (Krisnamukti et al., 2020). These competencies include mastery of learning material, implementation of evaluations, empathy, social sensitivity, responsibility, honesty, discipline and objectivity (Alouw et al., 2021).

Lecturers' pedagogical competence, especially in the context of learning Pancasila education courses, is related to their ability to deliver project-based learning so they must also be able to encourage students to be able to collaborate in interactions between students and students with lecturers. According to Saefudin (Berdiati & Saefuddin, 2014), project-based learning itself is a learning method that uses problems as the first step in collecting and integrating new knowledge based on experience with real life activities. This project-based learning is implemented to help, encourage and guide students to focus on collaboration by involving cooperation in groups and helping students to focus on their development in capturing problems and finding solutions to the problems they face.

Pancasila Student Profile

Pancasila is a reflection of the educational character in building the national identity of Indonesia as a great nation, modern, dignified and civilized. Pancasila is also the guidelines for people to act and have to be understood and implemented in daily life. At the college level, students need to grow in their environment to learn how to feel empathy

for others, to share, to learn rationality, spirituality, competence in technology; as well as communication skills, and other fields that will support their life in society. Previous study showed that students can implement the value of Pancasila. It meant that they understood the values of Pancasila and be able to implement in their daily lives. Students' integrity is also increasingly formed by participating in Pancasila Education learning through habituation and role models. Habituation of learning activities and role models come also from the teacher concerned. Pancasila Education is one way to instill a moral and broadminded personality in the life of the nation and state. As for the various factors that cause the decline in knowledge and application of Pancasila values among students, it must be explored more deeply to find the best solution for strengthening the Pancasila ideology among students. However, the use of Pancasila and Religion education is intended to raise the humanistic element, whether as a Pancasila human or religious person.

Therefore, Pancasila Education must be a process of developing the potential of students in the context of realizing human beings who believe and fear God, so that their behavior is always based on certain moral values according to the religion education he received. He is expected to be a human with noble character, independent and responsible for himself, the nation and the state. Pancasila education is a reflection of character education to build the identity of the Indonesian nation as a large, modern, dignified and civilized nation. Pancasila as the ideology of the Indonesian nation is a guideline for Indonesian people in acting in everyday life. The integrity of students is also increasingly formed by participating in Pancasila Education learning through habituation and example.

Definition of The Pancasila Student Profile is a number of characters and competencies that are expected to be achieved by students, which are based on the noble values of Pancasila. This is also in line with the Regulation of the Minister of Education and Culture Number 22 of 2020 concerning the Strategic Plan of the Ministry of Education & Culture (Definition of The Pancasila Student Profile, 2023). More explicitly, the use of the establishment of the Pancasila Student Profile by the Ministry of Education and Culture of the Republic of Indonesia is (1) as translation of the goals and vision of education into a format that is more easily understood by all education stakeholders, (2) as a compass for Indonesian educators and students, and (3) as the ultimate goal of all learning, programs and activities in educational units. The Dimensions and Elements of the Pancasila Student Profile are (1) Have faith, fear God Almighty, and have a noble character, (2) Global diversity, (3) Independent, (4) Team Work, (5) Critical thinking, and (6) Creative. (Dimensi, Elemen, Dan Suplemen Profil Pelajar Pancasila, 2023).

Have faith, fear God Almighty, and have a noble character mean that Pancasila students believe in and practice the values and teachings of their religion/belief. This is manifested in good morals towards oneself, fellow human beings, nature and the Indonesian state (nationalism).

Global diversity means that Pancasila students know and love their culture and country (nationalism), respect other cultures, and are able to communicate and interact between cultures. They also reflect on their experiences of diversity, so they can harmonize cultural differences to create an inclusive, just and sustainable society.

Independent means that Pancasila students must have an understanding of themselves and the situation they face, as well as self-regulation to achieve their goals and improve their quality of life.

Team Work means that Pancasila students carry out collaborations that are built on the basis of humanity and concern for the nation and state, so they can share with others.

Critical thinking means that Pancasila students who think critically analyze and evaluate all information and ideas well obtained. They are also able to evaluate and reflect on their own reasoning and thinking.

Creative means that Pancasila students are students who can produce original ideas, works, and actions. They also have the flexibility of thinking in finding alternative solutions to problems.

So, it can be mentioned several reasons for the importance of realizing the Pancasila Student Profile in this 21st century learning era which tends to apply a distance learning system:

1. The students have a strong mentality and character that are not easy falling into negative things;

2. Facilitate students to compete and adapt to changes that are fast and dynamic;

3. Preserving and passing on the noble values of Pancasila;

4. The way of thinking becomes more open and willing to accept any differences;

5. Familiarize students to have independent, critical and creative characters;

6. Have global abilities and skills, but still have character according to local values;

7. Preserving the spirit of team work, mutual respect and deep cooperation in every learning activity.

Method

This research used quantitative method it is suitable for researching obvious problems and has a large population, and intends to test hypotheses. The targets in this research are students who have taken Character Building. The affordable population in this research was 120 students from Bina Nusantara University, Jakarta, who are the students of the researcher as the sample frame. The number of samples taken for this study was 120 students randomly because this study used the Simple Random Sampling technique. It means that 120 respondents who were selected by simple random sampling were asked to fill out a questionnaire concerning the three variables. This technique is used because the population elements are homogeneous, so that any element selected to be the sample can represent the population. The questionnaire was constituted using a Likert scale with the choices such as (1) Strongly disagree; (2) disagree; (3) Slightly disagree; (4) Agree; (5) Strongly Agree.

There are 3 variables. The first variable (X_1) is Servant Leadership consists of 45 questions. The second variable (X_2) is Lecturer Competence of 36 questions. The third variable (X_3) is Pancasila Student Profiles consists of 30 questions. After data is collected, then data is analyzed using path analysis with SPSS 22 software. Path analysis is intentionally used to determine the magnitude of the contribution of (X_1) and (X_2) on the (X_3).

Results

For showing the validity result of using the parametric statistics such as path analysis requires three things to be fulfilled, namely the data has a normal distribution, linear regression, and significant regression as described follow:

Result Test of Normality

Table 1: Tests of Normality

	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	*df*	*Sig.*	*Statistic*	*df*	*Sig.*
VAR00001	0.063	120	0.200*	0.979	120	0.058
VAR00002	0.052	120	0.200*	0.976	120	0.029
VAR00003	0.049	120	0.200*	0.986	120	0.266

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

The table 1 test of normality above showed that the three variables are normally distributed, because the significance value in the Kolmogorov-Smirnov column is greater ($>$) than 0.050, such as X_1 (Servant Leadership) is 0.200*; X_2 (Lecturer Competence) is 0.200*; and X_3 (Pancasila Student Profile) is 0.200*.

Result test of Linearity

There is information, that if the value of Deviation from Linearity Sig > 0.05, there is a significant linear relationship between the independent variable and the dependent variable. On other hand, if the value of Deviation from Linearity Sig <0.05, there is no significant linear relationship between the independent variable and the dependent variable.

Table 2: ANOVA Table

			Sum of Squares	df	Mean Square	F	Sig.
VAR00003* VAR00001	Between Groups	(Combined)	60380.430	46	1312.618	3.507	0.000
		Linearity	37585.667	1	37585.667	100.429	0.000
		Deviation from Linearity	22794.763	45	506.550	1.354	0.124
	Within Groups		27320.362	73	374.252		
	Total		87700.792	119			

The Table 2 above showed that the Deviation from Linearity Sig value is obtained of 0.124 is greater than 0.05. So, it can be concluded that there is a significant linear relationship between the variable (X_1) and variable (X_3).

Table 3: ANOVA Table

			Sum of Squares	df	Mean Square	F	Sig.
VAR00003* VAR00002	Between Groups	(Combined)	44313.863	50	886,277	1.409	0.093
		Linearity	5489.504	1	5489,504	8.730	0.004
		Deviation from Linearity	38824.359	49	792.334	1.260	0.186
	Within Groups		43386.929	69	628.796		
	Total		87700.792	119			

The Table 3 above showed that the Deviation from Linearity Sig value is obtained of 0.186 is greater than 0.05. So, it can be concluded that there is a significant linear relationship between the variable (X_2) and variable (X_3).

Result Test of Significance

There is information, if the significance value (Sig) is smaller (<) than the 0.05 probability, it means that there is significance influence. On the other hand, if the significance value (Sig.) is greater (>) than the probability of 0.05, it means that there is no significance influence.

Table 4: ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	37585.667	1	37585.667	88.498	0.000[b]
	Residual	50115.125	118	424.704		
	Total	87700.792	119			

a. Dependent Variable: VAR00003
b. Predictors: (Constant), VAR00001

From the Table 4 above, it is known that the significance value (Sig.) of 0.000 is smaller than the probability of 0.05, so it can be concluded that there is a significance influence of X_1 on X_3.

Table 5: ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5489.504	1	5489.504	37.681	0.000[b]
	Residual	66473.571	118	563.335		
	Total	71963.075	119			

a. Dependent Variable: VAR00003
b. Predictors: (Constant), VAR00002

The Table 5 above showed that the significance value of 0.000 is smaller than the probability of 0.05, so it can be concluded that there is significance influence of X_2 on X_3.

More deeply, the result test of significance is known based on the coefficients model, as below:

Table 6: Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-15.532	19.618		-,792	0.430
	VAR00001	0.404	0.102	0.281	3.955	0.000
	VAR00002	0.803	0.113	0.520	7.126	0.000

a. Dependent Variable: VAR00003

Based on the table 6 above as the result of the data processing, a structural equation can be made as follow:

$$X_3 = 0.281 \, X_1 + 0.520 \, X_2 + \epsilon_1$$

The equation showed the magnitude of the direct influence of variables X_1 and X_2 on X_3, which X_1 variable is 0.281 and X_2 is 0.520 or a total of 80.1%. This means that the two variables as a whole have been able to explain the X_3 variable, and there are 19,9 percent that also influence the Pancasila Student Profile (X_3), which in this study is not discussed.

Discussion

The Influence of Servant Leadership on Pancasila Student Profile

Based on the results of this study, it showed that Servant Leadership variable (X_1) has a positive direct influence (60%) on the Pancasila Student Profile variable (X_3). This finding is in line with the theory used. Servant Leadership will make students inspired and motivated to achieve Pancasila Student Profile. Servant Leadership creates a feeling of belonging to the values which include in the Pancasila Student Profile. Pancasila Student Profile shows strong belief and support for the values and goals to be achieved by Servant Leadership. Thus Servant Leadership is an important behavioral dimension that can be used to build Pancasila Student Profile with all the consequences, such as increasing its ability in delivering hybrid learning, which is a demand at Binus University in the era of industrial revolution 4.0.

Lecurer Competence on Pancasila Student Profile

Based on the results of this study, it showed that Lecturer Competence (X_2) has a positive direct influence (21,9%) on the Pancasila Student Profile (X_3). Thus, Lecturer Competence has a positive direct influence on the Pancasila Student Profile. This finding is in line with previous research findings which stated that Lecturers who have more competencies especially in delivering project base learning through blended learning showed greater influence for the students to achieve Pancasila Student Profile with all the consequences, such as increasing its ability in delivering hybrid learning, which is a demand at Binus University in the era of industrial revolution 4.0..

Conclusion

Based on the research results and data analysis above, the following conclusions can be drawn: There is significance influence of Servant Leadership on the Pancasila Student Profile. This means that the better leadership that represent in the attitudes, feelings, desires and behavior to serve of lecturer in delivering blended learning and with spirit of collaborative learning increase the spirit of the student in building the Pancasila Student Profile as the goal of education in Indonesia.

There is significance influence of Lecturer Competence on the Pancasila Student Profile. That is, the better competence of the lecturer in delivering blended learning and supported by collaborative learning will increase the spirit of the students in building the Pancasila Student Profile as the goal of education in Indonesia. Management design model design to improve the servant leadership and lecturer competence at Binus University offers a design model for building Pancasila Student Profile as the goal of education in Indonesia must be improved based on research results in delivering hybrid learning in the spirit of collaborative learning.

Acknowledgements

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The Effect of Household Waste Treatment on The Quality of Clean Water in The Rivers

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Abstract: This research is motivated by the awareness of the importance of clean water and sanitation for a decent and sustainable life on the one hand. While on the other hand, there is a decline in the quality of river water due to household waste pollution. This phenomenon is further exacerbated by rapid population growth and urbanization, where sanitation infrastructure and waste management do not run according to community needs. In many urban and suburban areas, household waste, both in the form of wastewater and solid waste, is often dumped directly into rivers without adequate treatment. This of course causes a decline in the quality of river water which is the main source of raw water for many residents. Using the observation method, this study aims to determine that inadequate waste processing has a significant impact on the quality of clean water in rivers, and this is a serious problem that needs to be addressed immediately. Strengthened by the collection of qualitative data through structured or unstructured interview with individuals or groups, individual understanding and experiences are obtained regarding the problems

of residents around the river, who are exposed to household waste along with the impact of household waste on river water quality. From there, the results obtained that household waste has a significant impact on river water quality. Detergents, kitchen waste, and bathroom wastewater contain chemicals that are harmful to aquatic ecosystems. The habit of dumping waste directly into rivers without processing worsens pollution, damages ecosystems, and threatens public health. These findings support the Sustainable Development Goals (SDGs) to ensure access to clean water and adequate sanitation, especially in urban areas with high population densities.

Keywords: Household waste; Water Pollution; Clean Water Quality; Sanitation Infrastructure

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Introduction

This research is motivated by the urgency of the importance of clean water and sanitation for a decent and sustainable life. Therefore, this study aims to determine the causes of the decline in river water quality and the importance of improving the incorrect processing of household waste. Access to clean water that is safe and free from household waste contamination is very important for public health, economic welfare, and environmental sustainability. Meanwhile, in many developing countries, including Indonesia, river water pollution due to household waste disposal is still a serious problem (World Bank, 2009). This phenomenon is further exacerbated by rapid population growth and urbanization, where sanitation and waste management infrastructure is not developing as fast as community needs. In many urban and suburban areas, household waste disposal, both in the form of wastewater and solid waste, is often directly discharged into rivers without adequate treatment (World Bank, 2009). This has contributed to the deterioration of the quality of river water, which is the main source of raw water for many residents (Agency, 2019).

Household waste containing organic materials, nutrients such as nitrogen and phosphorus, and hazardous chemicals such as detergents and microplastics, pollutes river water and causes various environmental problems (Arum et al., 2019; Dinas Lingkungan Hidup dan Kebersihan Kabupaten Badung, 2019). One of the most obvious impacts is eutrophication, where increased nutrients in river water cause excessive algae growth, reduce oxygen levels, and ultimately threaten aquatic life (Smith et al., 1999). In addition, poor water quality also increases the risk of spreading water-related diseases, such as diarrhea and skin infections, which are very detrimental to public health, especially in areas that lack access to proper sanitation (Arum et al., 2019; Dinas Lingkungan Hidup dan Kebersihan Kabupaten Badung, 2019).

Household waste is one of the main causes of river pollution. This waste consists of organic materials, nutrients such as nitrogen and phosphorus, and hazardous chemicals, including detergents and microplastics. When these substances enter rivers, they create serious environmental problems (Arum et al., 2019; Dinas Lingkungan dan Kebersihan Kabupaten Badung, 2019). Many households dispose of their waste directly into rivers due to a lack of proper waste

management systems. Over time, this leads to severe water pollution, making rivers unsafe for both human and aquatic life.

One of the most serious effects of household waste in rivers is eutrophication. This process occurs when excessive nutrients, particularly nitrogen and phosphorus, enter the water, leading to rapid algae growth. While algae are naturally present in rivers, their uncontrolled growth can block sunlight from reaching underwater plants. This disruption affects the entire aquatic ecosystem (Smith et al., 1999). Moreover, when algae die and decompose, they consume a large amount of oxygen, reducing oxygen levels in the water. As a result, fish and other aquatic organisms struggle to survive, leading to a decline in biodiversity (Carpenter et al., 1998). In extreme cases, eutrophication can create "dead zones," where no aquatic life can exist due to the lack of oxygen.

In addition to harming aquatic ecosystems, river pollution also poses serious risks to human health. Contaminated water can spread various diseases, including diarrhea, cholera, and skin infections. This is particularly dangerous for people living in areas without proper sanitation facilities, as they often rely on river water for drinking, cooking, and washing (Environmental Service, 2016; Arum et al., 2019). According to Prüss-Ustün et al., poor water quality contributes significantly to global health problems, especially in developing countries. Children and elderly individuals are more vulnerable to waterborne diseases, which can lead to severe dehydration and even death in extreme cases (Prüss-Ustün et al., 2019).

Microplastic pollution is another major issue caused by household waste. Microplastics are tiny plastic particles that come from household products such as synthetic fabrics, cosmetics, and cleaning agents. These particles do not easily degrade and can remain in the environment for years. Many aquatic organisms, such as fish and shellfish, ingest microplastics, which can accumulate in their bodies (Cole et al., 2011). When humans consume seafood contaminated with microplastics, these harmful substances may enter the human body, potentially leading to health problems such as digestive disorders and hormonal imbalances (Rochman et al., 2013).

In this context, this study aims to evaluate the effect of household waste disposal on river water quality, using appropriate water quality parameters, such as pH, organic content, and nutrient concentration. This study is also expected to provide solutions that can be implemented by local governments and communities in an effort to improve household waste management and maintain river water quality sustainably.

Sustainable Development Goals (SDGs) and Clean Water Quality

The SDGs, launched by the United Nations (UN) in 2015, aim to address a number of global challenges, including clean water and adequate sanitation. Goal 6 of the SDGs specifically targets the availability and sustainable management of clean water and access to adequate sanitation for all. The issue of clean water is urgent, especially in developing countries such as Indonesia, where rapid urbanization and population growth are exacerbating water quality issues. Poor water quality due to pollution has significant impacts on public health and environmental sustainability (Nations, 2015).

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Household Waste and Water Pollution

River water pollution due to household waste is one of the main problems in water management in many urban and rural areas in Indonesia. Household waste, especially from activities such as disposal of untreated wastewater and solid waste, is often discharged directly into rivers. According to the Theory of Environmental Ecology, household waste contains various pollutants, such as organic matter, nutrients (nitrogen, phosphorus), and hazardous chemicals such as detergents, microplastics, and other toxic materials (Leopold, 1971; Ponce, 2017). These substances have damaging effects on aquatic ecosystems and humans.

Organic waste can cause an increase in biological oxygen demand (BOD), which reduces the oxygen level in the water and threatens the lives of aquatic organisms. On the other hand, nutrients such as nitrogen and phosphorus can trigger eutrophication, where algae grow excessively, cover the water surface, and eventually cause deoxygenation of the water, which is detrimental to the ecosystem (Smith et al., 1999). Socio-ecological Systems Theory also highlights the link between human behavior and environmental degradation, showing that river water pollution not only impacts environmental health but also causes public health problems, such as diarrhea and skin infections.

Population Growth, Urbanization, and Sanitation Infrastructure

Rapid population growth and urbanization in Indonesia have contributed to an increase in the amount of household waste. The Demographic Transition Theory explains that the rapid urbanization phase is often not accompanied by adequate sanitation infrastructure development (World Bank, 2009). Most urban areas in Indonesia do not have effective wastewater treatment systems, so household waste flows directly into rivers. This causes a decline in river water quality and endangers the availability of clean water for residents who depend on the river as a source of raw water.

Public Health and Adequate Sanitation

Poor water quality is closely related to the theory of environmental health, which suggests that water quality affects the level of public health. According to WHO, polluted water can cause various diseases such as diarrhea, cholera, and skin infections (World Health Organization, 2017). This emphasizes the importance of good sanitation in maintaining water quality and preventing the spread of waterborne diseases.

Method

Observation

The observation method in the study aims to find out that inadequate waste processing has a significant impact on the quality of clean water in rivers, and this is a serious problem that needs to be addressed. Some things that need to be considered in this regard include:

a) Location:

To determine the location of the river to be studied, pay attention to points suspected of being affected by household waste.

b) Parameters:

To determine the parameters to be observed, such as:

• Physical: Color, odor, temperature, turbidity

• Chemical: pH, dissolved oxygen levels (DO), BOD, COD, heavy metals (if any)

• Biological: Abundance and types of plankton, macro invertebrates

c) Method:

By using a water sampling method that is in accordance with the parameters being observed. Record observation data systematically.

d) Frequency:

To conduct observations periodically (for example, weekly, monthly) to see changes in water quality.

2.2.   Deep Interview

This method is a process of collecting qualitative data through structured or unstructured conversations with individuals or groups. This also aims to understand the perspectives and experiences of individuals related to a complex topic and ask several questions such as interviewing residents around the river, especially those living near household waste sources, how do they process household waste? Do they use a waste management system? Do they know the impact of household waste on river water quality? How do they perceive river water quality.

Results

Observations were conducted at several points along the river that are close to residential areas. The identified locations have the potential for household waste pollution. Most residents do not have an adequate waste management system. They tend to dispose of waste directly into the river. Many residents are not fully aware of the negative impacts of household waste on river water quality, although there is awareness of pollution and are concerned about their health and the surrounding environment. In addition, the main findings in this study include:

Types of Household Waste that Cause Pollution

● Detergent: Phosphates in detergents promote eutrophication, causing excessive algae growth and reducing oxygen levels in the water (Smith et al., 1999). This disrupts the balance of aquatic ecosystems and leads to the death of fish and other aquatic organisms.

● Kitchen Waste: Leftover food and cooking oil trigger the growth of decomposing bacteria which reduce dissolved oxygen in water and cause odor. Leftover food and used cooking oil encourage bacterial growth, which depletes dissolved oxygen in the water and causes foul odors (Arum et al., 2019). When large amounts of organic waste

accumulate, water quality deteriorates significantly.

● Bathroom Wastewater: Soap, shampoo, and toothpaste contain chemicals that are harmful to aquatic life. Soap, shampoo, and toothpaste contain chemicals harmful to aquatic life. These substances can accumulate in the river, affecting water quality and harming fish and other aquatic organisms (World Health Organization, 2017).

Improper Waste Management Methods

● Direct discharge into rivers: Waste that is directly discharged into rivers without filtering results in direct pollution. Many households dispose of their waste directly into the river without filtering or treatment. This practice leads to an immediate decline in water quality, making it unsafe for both aquatic life and human use (Agency, 2019).

● Non-standard septic tanks: Seepage from septic tanks that are not watertight causes groundwater pollution that eventually flows into rivers. Many homes use poorly constructed septic tanks that leak, causing groundwater contamination that eventually reaches rivers. Proper septic tank installation and maintenance are crucial to preventing water pollution (Johansson & others, 2010).

Impacts on Environment and Health

● Damage to river ecosystems that cause death of fish and aquatic plants. Polluted water leads to fish and aquatic plant deaths. Excessive algae growth from eutrophication blocks sunlight and reduces oxygen levels, further harming aquatic life (Smith et al., 1999).

● Contamination of clean water sources, resulting in rivers becoming unsuitable for daily needs. Polluted rivers become unsafe for daily use, affecting communities that rely on them for washing, cooking, and drinking (World Health Organization, 2017).

● Increased risk of diseases such as diarrhea, cholera, and skin diseases. Contaminated water increases the spread of diseases such as diarrhea, cholera, and skin infections, particularly in areas lacking access to clean water and sanitation (Arum et al., 2019).

Proposed Solutions and Waste Management Approaches

1. To address these issues, an Integrated Waste Management approach is recommended. This approach involves cooperation between the government, private sector, and communities to ensure sustainable waste management (Johansson et al., 2010). Some key solutions include:

2. Wastewater Treatment Systems: Implementing household and community-level wastewater treatment systems to prevent direct waste discharge into rivers.

3. Public Awareness Campaigns: Educating residents on proper waste disposal methods and encouraging behavioral changes toward sustainable waste management (United Nations, 2015).

4. Government Regulation and Support: Enforcing stricter regulations on waste disposal and providing incentives for households to adopt proper waste management practices (World Bank, 2009).

5. Community-Based Monitoring: Forming local groups to monitor river water quality and report pollution cases to authorities.

Discussion

Various approaches have been proposed to address river water pollution due to household waste. The theory of Integrated Waste Management suggests a combination of solutions involving government, the private sector, and communities in handling waste in a sustainable manner. For example, implementing a wastewater treatment system at the household to community level is key to preventing direct discharge into rivers (Johansson & others, 2010). In addition, a participatory approach to environmental management, involving community awareness, is essential to support pro-environmental behavior in managing household waste.

Addressing river water pollution caused by household waste requires a comprehensive and integrated approach. Various strategies have been proposed to minimize pollution and improve water quality. The Integrated Waste Management theory suggests that effective waste handling involves collaboration between the government, private sector, and local communities. This approach focuses on sustainable waste management by combining waste reduction, recycling, and proper disposal methods (Johansson & others, 2010). One key strategy is implementing wastewater treatment systems at the household and community levels to prevent the direct discharge of pollutants into rivers. Proper treatment of household wastewater, including the use of filtration systems and septic tanks that meet environmental standards, plays a crucial role in reducing water contamination.

Furthermore, a participatory approach is necessary to support pro-environmental behavior in managing household waste. Increasing community awareness through educational campaigns and training programs can encourage better waste disposal practices. Studies suggest that when residents understand the impact of household waste on river ecosystems, they are more likely to adopt environmentally friendly habits, such as composting kitchen waste and properly disposing of detergents and chemicals (Arum et al., 2019). Strengthening local community engagement in monitoring and reporting pollution can also help maintain water quality.

To evaluate the impact of household waste on river water quality, it is necessary to measure several water quality parameters, such as pH, organic matter content, total suspended solids (TSS), and nutrients such as nitrogen and phosphorus. This water quality measurement method approach is important in providing an overview of the level of pollution and determining appropriate mitigation steps. The use of scientific methods to measure water quality can provide results that support the implementation of better water management policies (Agency, 2019).

Literature shows that river water pollution due to household waste is a serious challenge related to Goal 6 of the SDGs. Research on the impact of household waste on river water quality is very important, not only for environmental health but also for public health. Implementation of effective waste management solutions and proper water quality measurement are critical steps in achieving the availability of safe and sustainable clean water in accordance with the SDGs targets.

To assess the effects of household waste on river water quality, it is essential to conduct scientific water quality measurements. Key parameters that need to be analyzed include pH levels, organic matter content, total suspended solids (TSS), biochemical oxygen demand (BOD), chemical oxygen demand (COD), and nutrient concentrations such

as nitrogen and phosphorus. These parameters indicate the extent of pollution and provide data for identifying the most effective mitigation strategies (Agency, 2019). The presence of excess nutrients, particularly nitrogen and phosphorus from detergents and kitchen waste, contributes to eutrophication, which leads to excessive algae growth, oxygen depletion, and aquatic ecosystem degradation (Smith et al., 1999). Monitoring these indicators regularly enables authorities to detect pollution trends and implement timely interventions.

Research highlights the strong connection between household waste pollution and public health. Contaminated river water increases the risk of waterborne diseases, such as diarrhea, cholera, and skin infections. This is particularly concerning in densely populated areas where many households rely on river water for daily activities, such as washing, bathing, and cooking (Organization, 2017). Improving waste management practices and ensuring access to clean water and sanitation are essential steps toward protecting public health.

Literature suggests that effective waste management solutions play a significant role in achieving Sustainable Development Goal (SDG) 6, which aims to ensure access to clean water and sanitation for all (United Nations, 2015). Governments, organizations, and communities must work together to promote policies that encourage responsible waste disposal and water conservation. The World Bank (2009) emphasizes the importance of urban sanitation planning to prevent pollution in rivers that serve as primary water sources for many communities. Integrating environmental regulations with waste management infrastructure development can significantly improve water quality.

Conclusion

From the results of observations and deep interviews as well as the discussion of the results of this study, it can be concluded that household waste has a significant impact on river water quality. Detergents, kitchen waste, and bathroom wastewater contain chemicals that are harmful to aquatic ecosystems. The habit of dumping waste directly into rivers without treatment worsens pollution, damages ecosystems, and threatens public health. These findings support the Sustainable Development Goals (SDGs) to ensure access to clean water and proper sanitation, especially in urban areas with high population density.

Recommendations

1) Education and Training: Conducting educational programs on waste management and its impacts on health and the environment. Raising awareness about proper waste management is crucial. Educational programs should be conducted in schools, community centers, and public gatherings to inform people about the negative effects of improper waste disposal. Training sessions can also be organized to teach households simple waste treatment methods, such as composting and wastewater filtering.

2) Collaboration with the Government: Proposing to the government to provide better waste treatment facilities and easy access for residents. Local authorities should invest in wastewater treatment plants and provide easy access to waste collection services. Governments can also introduce stricter regulations and fines for illegal waste dumping. Public-private partnerships can be encouraged to fund and develop better waste treatment solutions.

3) Community Monitoring: Forming water quality monitoring groups in the community that can report changes and help maintain river cleanliness. These groups can work with local environmental agencies to ensure that pollution levels are regularly checked and that immediate action is taken when necessary. By involving the community, people become more responsible for keeping their surroundings clean.

4) Kitchen Waste Management: Encouraging composting from food scraps and separating used cooking oil for recycling. Food scraps can be turned into organic fertilizer, reducing the amount of waste entering the river. Used cooking oil should be collected separately for proper recycling instead of being poured into drains.

5) Making Biopore Infiltration Holes: These biopore holes help wastewater to be absorbed more quickly into the soil so that it does not directly pollute the river. These small holes improve water absorption into the soil, preventing direct discharge into rivers. This method is effective in reducing surface runoff and preventing flooding.

6) Use of Standard Septic Tanks: Provide information and technical assistance to the community to use septic tanks that meet standards and recommend regular suction. Communities should be informed about proper septic tank installation and maintenance, including regular suction to prevent leaks and overflows.

7) Anti-River Waste Campaign: Conduct social and educational campaigns to invite the community to stop dumping waste into rivers and maintain environmental cleanliness. Social media, posters, and local events can encourage people to stop throwing garbage into rivers. Simple messages like "Keep Our Rivers Clean" can inspire communities to take action.

Acknowledgements

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Cultivating A Sustainability Mindset Through Un PRME-Best Practices from United Arab Emirates

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Abstract: In the time of the numerous corruption scandals and irresponsible behaviours in the world of business, society still perceives higher education in terms of its mission of discovering the truth, developing knowledge, and educating citizens who will make this world a better place for all of us. There is a need to develop practical guidelines and solutions that enable business schools to be more engaged in providing future leaders with the skills needed to balance economic and sustainability goals. The main objective of this paper is to develop the roadmap and set practical guidelines for using United Nations (UN) Principles for Responsible Management Education (PRME) for Cultivating a Sustainability Mindset among students, faculty member, and society actors at large based on the best practices from United Arab Emirates (UAE). In the paper, the author presents the best organizational and educational practices applied by four higher education institutions from UAE that adopted Principles for Responsible Management Education. The analysis was conducted in terms of over 50 criteria and was based on the SIP Reporting Universities' reports from 2020, 2021, 2022 and 2023.

Keywords: Responsible Management Education, Sustainability Mindset, Higher Education, PRME

Introduction

The Principles for Responsible Management Education (or 'PRME' in short) were established in 2007 as a United Nations-supported initiative aimed to "raise the profile of sustainability" by inspiring responsible management education, research, and leadership globally (PRME 1, n.d.). PRME's critical focus on management education is no accident; indeed, business and management schools are among the most influential forces globally to shape skills, values, and mindsets of tomorrow's leaders. In the past years, PRME has become the largest organized relationship between the United Nations and higher education institutions devoted to management education (PRME 1, n.d.). As such, PRME provides a framework for management education that can equipped future leaders with skills that balance economic, environmental, and social goals alongside the continuous improvement of best business practices. PRME does so by centring its framework on the United Nations Sustainable Development Goals (SDGs), highlighting the need to incorporate sustainability – or a *sustainability mindset* - into management education.

This paper responds to the growing need that business schools and higher education institutions face, that is to establish practical guidelines and strategies to help future leaders master both economic ambitions and sustainable

practices that allow for environmental responsibility. This need is reflected amongst the growing recognition that education institutions should assume pivotal roles mentoring and actively preparing future leaders in the steering multifaceted and intricate relationship of business and environmental responsibility (Wankel and Stachowicz-Stanusch 2014; Felgendreher and Löfgren 2017; Ayers et al., 2020; Stachowicz-Stanusch, Contu, and Alami, 2024). Thus, the main objective of this paper is to outline a roadmap and a set of practical guidelines for using the framework of PRME for cultivating the Sustainability Mindset among students and faculty members based on the best practices from the United Arab Emirates (UAE). This paper presents the best organizational and educational practices applied by the universities from UAE that adopted PRME with an aim of more sustainable education. The analysis was conducted in terms of over 50 criteria and was based on the 'Sharing Information on Progress' (PRME 3, n.d.) reports from five UAE universities from the period of five years between 2019-2024.

The Sustainability Mindset: understanding, measuring, developing

Scholars emphasize the importance of rethinking education to foster critical reflection on cultural norms and unconscious behaviours that perpetuate unsustainability, encouraging both individual and collective responsibility for systemic change (Sterling, 2001; Rimanoczy, 2021). Indeed, "society, business, and professional educators, are witnessing an environmental and social planetary crisis that threatens life in its current form" (PRME 2, n.d.). In the words of Paul Vare, "if we are not actively working against unsustainability then we are probably supporting it" (Vare, 2018). A step towards this direction is the cultivation of *Sustainability Mindset*.

A *Sustainability Mindset* refers to a way of thinking that integrates ethical awareness, social responsibility, and a commitment to long-term ecological and economic balance; "the Sustainability Mindset is a way of thinking and being those results from a broad understanding of the ecosystem, from social sensitivity, and an introspective focus on our personal values and higher self. It finds its expression in actions for the greater good" (Kassel, Rimanoczy, Mitchell, 2018). In other words, the sustainability mindset becomes a lens through which individuals and collectives assess their choices and impact, serving as a foundation for leadership that promotes equity, inclusivity, and ecological stewardship. As highlighted by PRME, cultivating this mindset in future leaders is crucial for aligning business practices with the SDGs, thereby equipping them to navigate complex global challenges (PRME, n.d.).

The Sustainability Mindset can be understood through its twelve foundational principles, which are organized into four interrelated domains: Ecological worldview; Systemic perspective; Emotional intelligence; and Spiritual awareness (see table below) (PRME2, n.d.). Although inherently internal, the Sustainability Mindset manifests externally through observable behaviours and decisions aligned with sustainable values. In business education, the integration of this mindset requires more than theoretical instruction; it demands transformative, experiential learning opportunities. A development of Sustainability Mindset is fostered through pedagogical approaches that emphasize ecoliteracy and the cultivation of emotional and spiritual awareness. Educators play a pivotal role by facilitating innovative, collaborative, and community-oriented projects that engage students in real-world challenges. Such practices not only deepen understanding but also empower learners to become active agents of change within their local and global contexts.

Table 1. The Twelve Principles of The Sustainability Mindset Adapted from Rimanoczy (2019)

Category	Principle	Description
Ecological Worldview	**Ecoliteracy**	Understanding the planet's condition helps us grasp complex global issues and how they're connected, encouraging deeper awareness.
	My Contribution	Recognizing our own role in environmental and social problems empowers us to make changes and become more conscious and socially engaged.
Systems Perspective	**Long-term Thinking**	Considering future impacts helps us make more sustainable decisions with lasting positive effects.
	Both-and thinking	Embracing multiple viewpoints and paradoxes leads to creative and inclusive solutions that support both the people and the planet.
	Flow in Cycles	Nature operates in repeating cycles—not straight lines. Ignoring this truth often leads to unsustainable practices.
	Interconnectedness	Recognizing how everything is linked, including diverse perspectives, leads to more thoughtful, sustainable choices.
Emotional Intelligence	**Creative Innovation**	True resilience comes from continuous creativity and ensuring our solutions are holistic and sustainable.
	Reflection	Taking time to reflect before acting helps us make more thoughtful and impactful choices.
	Self-Awareness	Understanding our own values and motivations helps us change behaviors and see new ways to contribute positively.
Spiritual Awareness	**Oneness with Nature**	Feeling connected to nature as part of it—not separate—fosters harmony with others and the environment.
	Mindfulness	Being fully present increases empathy and awareness, encouraging actions that benefit both society and nature.
	Purpose	A clear, values-driven purpose acts as an internal guide, inspiring us to create positive change in the world.

The Sustainability Mindset Indicator (SMI) is a research and personal development tool designed to assess where an individual stands on the journey toward a sustainability mindset. Developed by Isabel Rimanoczy and Beate Klingenberg, it is grounded in 12 Sustainability Mindset Principles and integrates concepts from positive psychology, human development, transformative learning, humanistic psychology, and polarity thinking (PRME 4, n.d.). Through a 36-statement questionnaire, the SMI explores the cognitive, behavioural, and affective dimensions of sustainability, providing personalized reports that highlight each participant's strengths and areas for growth (SM Indicator, n.d.). Recognized with awards and adopted by educators worldwide, the SMI also supports the integration of the UN Sustainable Development Goals into teaching, helping to make educational practices more relevant and action-oriented for a better world. While SMI is a great tool, particularly for individual guidance, this paper offers a somewhat different approach to measuring the Sustainability Mindset by turning to practical guidelines on an institution (university) level as indicators of incorporating Sustainability Mindset education into business education curriculum. This study investigates the implementation of PRME to promote Sustainability Mindset in business schools. To uncover the most effective strategies and approaches, this study draws upon the best organizational and educational practices observed in universities that have received recognition for their excellence in reporting.

Method

Principles for Responsible Management Education (PRME) consist of six essential principals designed to steer academic institutions toward embedding sustainability into management education and operational endeavours. These

guidelines serve as a framework that not only facilitates the integration of environmental and social considerations into academic programs but also reinforces the commitment of these institutions to instil responsible governance. By embracing these principals, higher education institutions are positioned to cultivate future leaders who are both ethically and environmentally conscious, thereby reinforcing sustainability as a central pillar of their institutional missions. PRME principals can this serve and methodological indicators of instruction-level operation that can aid in developing the Sustainability Mindset. Table 2 presents an enumeration of these principles, accompanied by succinct explanations that underscore their significance in advancing the global sustainability agenda.

Table 2. PRME and The Respective Methods for Evaluation and Implementation in Higher Education Context

PRME Principle	PRME Principal definition	Principle as a method for analysis
Principle 1: Purpose	"We will develop the capabilities of students to be future generators of sustainable value for business and society at large and to work for an inclusive and sustainable global economy."	The analysis focuses on identifying proactive student behaviours via active participation in student organizations, clubs, conferences, workshops, competitions, and similar events, as well as roles in organizing these activities.
Principle 2: Values	"We will incorporate into our academic activities and curricula the values of global social responsibility as portrayed in international initiatives such as the United Nations Global Compact."	The analysis evaluates strategic plans, codes of ethics, responsible management units, performance indicators, committees, and surveys on educational responsibility. It also considers resources on responsible management in labs, libraries, and databases.
Principle 3: Method	"We will create educational frameworks, materials, processes and environments that enable effective learning experiences for responsible leadership."	The analysis assesses the inclusion of the topics of on legal, financial, and environmental responsibility in the curriculums as well as the presence of courses on ethics, sustainability, and corporate social responsibility (CSR). It also considers the integration of special programs like MBA, practicums, internships, and study tours.
Principle 4: Research	"We will engage in conceptual and empirical research that advances our understanding about the role, dynamics, and impact of corporations in the creation of sustainable social, environmental and economic value."	The analysis focused on assessing the availability of financial support for research teams, the inclusion of ethics/responsibility in research agendas, and the presence of related publications, conference presentations, and research accolades. It also included the identification of dedicated ethics and/or responsibility research units, such as institutes. We also
Principle 5: Partnership	"We will interact with managers of business corporations to extend our knowledge of their challenges in meeting social and environmental responsibilities and to explore jointly effective approaches to meeting these challenges."	The analysis focused on the tracible signs of partnerships with businesses and government such as joint projects, industry leader involvement in education, and financial support. The analysis also included the evaluation of collaborations with other institutions and students, such as student organizations, exchange programs, and networking opportunities.
Principle 6: Dialogue	"We will facilitate and support dialog and debate among educators, business, government, consumers, media, civil society organizations and other interested groups and stakeholders on critical issues related to global social responsibility and sustainability."	The analysis focused on evaluating the dissemination of communication tools including conferences, reports, websites, symposia, social media, and alongside policies explicitly supporting renewable energy, emission reductions, and responsible HR practices.

Once organization signs up for PRME, as Lorejo-Cosape and Velos-Decang (2023) note, institutions are obliged to "routinely share information about their work in progress; otherwise, they will be removed as signatories. Active participation in the UN PRME program by signatory institutions includes reporting on success to other business

schools and others" via the so-called "SIP reports." This approach is building upon the methodology introduced by Stachowicz-Stanusch (2011), and further developed in Stachowicz-Stanusch, Contu, and Alami (2024), to systematically examine relevant initiatives within exemplary SIP reports for each of PREM six principles See Table 2 for specific examples. It does so to assesses the best practices of incorporation of pedagogical strategies, such as: the integration of case studies into the curriculum, the inclusion of collaborative team projects, joint ventures with industry or other organizations, and various other curricular enhancements.

Results

The following results are based on data collected, analysed, and included here as examples within tables coming from different SIP reports from four universities across UAE: Canadian University Dubai (CUD) (Canadian University Dubai 2023), The British University in Dubai (BUiD) (The British University in Dubai 2021), Abu Dhabi School of Management (Abu Dhabi School of Management 2022), and Mohammed bin Rashid School of Government (Mohammed bin Rashid School of Government 2020). Examples are extracted from respective SIP reports that each of the four universities published in a given year in a period between 2020-2023. This cross-institutional synthesis highlights both commonalities and distinctive approaches of PRME principles adaptation. As such, the following discussion offers a nuanced understanding of how PRME principles can be operationalized via concrete examples.

Principle 1: Purpose

PRME Principle 1: Purpose focuses on aligning educational aims with broader sustainability goals by, e.g., equipping students with skills to create sustainable value for both business and society (see Table 3 for examples). A recurring theme across institutions analysed in this paper is sustainability-oriented activities for and by students. Students are positioned as key actors in translating sustainability principles into real-world outcomes. These initiatives not only foster experiential learning but also enhance student ownership over social and environmental impact. The examined universities also demonstrate a deliberate effort to link sustainability education with community well-being, further centring their focus on students. Canadian University Dubai (CUD)'s and Abu Dhabi School of Management (ADSM)'s focus on mental health and wellbeing, and Mohammed bin Rashid School of Government (MBRSG)'s framework for humanitarian aid and societal resilience, reflect a broader understanding of sustainability as encompassing social equity and public value creation. These practices extend the reach of responsible management education beyond the classroom, engaging both the campus and the campus community in shared transformation.

Across all four institutions, there is a visible alignment with the SDGs. It is particularly visible in the incorporation of social responsibility and ethical leadership into curricular and co-curricular experiences. CUD, for instance, mandates the integration of sustainable and social entrepreneurship in its ENT 141/142 courses. We can argue that as a general guideline, degree programs should indeed strive to integrate sustainability principles with explicit references to the SDGs to ensure better alignment with PRME. Beyond the curriculum, PRME's Principle 1 is also institutionalized through formal policy frameworks and strategic objectives. The British University in Dubai (BUiD) exemplifies this with its Sustainability and Community Engagement Policy, revised in 2021 to reflect contemporary

sustainability priorities. Sustainability and social responsibility should be thus also embedded within university policies, strategic plans, and quality assurance frameworks to work most effectively.

Table 3. Examples of Initiatives Pertaining to Principle 1: Purpose

Principle	Publication Year	Example (directly quoted from the respective reports)	University
Principle 1 (Purpose)	2023	Business Society provides a platform for students to translate theoretical ideas into practical ventures by hosing a weekly event caled "Trader Thursday," which encourages student businesses and associated student-centered initiatives, and also enables CUD students, staff, and alumni to show support.	Canadian University Dubai
	2023	Within the Department of Environmental Management, the students strive to make a positive impact in the environment by increasing awareness of environmental issues within Health and Environmental Society.	Canadian University Dubai
	2023	CUDcares focuses on social responsibility and community involvement by seeking and organizing volunteering opportunities.	Canadian University Dubai
	2023	ENT 141/142 Teaching programs have a mandatory focus on social and sustainable entrepreneurship that must be aligned with solving global chalenges that are linked to UN SDGs.	Canadian University Dubai
	2023	CUD's Student Success Centre (SSC) is dedicated to helping the university's students thrive academically, socialy, and personaly by providing then with additional help and support.	Canadian University Dubai
	2022	ADSM Cognitive Diversity Metrics is an indicator of people with different backgrounds and/or knowledge, employed by an organisation [as well as the student body].	Abu Dhabi School of Management
	2022	Under the Community Engagement activities, ADSM has organized several events e.g., (…) Mental Health and Well-being in the time of COVID-19 (…); Creating Collaborative Communities: Ma'an University Roadshow (…); Heartsaver Month: CPR Workshop	Abu Dhabi School of Management
	2021	BUiD has adopted a Sustainability and Community Engagement Policy since 2012; the policy was revised in 2021.	The British University in Dubai
	2021	BUiD's team 'Harmony', comprising of 18 students and alumni, (…) [participated] in the Solar Decathlon ME design competition organised by Dubai Electricity and Water Authority (DEWA) (…) [during] Dubai Expo 2020.	The British University in Dubai
	2021	BUiD won the Energy Management award for the Middle East's region in a virtual ceremony organised by the Association of Energy Engineers (AEE) on 14 October 2020.	The British University in Dubai
	2021	BUiD won the Award for its accomplishments in developing, organising, managing and implementing an outstanding Corporate Energy Management Programme.	The British University in Dubai
	2020	The vision is to develop a comprehensive humanitarian aid and social framework that adopts and implements a culture of creating hope and building a better future for societies	Mohammed bin Rashid School of Government

Furthermore, institutional recognition through awards and metrics, such as ADSM's cognitive diversity metrics, reinforces the internal and external accountability mechanisms required to sustain a culture of responsible education with sustainability as its purpose. In line with ADSM's cognitive diversity metrics, universities should develop mechanisms to recognize and leverage diverse student and faculty backgrounds as a resource for inclusive and

innovative thinking on sustainability issues. Initiatives like MBRSG's focus on social frameworks and BUiD's involvement in energy innovation projects further demonstrate the value of such approaches.

Principle 2: Values

PRME Principle 2: Values, evaluates how institutional values reflect through strategies, codes of conduct, ethics units, evaluation tools, and accessible responsible management resources. Across all four institutions, there is a great interest to co-develop curriculum with accreditation partners to ensure that sustainability, inclusivity, and social responsibility are central to technical competencies (see Table 4). CUD demonstrates a commitment to professional ethics and standards through its integration of internationally recognized accreditations into its degree programs. This alignment ensures that students are not only academically prepared but also equipped to meet the ethical and operational standards of global industries.   Similarly, at ADSM, the learning outcomes of the MS in Leadership and Organizational Development are anchored in the ability to critically engage with ethical and cultural dilemmas in organizational settings.

Indeed, it also appears that institutions must *walk the talk* by embedding sustainability and ethical responsibility into their day-to-day operations. For example, ADSM extends the concept of values beyond individual student competencies by undertaking institution-wide transformations such as becoming a paperless campus and developing executive education in carbon reporting and mitigation. The deployment of ERP software like Odoo also aligns institutional practice with broader environmental goals, linking digital transformation with sustainability. Whether through digital transformation, green campus initiatives, or transparent governance, universities should demonstrate the values they aim to nurture in students.

Across the four institutions analysed here, it is evident that programs that promote intercultural dialogue, social outreach, and multilingual engagement are crucial to allow students to practice empathy and global citizenship. Such programs should be formalized within co-curricular frameworks, supported by community-based learning methodologies. The British University in Dubai (BUiD) operationalizes values through student-led volunteerism, multicultural leadership training, and entrepreneurship workshops. Participation in the international programs, conferences, and exchanges, as well as the real-life support for labourers through multilingual outreach initiatives can foster cultural sensitivity, empathy, and inclusivity, and show how the central values can be made visible, tactile, and stronger in seemingly every day professional and private life.

Table 4. Examples of Initiatives Pertaining to Principle 2: Values

Principle	Publication Year	Example (directly quoted from the respective reports)	University
Principle 2 (Values)	2023	Obtaining accreditation from recognized organizations (…) Accreditation/certification further emphasizes the university's commitment to providing quality education that meets industry standards.	Canadian University Dubai
	2023	The BBA in Human Resource Management program is aligned with the professional body of HRM practitioner knowledge, as guided by the Society for Human Resource Management (SHRM, USA). By following the curriculum and actively participating in the HRM	Canadian University Dubai

	program at CUD, students have the opportunity to sit for the SHRM Certified Professional (SHRM-CP) accreditation upon graduation.	
2022	One of the learning outcomes of the Master of Science in Leadership and Organizational Development (MSLOD) program is "Critically Evaluate the Ethical and Cultural Dimensions of Leadership", where students should be able to propose decisions on key issues around strategic leadership, culture and ethics in organizations.	Abu Dhabi School of Management
2022	The "Leadership Culture and Ethics" course (…) explores the key issues around strategic leadership, culture and ethics in organizations and business environments.	Abu Dhabi School of Management
2022	The collaborative agreement with the Energy institute – Middle East (Abi Dhabi), ADSM is developing Executive & Master's courses in Energy Management (…). The key requirements of mandatory and voluntary carbon reporting and the principles of carbon mitigation and carbon offsetting and how to relate this to the UN SDGs.	Abu Dhabi School of Management
2022	The ADSM initiative for a continuous migration towards becoming a paperless institution (…). ADSM is targeting zero waste by reducing, reusing, and recycling of used paper. For example, in 2021 ADSM introduced the Enterprise Resources Planning (ERP) software, including Odoo facility, to automate several of its services and enhance the data integrity and synchronization.	Abu Dhabi School of Management
2021	Voluntary work (…)[:] students volunteered to give support to labourers by distributing goody bags and positive messages in different languages.	The British University in Dubai
2021	Four of BUiD's postgraduate students participated in the 29th Academic Training Programme (ATP) in Multiculturalism and Leadership Skills at the Al Maktoum College of Higher Education in Dundee, Scotland.	The British University in Dubai
2021	The British University in Dubai, in cooperation with the Dubai Future Foundation "Alchemy Programme", launched a series of entrepreneurship workshops and training Sessions (…) to encourage students to develop start-up ideas into the final stage of implementing them.	The British University in Dubai
2021	BUiD held its Fifth Doctoral Research Conference online on 20 March 2021. More than 70 research papers were presented by BUiD postgraduate students in areas of education, management, finance, Blockchain, sustainability, computer science, AI and cyber security.	The British University in Dubai
2020	MBRSG (…) launched the Dubai Policy Review, which is published in English and Arabic.	Mohammed bin Rashid School of Government

Higher education institutions should also create avenues for student research and civic engagement. Such engagement is not only yet another way to take sustainable values from the classroom to the real world, but also it constitutes an opportunity for students to observe the roles of sustainability in, e.g., public discourse and national policy frameworks. At a systemic level, MBRSG anchors the Values Principle through the Dubai Policy Review, a bilingual publication aimed at shaping inclusive and evidence-based public policy. This reflects an institutional commitment to advancing values-driven governance and civic leadership as a public good, as ties back to the *walk the talk* argument from the previous paragraph. As also clear in MBRSG's policy publication work, embedding students and faculty in the processes of policy innovation and dissemination enables a more expansive understanding of values-based leadership. Furthermore, initiatives like BUiD's cooperation with the Dubai Future Foundation to develop student-led entrepreneurship reflect the importance of linking ethical values to innovation ecosystems and outside classroom

encounters with real world scenarios. Institutions should facilitate such cross-sectoral platforms to amplify the visible impact and assuring of the growth of Values principle.

Principle 3: Method

PRME Principle 3: Method assesses integration of ethics, sustainability, diversity, and CSR into curricula, including practical programs like internships and MBAs. Institutions seem to understand the need to move beyond isolated courses on ethics or sustainability and, instead, to include ethics and sustainability horizontally and vertically across disciplines (see Table 5). For example, CUD offers a compelling example of embedding ethics and environmental responsibility across disciplinary boundaries; the Business Ethics and Social Responsibility course targets ethical decision-making within managerial contexts, while Ethics for Computing Professionals bridges sustainability and ethics with emerging technologies—emphasizing the societal implications of tech innovation. Additionally, the course Marine and Air Pollution connect environmental science with socio-economic consequences. At ADSM, ethics and responsibility are codified into the learning objectives of core graduate programs. Both the MBA and the MSc in Leadership require students to demonstrate ethical judgment and cultural awareness in decision-making. This deliberate curricular scaffolding reinforces the cognitive dimensions of a sustainability mindset, moving ethical reasoning from abstract values into applied, discipline-specific competencies.

Promotion of experiential, interdisciplinary, and team-based learning is yet another common themes in across institutions analysed here. Courses like ADSM's Signature Learning Experience (SLE) exemplify how learning by doing can significantly enhance ethical awareness and systems thinking. BUiD highlights the role of student-led research in exploring well-being and sustainability. For instance, a student-led webinar on well-being and obstacles during COVID-19 pandemic reflects how institutions can support reflexivity and real-time learning around contemporary challenges. To institutionalize such experiential models of learning and expression is to create opportunities for students to lead research and public discussions and, thus, to cultivate the reflective dimension of responsible leadership and promote a sense of agency among students.

Table 5. Examples of Initiatives Pertaining to Principle 3: Method

Principle	Publication Year	Example (directly quoted from the respective reports)	University
Principle 3 (Method)	2023	Course (…) Business Ethics and Social Responsibility (…) examines the practical issues of managers in addressing ethical and moral problems in business.	Canadian University Dubai
	2023	Course (…) Ethics for Computing Professionals (…) covers the topics of ethics for computing and IT professionals, users, and organizations.	Canadian University Dubai
	2023	Course (…) Marine and Air Pollution (…) focuses on marine water and indoor and ambient air, with an emphasis on the sources and types of polutants, the health effects and the economic consequences of exposure to polutants and environmental degradation [and its management].	Canadian University Dubai
	2022	Master of Business Administration (…) [teaches students to] demonstrate the ability to make decisions based on ethical values and social awareness.	Abu Dhabi School of Management

2022	Master of Science in Leadership (…) [teaches students to] critically evaluate the ethical and cultural dimensions of leadership.	Abu Dhabi School of Management
2022	The Signature Learning Experience (SLE) course (…) provides learning experience that entails small teams of students creating and developing an entrepreneurial project. As a result, students receive first-hand experiences in entrepreneurial decision-making while integrating the diverse knowledge areas of MBA core courses.	Abu Dhabi School of Management
2022	ADSM organized a series of public lectures on entrepreneurship, leadership, innovation, business analytics, AI fundamentals, socio-economic development during the pandemic.	Abu Dhabi School of Management
2022	ADSM offers four Master courses that include different aspects of Responsibility, Ethics and Sustainability.	Abu Dhabi School of Management
2021	[In a webinar,] a BUiD student, discussed their research paper, 'Teacher Well-being During COVID 19'. The research looked at the challenges faced by teachers and identified areas where more support is needed.	The British University in Dubai
2020	The MPA program provides in-depth academic and applied knowledge in some of the taught modules on SDG solutions being implemented in the local and global context.	Mohammed bin Rashid School of Government
2020	Students on the program often contextualize their research in line with the SDGs that are embedded within the national agenda when they study topics.	Mohammed bin Rashid School of Government
2020	MBRSG offers two sustainability modules within its Master of Public Policy (MPP) program; Global Sustainable Development – the Challenge and Sustainable Development and Regional Policy in Practice which, together with the dissertation, comprise the MPP sustainable development specialization.	Mohammed bin Rashid School of Government

Another method reported across the four institutions analysed here is allowing for various modes of public engagement and societal relevance. For example, ADSM advances PRME's Method principle by public lecture series on entrepreneurship, leadership, and socio-economic development. Community events and partnerships with public institutions can extend the learning environment beyond the classroom. MBRSG not only integrates the UN SDGs directly into the Master of Public Administration (MPA) and Master of Public Policy (MPP) curricula but also allows its students to engage with national SDG implementation through case studies and research collaborations with the UAE's Federal Competitiveness and Statistics Authority (FCSA).

Principle 4: Research

PRME Principle 4: Research examines institutional support for research in ethics and responsibility, including dedicated units, funding, scholarly output, and recognition through awards or conferences. Active participation in regional and international academic forums—such as CUD's role in PRME Regional Conferences—helps institutions foster intellectual communities around sustainability (see Table 6). Hosting and contributing to symposia, roundtables, and public lectures on sustainability should be thus integral. CUD's active participation in networks such as the Silk Road Universities Network and its role as co-organizer of the 9th PRME Regional Forum reflect a deliberate

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orientation toward research diplomacy and transnational collaboration. Similar can be said of producing high-quality research and meaningful publications. For example, at ADSM, the emphasis is placed on institutional use of Scopus and Google indexing to evaluate research impact as a robust quality assurance mechanism.

Yet, as all four institutions report, collaborations should not only take place *outside* the university and across institutions and scholars, but also *within* the university. ADSM actively involves students in the research process, both independently and in collaboration with faculty. This inclusive research model directly supports the development of a sustainability mindset among students by positioning them as co-creators of responsible knowledge. Institutions should thus expand opportunities for undergraduate and graduate students to co-author papers, participate in funded projects, and present at academic conferences. In a similar spirit, BUiD fosters research through centralized governance mechanisms such as the University Research Committee, which promotes cross-disciplinary collaboration and supports research clusters. The establishment of the Centre for Research in Digital Education (CRDE) demonstrates institutional foresight in addressing future-oriented challenges such as digital sustainability in education. This dual emphasis on governance structures and thematic specialization enhances the systemic capacity of the institution to produce research aligned with societal needs and sustainable transformation. Such establishment of research committees and centres can serve as institutional mechanisms to coordinate interdisciplinary research.

Table 6. Examples of Initiatives Pertaining to Principle 4: Research

Principle	Publication Year	Example (directly quoted from the respective reports)	University
Principle 4 (Research)	2023	CUD has pursued faculty-to-faculty collaborations to advance research with societal impact, while establishing strategic partnerships with both Canadian and international universities.	Canadian University Dubai
	2023	Several institution-to-institution partnerships being developed.	Canadian University Dubai
	2023	The hosting of conferences is an essential part of sustaining strategic partnerships. CUD has brought together speakers from across the globe to discuss the emerging challenges and opportunities.	Canadian University Dubai
	2023	CUD is also a member of the Silk Road Universities Network, consisting of 79 universities from across 28 nations.	Canadian University Dubai
	2022	CUD co-organized the 9th PRME Regional Forum and 2022 Conference	Canadian University Dubai
	2022	ADSM faculty are now actively publishing research articles in high-ranked Scopus indexed journals. To assess the quality of the research output, ADSM uses a matrix based on Scopus and Google indexing.	Abu Dhabi School of Management
	2022	ADSM Case Center (…) is producing world-class case studies on a variety of topics including sustainability, leadership, and corporate social responsibility.	Abu Dhabi School of Management
	2022	ADSM students have been assigned an important role as participant in research and scholarly activities. They have independently produced, researched and published research articles in Scopus-indexed journals. Other students have produced joint research articles with ADSM faculty.	Abu Dhabi School of Management

2021	The operation of the University Research Committee, which identifies cross-faculty research clusters, pools resources from all programmes and their respective associates, enables major research initiatives, and assesses research proposals, allying student and early research activity with that of established academic researchers.	The British University in Dubai
2021	In its efforts to support research and innovation in the UAE, BUiD has established: The Centre for Research in Digital Education (CRDE). This is the UAE's first non-profit research centre which focuses solely on digital education within the Middle East.	The British University in Dubai
2020	MBRSG has three primary tracks: Policy and Scholarly Research, Regional Development Activities, and Policy Advisory. A key research philosophy is evidence based policy research, and to help bridging the gap between theory and practice, practice and what is needed for future evolving government needs.	Mohammed bin Rashid School of Government
2020	The Dubai Public Policy Review's second volume (…) was focused on Sustainable Development.	Mohammed bin Rashid School of Government

The commitment to bridging theory and practice resonates strongly with PRME's vision of research as a means of catalyzing sustainable value creation. Such approach is visible particularly in MBRSG, which grounds its research strategy in a three-pronged model: Policy and Scholarly Research, Regional Development Activities, and Policy Advisory. Its publication of the Dubai Public Policy Review, particularly the volume dedicated to Sustainable Development, illustrates how academic research can be transformed into a tool for public discourse and evidence-based policymaking. MBRSG's model of promoting research for policy impact and societal benefit, that shows real-life examples of translation of research into policy, is a best-practice framework. Institutions should allow visibility or spaces for policy labs or advisory units that can synthesize academic research into white papers, policy briefs, and consultation reports for governmental and international bodies.

Principle 5: Partnership

PRME Principle 5: Partnership looks at collaborations with business, government, and other institutions, involving joint projects, guest leaders, funding, and opportunities for student exchange and engagement. Whether the collaboration is with a multinational corporation or a local NGO, sustainability metrics, such as environmental impact, ethical innovation, or social inclusion, should be included in Memorandums of Understanding (MoU) objectives and partnerships (see Table 7). For example, CUD has developed high-impact collaborations with both global corporations and technology leaders. Notable examples include a partnership with PepsiCo aimed at reducing single-use plastic waste on campus, a tangible environmental initiative that brings corporate sustainability goals into the university setting. These partnerships provide students with direct access to tools, practices, and mentorship aligned with global industry standards in sustainability. Similarly, ADSM exemplifies a multi-sectoral partnership strategy that spans local, federal, and international domains. Its collaborations with e.g., Emirates Nuclear Energy Corporation (ENEC) and the Zayed Charitable and Humanitarian Foundation, demonstrate how partnerships can integrate social, environmental, and economic priorities. BUiD's collaboration with Saint-Gobain UAE focuses on energy efficiency

and retrofitting for sustainable built environments. Another partnership with Global Innovation Institute (GInI®) via Al Tafaouq Al Elmi facilitates certification programs in innovation management.

Table 7. Examples of Initiatives Pertaining to Principle 5: Partnership

Principle	Publication Year	Example (directly quoted from the respective reports)	University
Principle 5 (Partnership)	2023	CUD became an academic key partner with Autodesk, a global leader in design and technology. The agreement was signed and facilitated by leading training centre, Omniplan, and qualifies CUD to teach courses on Autodesk programs.	Canadian University Dubai
	2023	CUD partnered with global Foods and Beverages company, PepsiCo, to help promote environmental sustainability through the reduction of single-use plastic on campus.	Canadian University Dubai
	2023	CUD's partnerships with schools and universities provides valuable opportunities to engage with faculty experts, gain hands-on experience, and build professional networks.	Canadian University Dubai
	2022	ADSM is actively working on both international and national MOUs to bolster its partnerships and cooperation with industry and governmental organizations. Few examples (…) include (…) Emirates Nuclear Energy Corporation (ENEC), Abu Dhabi Youth Council, Zayed Charitable and the Humanitarian Foundation.	Abu Dhabi School of Management
	2022	ADSM has finalized its partnership agreement (…) to collaborate and gain experience with sustainable leadership courses (…) to conduct collaborative research in a number of areas related leadership, sustainability, (…), etc.	Abu Dhabi School of Management
	2022	ADSM and EI-Middle East entered into agreement to explore the opportunity to develop and deliver an executive program "Executive Leadership Program – Leadership in Energy". The program is designed to support Executives with 5 to 10 years of experience within the Energy and Energy related industries in their career.	Abu Dhabi School of Management
	2021	BUiD signed a collaborative agreement with Al Tafaouq Al Elmi to deliver the certification programmes of the Global Innovation Institute (GInI®) in Dubai.	The British University in Dubai
	2021	BUiD and Saint-Gobain UAE signed a collaborative MoU on academic research and innovation. The MoU will align the two organisations' efforts to conduct research in the field of energy efficiency and the built environment through deep retrofitting.	The British University in Dubai
	2022	BUiD has collaborated with Siemens and AEE to organise free training sessions for members in the UAE.	The British University in Dubai
	2022	In 2019 we had 96 MOUs, Service contracts, training agreements and consultancy projects (…). MBRSG actively works with the UAE government at many levels (federal, emirate and local).	Mohammed bin Rashid School of

		Government
2020	MBRSG entered into an MOU with Microsoft Gulf FZ LLC for a ten-year sponsorship and collaboration	Mohammed bin Rashid School of Government
2020	MBRSG worked closely with the Institute to develop a strategic plan and training program on Tolerance.	Mohammed bin Rashid School of Government

Another tangible way of materializing such partnerships is by co-designing sector-specific executive and professional education programs, ADSM co-developed the Executive Leadership Program – Leadership in Energy in collaboration with EI-Middle East, targeting mid- to senior-level professionals in the energy sector. BUiD also delivers free CSR-based training in partnership with Siemens and the Association of Energy Engineers (AEE), reinforcing the institution's mission of social contribution and industry empowerment. These initiatives enable the university to co-create practical learning solutions in areas where sustainable leadership is most urgently needed. Such collaborations offer real-world learning experiences while driving sectoral sustainability transformations.

Establishing policy innovation centres, hosting regional dialogues, and collaborating with ministries can position universities as thought leaders and co-creators of national sustainability agendas. MBRSG is rather distinct in its systemic approach to partnership, yet its example outlines a much-needed point of view for operationalization of PRME principles on institution-level. MBRSG collaborates extensively with UAE government bodies at all administrative levels. A particularly impactful initiative is its ten-year collaboration with Microsoft Gulf to establish a Policy Innovation Center, focusing on regional reform and sustainable governance. MBRSG has also led initiatives in policy training on tolerance, linking academic, governmental, and global networks in the pursuit of sustainable development and responsible public leadership. Following MBRSG's model, academic institutions should play a more active role in public policy development or highlight the presence of such possibility.

Principle 6: Dialogue

Principle 6: Dialogue assesses use of communication platforms (e.g., events, media, reports) and commitment to sustainable operations like energy use, emissions, and HR practices. As all four institutions canalized here report, dialogue is not limited to classroom or formal curricula but is embedded in institutional culture through forums, campaigns, and public knowledge exchange (see Table 8). CUD foregrounds student-led initiatives and engagement for fostering responsibility and the Sustainability Mindset. MBRSG centres its actions around public policy discours with government stakeholders and the organization of high-profile platforms such as the UAE Public Policy Forum, which demonstrates an institutional ambition to impact macro-level governance.

The integration of online communication modes (e.g., LinkedIn expert networks, social media publications) signals an adaptive model of dialogue that transcends the material campus (perhaps a reminiscence of the post-pandemic modalities). The use of digital platforms to disseminate knowledge (e.g., MBRSG's "Ask an Expert") aligns with a broader goal of inclusive and equitable education. All four institutions analysed here aim to establish interactions across micro (students), meso (faculty, alumni), and macro (government, civil society) levels. This multi-scalar

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engagement enhances systems thinking and prepares students for sustainability leadership in complex, interconnected environments.

Table 8. Examples of Initiatives Pertaining to Principle 6: Dialogue

Principle	Publication Year	Example (directly quoted from the respective reports)	University
Principle 6 (Dialogue)	2023	CUD offers a range of extra-curricular events and career resources that align with the commitment to the Principles for Responsible Management Education (PRME) and the United Nations' Sustainable Development Goals (SDGs). (…) CUD is dedicated to promoting student-led and student-oriented initiatives that advance sustainable development and societal impact. The university holds the belief that by empowering students, they are contributing towards a more promising and sustainable future for everyone.	Canadian University Dubai
	2023	CUD is promoting and sharing its core values of tolerance, integrity, equity, and diversity. These core values are central to the mission of the institution and are primordial to assure an inclusive environment.	Canadian University Dubai
	2023	Our dialogue occurs though many channels, including conferences, workshops, seminars, online portals/ media, brochures and publications, and landing pages	Abu Dhabi School of Management
	2022	ADSM's commitment to the economic, social, and environmental sustainability issues is witnessed through several ADSM faculty and students' international awards.	Abu Dhabi School of Management
	2022	ADSM is consistently promoting policy dialogue by publishing different articles and research studies on social media and journals (…). The publications take different forms such as print, landing page and/or social media announcements to create awareness among local community, policymakers and government officials in the Emirate of Abu Dhabi, and the wider public.	Abu Dhabi School of Management
	2021	As part of BUiD's support for research and knowledge activities, students are encouraged to be actively involved in research visits to universities and research centres around the world.	The British University in Dubai
	2020	(…) launched the 'Government Knowledge Gate' as a smart platform to facilitate knowledge exchange on best practices of local and global government entities.	Mohammed bin Rashid School of Government
	2020	MBRSG's Emirates Centre for Government Knowledge launched an "Ask an Expert" in May 2020 to create a valuable source of applied public management knowledge on the internet.	Mohammed bin Rashid School of Government
	2020	In cooperation with the Digital Government Society (DGS), the Mohammed bin Rashid School of Government organised the 20th Annual International Conference on Digital Government Research in June 2019 under the theme 'Governance in the Age of Artificial Intelligence'.	Mohammed bin Rashid School of Government
	2020	The UAE Public Policy Forum is an annual event and free to all participants. The conference theme of the 17-18 February 2020 event was "Agile Government: Becoming Future-Proof."	Mohammed bin Rashid School of Government

Conclusion

This paper demonstrates the different operationalizations of PRME's Principles in the UAE context ensuring both curricular and institutional coherence. Higher education institutions must embed ethics and social responsibility not

only in what they teach, but also in how they function as organizations and civic actors. This paper shows that a roadmap for cultivating the Sustainability Mindsets should be based upon in-class, institutional, and societal linkages. This comparative analysis of strategies reported by the four UAE-based institutions reveals rich and varied examples of how institutions can design and deliver sustainability, ethics, and responsibility at the core of education. Spanning curriculum design, public engagement, and SDG-aligned research, the roadmap outlined here show how examples of how to develop a sustainability mindset in accordance with PRME Principals.

This analysis also demonstrates how strategic implementation of PRME Principles creates a distinctive, locally grounded model of sustainability dialogue that blends values-based education, technological innovation, and policy engagement in a local context. Indeed, in practice, as this paper shows, the realization of PRME principles expands the institutions' role from an academic to a collaborative actor within a larger ecosystem. The data drawn from UAE universities' PRME reports illustrates how these principles is being deployed not merely as a tool for institutional prestige, but as a critical lever for social impact, sustainability-oriented innovation, and capacity building across sectors.

Just like businesses do, businesses education has to change to meet the demands of a rapidly changing world; the urgent need for more focus on sustainability and cultivation of the Sustainability Mindset is one such demand. Yet another demand, more recently, has been posed by the outburst of Artificial Intelligence (AI) technologies. In a more productive – and less pessimistic - view, AI emerges as both a catalyst and as a tool for embedding the PRME principles into the fabric of academic institutions. When thoughtfully integrated, AI might empower educators and students alike to cultivate the mindsets and frameworks necessary responsible the world. However, the deployment of AI within this context must itself be governed by PRME values—ethical conduct, inclusivity, human rights, and environmental stewardship. Indeed, higher education institutions Universities should see themselves as holding a unique responsibility to critically examine and guide the development and application of AI technologies in ways that align with sustainable development goals (SDGs) and broader societal well-being; and how it is to be accomplished remains one of the major challenges that higher education institutions are now facing.

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The Influence of Lexis and Praxis on Modern Georgian Political Discourse

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Abstract: This research examines the characteristics of language behaviors from Georgian into English and Russian as used by Georgians in Georgia in the context of the current political situation depicted in social media (Facebook and Instagram). The study focuses on 1. the functional classification of language behaviors and lexical items used by Georgians Facebook and Instagram users, 2. the structural classification of these language behaviors and lexical items, 3. how these lexical items are established as propaganda in the socio-political spares. Therefore, based on the data collected between March 2023 – July 2024, the results show that there were almost 5000 Facebook and Instagram posts, in which the most frequent topics evolve around the EU integration process demonstrations protesting the law on foreign agents and the election and post-election periods. By using CDA (Fairclough, 1992), we analyzed the three dimensions of Georgian political discourse. The collected examples incorporate more code-switching (1105 cases) (mostly exclamatory (1005) and interrogative (45) sentence types) than code-mixing (15 cases) (mostly nouns (10), adjective (3) verb (2)) behaviors. Some examples of neologisms (18 phrases, 16 nouns, six adjectives, and one verb; and five conceptual metaphors found referring to the Georgian politicians and the current political situation in Georgia depicted on Facebook and Instagram posts. The given examples were analyzed quantitatively through the SPSS Statistics (110 responses) to measure the validity and frequency of their utilization. Moreover, the above-mentioned lexical items are not coined by Facebook and Instagram users but by formal political and social institutions; these are the authoritative individuals who can persuade the masses—for instance, the statements of politicians and influential social features. This propaganda's success is determined by its language being trivial, repetitive, intensive, and flexible to the socio-political challenges. Thus, these lexical items are legitimated through propaganda and, therefore, are indoctrinated within society. This metamorphosis of lexical items is a novelty for the Georgian reality but not unique since it has always been a common practice for a modern Russian worldview. In conclusion, this sociocultural practice, which has become a common practice daily, contradicts and splits Georgian society.

Keywords: Political Discourse, Propaganda, Lexical Items, Indoctrination, Discourse of Social Media

Introduction

Using multiple languages in speeches is a weapon for politicians to show their language competence, spread their

power and influence, persuade people, and express their attitudes. Switching between languages in spoken political discourse is expected to be either conscious or unconscious, but in typed political discourse, it is premeditatedly featured in the typed speech. We contend that no text is neutral, including that which involves code-switching. Political speech, in particular, is strategically planned to be convincing, to appeal to the emotions of voters, to portray a particular political persona (Corner, 2003), and to "construct alliances and membership" (Wodak, 2004). Code-switching is a natural practice for bi and multilingual individuals, and its use in political campaigns is becoming increasingly common worldwide (Opeibi, 2007). Since political leaders' use of CS is conspicuous, our research aims to investigate neutral citizens' (Georgians with no political background) eagerness to use two or more languages while expressing their viewpoints and attitudes in the context of a current political affair in Georgia (in our paper – Foreign Agents Law - so-called "Russian Law"). Hence, the study aims to answer the following questions: 1. functional classification of language behaviors and lexical items used by Georgians Facebook and Instagram users; 2. the structural classification of these language behaviors and lexical items; 3—how these lexical items are established as propaganda in the socio-political spares.

To acknowledge these questions, we must first illustrate the standard peculiarities of political discourse and code-switching as an important verbal strategy in political discourse with which one can achieve pragmatic and strategic functions without assuming the responsibility or the risk of being put on record (Obeng, 1997). Previous studies related to code-switching in written discourse will be reviewed for their contribution to our understanding of how people use multiple languages, dialects, and codes to express their attitudes and civic awareness.

Research Framework

The following section will review existing research papers on the fluid use of languages within political discourse. Although there are some studies done on CS and CM spoken behaviors in the Georgian higher and general educational settings (Buskivadze, 2021, 2023), not much has been done in terms of studying language behaviors in written political discourse. However, some studies are on political discourse's pragmatic, functional, and structural peculiarities (Amaglobeli, 2017; Matchavariani, 2020). Thus, this article aims to study Georgian language behaviors in typed political discourse through social media (Facebook, Instagram). The present study seeks to understand this genre's functional and structural loading of language behavior and how these lexical items are established as propaganda in the socio-political spares.

Our framework is focused on discovering the strategies and structures employed in the discourse of Georgian citizens posting about the so-called Russian Law. For this purpose, the framework of critical discourse analysis (e.g., Chilton, 2004; Fairclough, 1992; Dijk, 1997; Weiss & Wodak, 2003) is considered suitable for uncovering agendas and strategies (e.g., code-switching) of the Georgians in the light of the concepts of power and dominance. The study claims that code-switching in political discourse is an interpersonal strategy that can be used to create, strengthen, or destroy interpersonal boundaries. Thus, it functions as a discourse strategy for pragmatic and strategic purposes (Wei, 2005). Besides the qualitative studies, the research encapsulates the quantitative research conducted with the help of Google Forms and then analyzed through SPSS Statistics to measure, on the one hand, validity and, on the other, frequency of using the lexical items gathered quantitatively. While language use in political campaigns, interviews,

and speeches has been widely researched, few studies have examined how monolingual, bi-, and multilingual social media statuses typed in Georgia have used these discourse features.

Method

Language behaviors in Georgian settings were mainly studied with the help of conversational analytic and interactional sociolinguistic approaches. Since this study deals with typed discourse, we found CDA (Critical Discourse Analysis) to be the most appropriate implementation. CDA is concerned with how power is exercised through language. It is an interdisciplinary approach to the study of discourse that views language as a form of social practice. Norman Fairclough assumes that any case of language is a communicative event. He has developed a model which consists of three categories.

Picture 1. Norman Fairclough's 3D model of Discourse Analysis (1995)

> **Dimension 3**
> The sociocultural practices of the community (the habitual ways that people relate to each other and to their environment)
>
> > **Dimension 2**
> > The discourse practices of the community (the habitual ways that people speak and structure this kind of text)
> >
> > > **Dimension 1**
> > > Text (Spoken, written, typed)
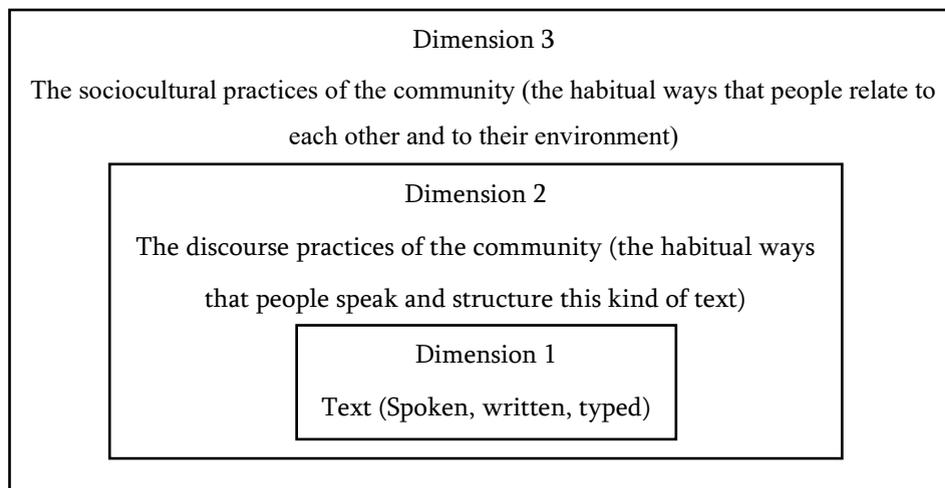
The three dimensions are summarized as follows: Dimension 1. Text - speech, writing, images, or a mixture of all three forms of communication description – the formal properties of the text, involves the analysis of the language of the texts and includes features such as lexis, grammar, cohesion, and text structure; Dimension 2. Discursive Practice – interpretation - analysis takes place at the text level; looking at discourse in this way means paying attention to the force of utterances, coherence of texts, intertextuality, and interdiscursivity; Dimension 3. Social practice – explanation – is concerned with the relationship between interaction and social context, the social determination of the process of production and interpretation, and their social effects (Fairclough, 2003, p. 26). the three steps are closely related. None of them are indispensable. With the three successive steps united, the hidden knowledge of linguistic, inter-textual, and social factors can be exposited in the social media discourse analysis. Critical discourse analysis is instrumental when you need to determine what the sender wants to convey to the recipient and what behavior the sender wants from the recipients. The following section will analyze our discourse through CDA. However, it is sometimes regarded to be subjective. The quantitative data was gathered and analyzed to prove the objective nature of our analysis. For the objective explanation, I conducted quantitative research and collected 110 Facebook and Instagram users).

At the first stage of our qualitative research, each status was examined (overall 5000 posts on Instagram and Facebook), after which all instances of code-switching (1105 posts), code-mixing (15 posts) (switches from Georgian into English and Russian), political neologisms (106 posts), metaphors (49 posts) were highlighted (in which the metaphors (5) and neologisms (41) presented below were repeated a couple of times). Each instance was coded based on shared political discourse strategies to determine the purpose of code-switching, neologisms, and metaphors. Each instance was categorized based on its political function, and each text could be categorized as serving multiple functions.

Fairclough's analytical approach assumes that language helps create change and can be used to change behavior, and language becomes a powerful tool. The first dimension is called text. Discourse is a collection of words and characters we choose when writing, typing, or speaking. By choosing specific words, we show our attitude to the subject. We found **3704** posts with #notorussianlaw written by Georgians on Instagram and Facebook. These people think that Foreign Agents Law is Russian law, while the party who voted for it calls it the "The Law of Transparency." By calling it 'Russian' or 'Transparency,' people express their attitudes towards the law, Russia, and the political party responsible for enacting it. Discourse is about language as a community. The words we choose make us feel we are part of a community. Thus, analyzing the discourse around the law, Georgians are divided into two distinct communities. The interpretations are as follows: one (primarily those who are supporters of the government) thinks the law is for transparency, and the others (the rest of the Georgians and not only) call it Russian.

Table 1. Detailed Explanation of Norman Fairclough's 3D Model of Discourse Analysis (1995)

Dimensions	Explanations
1. Text (the word level)	• **Lexis** – choice of words, patterns in vocabulary, metaphor • **Grammar** – e.g., passive instead of active, modal verbs, nominalization. • **Cohesion** – e.g., use of conjunctions, use of synonyms • **Text structure** – e.g., problem-solution, cause-effect, turn-taking in conversation.
2. Discourse Practices (production, distribution, consumption of the text)	• **Force of utterances -** it does not look for a direct-action response from the reader in the form of physical activity, but it is a rhetorical given. • **Coherence of Texts** should be considered a "property of interpretations" rather than a "property of text." • **Intertextuality links a text to other texts and** its context. • **Interdiscursivity -** when texts are made up of heterogeneous elements or various discourse types, such as a mix of formal and informal language in newspaper articles (Fairclough, 1992: 83).
3. Sociocultural Practices (the norm level)	• Discourse contributes to the formation and reflection of social structures. • Social practice builds social identities and social relationships. • Social practice contributes to the system of knowledge and trust.

By critical discourse analysis, we understand that language can be a bearer of change. The words we use and how we compose our sentences are essential, and how we talk about a subject can change our view. Text is almost always subject to interpretation. Language is not neutral and innocent. It often contains values, attitudes, and assessments the sender will convey to the recipient. Language creates opinions and characterizes our attitudes, social relationships,

and practices. Languages are associated with power; they are part of our communication, which is a social event. Language and the choice of words form the context of our social community.

Languages and communications are also closely linked to the society in which we are located. In this connection, society can be an organization with certain norms and traditions. The sociocultural practice of the community is set by implementing propaganda through the political background, which needs to be analyzed to provide a versatile view of the Georgian political setting.

On June 17, 2022, the European Union granted candidate status to Ukraine and Moldova. Simultaneously, Georgia was given a European perspective, which was followed by protests from Georgian citizens. Criticism was directed at the government's policy, as Georgia had been recognized as the leading country on the path to EU membership for the past decades. In response to the protests, the government-backed radical conservative group Alt-Info and troll bots on social media spread a narrative that Georgia was being "punished" by the West, particularly the European Union, for its decision not to join the war with Russia, which continues to wage war on Ukraine.

The propaganda message conveyed was: "The West is dragging us into a war with Russia—they are pressuring us to open a second front." The then-Prime Minister Irakli Gharibashvili remarked: "Despite numerous efforts to establish a second front in Syria, we successfully avoided it through our cautious policy." In contrast, the current Prime Minister Irakli Kobakhidze, the chairman of the ruling Georgian Dream party at the time, stated: "If we had been involved in the war, we would have secured our candidate status in December." (Online journal - Tabula.ge The West – A friend or foe? Ep: 1 - second front - The West is dragging us into war against Russia. Jun 22, 2023.)

Why do we perceive the positions presented as propaganda? At least two arguments can be given as evidence: 1. The government and its affiliated groups intentionally attempt to establish new lexical practices supported by corresponding socio-political actions. Lexis is reinforced by praxis. 2. The government's stance, along with its affiliated groups, is resistant to discussion. Any rational argument opposing their position is met with either verbal or, at times, physical aggression. It is deemed unacceptable even to pose a seemingly legitimate and completely harmless question—if the candidate's status in the war changed, why was Moldova not invited to participate? Moreover, the response was disappointingly simplistic if such a question could be asked: Moldova does not have an army. Similar methods were employed to establish propaganda narratives within society, such as the term "pseudo-liberal," which often became synonymous with "communist liberal."

A key component of propaganda is the construction of an enemy image, and during the 2000s in Russia, such an image was constructed around liberalism. The political regime countered this with a pseudo-nationalist narrative rooted in the concepts of "family sanctity," nationality, and faith. Consequently, it was unsurprising when President Vladimir Putin referred to the military operation launched by Russia in Ukraine on February 24, 2022, as an operation against denazification rather than a war. Over time, the notion of "pseudo-liberalism" has evolved into terms like "liberal Nazism" or "liberal fascism," leading to a situation where anyone not seen as a supporter of the regime or labeled as "ours" in the "friend-foe" dichotomy has been branded as a "collective fascist or Nazi."

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Propaganda necessitated the formation of an "enemy" to evoke fear, hatred, and aggression within different layers of society. Consequently, this "enemy" must be portrayed as mythical: "They are strangers, foreigners—not genuine threats—but individuals characterized as such, where their differences become perceived markers of danger." (Eco, 2015, p. 25). The enemy may exist nearby, yet they remain distinct. The creation of the enemy image in Georgia is linked to two lexical propaganda narratives: the "collective West," which combines the credibility of a propaganda lexical narrative depending on several principles: 1. It must be created in simple language, 2. It must change quickly because it is impossible to make the public think, 3. Propaganda lexical narratives must be continuous, and 4. They must be repeatable. According to these principles, we can explain the diversity of lexical synonyms. The last propaganda lexical element so far is "deep state." However, the term does not have a Georgian equivalent in our political discourse."Pseudo-liberal or liberal fascism" is described above, and the second is the former ruling party, the "National Movement." Both are associated with irrational fear in society, as a result of which a new propaganda lexical entity, the "Collective National Movement," is efficiently created, which is linked to the "Collective West," and since February 24, 2022, to the "Global War Party." Thus, in the Georgian political discourse, "liberal fascism, collective West, pseudo-liberalism, collective national movement; global war party, Nazism" are synonyms and are used with one lexical meaning by both the propagandists and the victims of propaganda, and this meaning is "foreigner or enemy."

Why does society need to create an enemy image? Umberto Eco explains in his essay, "Having an enemy is important not only to define our identity but also to create an obstacle against which we can test and present our value system" (Eco, 2015, p. 15). It should be noted that the "enemy image" created by society lacks viability because it lacks the legal power tools to create fear in society. Therefore, the problem with "enemies" created by society is that they cannot provide long-term persuasion to society. That is why the government is the institution that can persuade and, therefore, actively uses it.

In a broad sense, the definition of government refers to the necessity of coercion and persuasion. However, Hannah Arendt says, "Where violence takes place, the government fails… when reason is invoked, the government temporarily becomes inactive" (Arendt, 1954, p. 21). Based on this definition, the ideal means of maintaining power is persuasion, which was theologically possible before the revival of modern philosophy. The object of persuasion was outside the sphere of direct governance. The government exercised its power "here" among the people, and the persuasion with which power was nourished was as mythical as the "image of the enemy" created in modern times.

Persuasion was associated with holiness, and therefore, the activities carried out by the government were considered to serve as a sacred idea. People quickly distinguished between violence and power. Modern philosophy has united the object of persuasion and the object of government. Today, we no longer doubt that the source of government power is the people, but let us ask the question, what does it mean when we say that the source of power is the people? If the effective government is based on persuasion, then it turns out that the source of persuasion and the subject of persuasion are the same; the distinction that creates the crisis of man as a knowing subject has been erased. Because man, only through distinction, can understand who he is or what the object he knows is. Therefore, like humans, "the development of the modern world is accompanied by a constant, ever-widening and deepening crisis of government" (Arendt, 1954, p. 18). The government uses propaganda to create the "image of the enemy" to overcome this crisis

In her essay "Truth and Politics" (Arendt, 1967), Hannah Arendt speaks of the inadmissibility of politics and truth because politics is based on the conviction of what cannot be proven. In contrast, truth is based on the truth that must be established. Every person who decides to tell the truth to society will be punished in the same way that one has been punished historically. The first person to try to resolve the conflict between politics and truth was Socrates, but the government punished him. Propaganda, a tool of persuasion of a political regime, requires a change of lexis and a constant praxis or practice, which cannot be achieved without falsifying or distorting facts. Falsifying facts differs from "ignorance" or illiteracy, which a person may unintentionally allow while falsifying facts is a deliberate attempt. Truth, like power, possesses a coercive instrument. Therefore, the government considers truth a competitor to its power.

Facts are free from all coercion. Recognizing the truth of facts depends on the subject's recognition of this fact as accurate, which is why it is more easily subject to deliberate falsification by the government. Propaganda works because it is based on the following principles (Arendt, 1967, pp.311-317): "When a liar, who has no power but insists on the doctrinal truth of his or her lie, claims that this is his or her personal opinion, to which he or she has a constitutional right. This is often resorted to by subversive groups whose ultimate goal is to create confusion in a politically uneducated society... It is doubtful that the action associated with deliberate lying is a marginal phenomenon, although, in contrast, simply stating the facts does not lead to any action... Only in a society that begins with organized lying in terms of principles, not details, does the truth become a political factor if it is not supported by forces distorted by power... Where everyone lies about the most important issues, the truth-teller, whether he or she knows it or not, begins to act politically because if he or she survives, he or she has the opportunity to change the world...."

In conclusion, our modest attempt is to speak not only about the results of propaganda but also about its causes, which are hidden in the word (vocabulary) and action, because "the suppression of the ability to theoretical imagination... paves the way for political madness... Suppose the Enlightenment does not make a reflection on this regressive moment an integral part of itself. In that case, it will strive for its destiny" (Horkheimer, M. & Adorno; T. W., 2022). Therefore, as thinkers, we have a moral obligation to be "truth-tellers"; as citizens, we have a responsibility to distinguish between fact and opinion, as people we have an existential obligation to affirm our existence in the public-political space as thinking-speaking and acting subjects (Arendt, 1958). It is the obligation of a human being as an entity not to destroy the public-political space, or polis, which represents the open space that defines our existence and humanity through political propaganda.

Results and Discussion

Analyzing social media statuses, we found some instances of political neologisms. I checked the reliability of neologisms with the following principle presented by many researchers, including Algeo (1991), Cabre (1999), and Boyko (2023), and, in particular, in their opinion, a word is a neologism if:
- it has been fixed among language users for the last few years and is perceived by them as a new word;
- not included in dictionaries;
- has signs of instability of meaning and form

(Algeo, 1991; Cabre, 1999; Boyko, 2023).

Accordingly, we checked all the neologisms found in the following dictionaries of the Georgian language:

- https://ena.ge/explanatory-online;
- https://www.ice.ge/liv/liv/ganmartebiti.php;
- http://www.nplg.gov.ge/gwdict/index.php?a=index&d=83

If the given words were not found in the mentioned dictionaries, i.e., they were neologisms. We checked the frequency of their use with the help of the Social Media web pages and The Georgian National Corpus (http://gnc.gov.ge/gnc/simple-query?session-id=NIL). The table given illustrates the structural categorization of Georgian political neologisms.

Together with neologisms, we encountered some metaphors illustrating attitudes towards some political figures.

Table 2. Definitions of Neologisms and Conceptual Metaphors

Neologisms in Georgian	Transcription	Neologisms Explained in English
Nouns		
ბიძინიზაცია	*bidzinizatsia*	Bidzinization
დებიძინიზაცია	*debidzinizatsia*	De-bidzinization
დეივანიშვილიზაცია	*deivanishvilizatsia*	De-ivanishvilization
ლუკაშენკოიზაცია	*lukshenkoizatsia*	Lukashenkoization
პუტინიზაცია	*putinizatsia*	Putinization
ევროპიზაცია	*evropizatsia*	Europization
ქოცბანდა	*qotsbanda*	"Qotsi" (a follower and supporter of the political party – "Georgian Dream"); the word "Banda" refers to the English word Gang. (Qotsgang)
ქოცხროვა	*qotskhrova*	"Qotsi" (a follower and supporter of the political party – "Georgian Dream"); the word "Khrova" refers to the English words troop, combination, and pack. (a pack of Qotsi)
ნაცბანდა	*natsbanda*	"Natsi" (a follower or supporter of the political party – "United National Movement"); the word "Banda" refers to the English word Gang. (Natsgang) However, this neologism can also refer to Georgians who do not share the political party's views – the "Georgian Dream."
ნაცხროვა	*natskhrova*	"Natsi" (a follower and supporter of the political party – "United National Movement"); the word "Khrova" refers to the English words troop, combination, and pack. (A pack of Natsi). However, this neologism can also refer to Georgians who do not share the political party's views –

		the "Georgian Dream."
Adjectives		
რუსეთუმე	*rusetume*	Is a person (Georgian) who shares the views and beliefs of the President of Russia, Putin, and his political ideology. For most Georgians, everything Russian is hostile and malignant.
ქოცი	*qotsi*	This refers to Georgians who support or are involved in the political party of the "Georgian dream." Furthermore, it supports the political ideology of its leader, Bidzina Ivanishvili.
ნაცი	*natsi*	designates 1. supporters of the political party of the United National Movement 2. People who refuse to share the ideology of the "Georgian dream."
ბიძინისტი	*bidzinisti*	It is a synonym of qotsi, i.e., people who worship the so-called oligarch-Bidzina Ivanishvili.
მიშისტი	*mishisti*	Mishisti, a synonym of Natsi, designates 1. supporters of the political party of the United National Movement and 2. people who refuse to share the ideology of the Georgian dream.
ლიბერალისტი	*liberalisti*	is used to designate those Georgians who strive to become members of the EU.
Verb		
გაპიდარასტება	*gapidarasteba*	is used to describe the action of becoming a European citizen.
Phrases		
პოლიტიკური მეძავი	*Politikuri medzavi*	Political slut - refers to those politicians who change their parties from government to government.
პუტინის კრეპტოკრატია	*Putinis kreptokratia*	Putin's Kleptocracy - an authoritarian regime ruled by a close-knit cabal... that used democracy for decoration rather than direction.
რუსეთის მონა პუტინის მონა	*Rusetis mona* *Putinis mona*	Russia's Slave, Putin's Slave. These two phrases are synonymous. They refer to Bidzina Ivanishvili and his followers, who were parliamentarians chosen by Bidzina Ivanishvili.
ივანიშვილის მონა მონის მონა	*Ivanishvilis mona* *Monis mona*	Ivanishvili's Slave, Slave of the enslaved person (Bidzina Ivanishvili). Georgian parliamentarians, who voted for the Russian law.
პუტინისტური მთავრობა რუსული მთავრობა ივანიშვილის რეჟიმი რუსული ოცნება	*Putinisturi mTavroba* *Rusuli mTavroba* *Ivanishvilis Rejimi* *Rusuli otsneba*	Putinistic Government, Russian Government, Ivanishvili regime, Russian dream, these synonyms refer to the political party of the Georgian dream.

Georgian	Transcription	English
სააკაშვილის რეჟიმი სისხლიანი 9 წელი	*Saakashvilis rejimi Sisxliani 9 tseli*	Saakashvili's regime and its synonym bloody 9 years/9 years of blood designate the Georgian Government between 2004-2012.
გამჭვირვალობის კანონი რუსული კანონი ქართული კანონი	*Gamtchvirvalobis Kanoni Rusuli Kanoni QarTuli kanoni*	The Law of Transparency is synonymous with Russian law, also known as Georgian Law, which the Georgian Dream and its supporters named.
გარდამტეხი არჩევნები	*Gardamtekhi archevnebi*	Refers to the upcoming election, October 2024, on which Georgians will decide between Russia and Europe.
გლობალური ომის პარტია	*Globaluri omis partia*	Global War Party was created and advanced by The Georgian Dream and its leader, Bidzina Ivanishvili. It refers to the European Union and the USA (Conspiracy theory).
პიდარასტი ევროპა	*Pidarasti Evropa*	Pederast Europe, the term was coined and advanced by followers of the Georgian Dream.
Conceptual Metaphors	Transcription	Conceptual Metaphors Explained in English
Nouns		
დუშკაბინა	*dushkabina*	Douchecabine (Bidzina Ivanishvili's bulletproof cabin)
ბელარუსი	*Belarus*	Belarus (Georgia as Europe's Belarus)
რუსი, მონა	*Rusi, mona*	Russian and enslaved person is told about those parliamentarians who, with or without their will, voted for Russian law.
adjective		
უსამშობლო	*usamshoblo*	Stateless (a person without a homeland) refers to pro-European Georgians.

The standard definition of conceptual metaphors is this: A conceptual metaphor is understanding one domain of experience (that is typically abstract) in terms of another (that is typically concrete) (Lakoff & Johnson, 1980). This study presents conceptual metaphors referring to the political party (Georgian Dream), Political figures (Ivanishvili and his parliamentarians), and Ivanishvili's house or bulletproof cabin used during his speeches standing before his Georgian supporters. Belarus is equally used to picture the current political situation in Georgia since the Georgian Dream aims to annul its opposing parties.

After examining the social media context, out of almost 5000 posts, 3704 posts were found with #notorussianlaw/#არარუსულკანონს/#ararusulkanons. Georgians of various age groups and the Georgian language (1105 posts) used hashtag and slogan - NOTORUSSIANLAW. It created a community of people who were pro-Europeans and considered Georgia to be part of the European Union. This code-switching behavior (we-code) expresses the solidarity and unity of Georgians under one goal. It will since it was barely used by the political party of the Georgian Dream and its supporters. They call the law transparent (they-code), with the help of which they cover the scandal of passing the so-called 'Russian law' and, as a result, distance themselves from the pro-European Georgians.

The following data shows functional and structural classifications, quantity of language behaviors, and lexical items found in social media discourse.

Table 3. Functional and Structural Classification of CS; Structural Classification of Neologisms and Conceptual Metaphors

Functional Classification of Code-switching (Overall, 1105 cases); Code-mixing (overall 15 cases)	
Exclamatory sentence	1005 cases
Interrogative sentence	45 cases
Declarative sentence	25 cases
Interrogative-exclamatory Sentence	20
Imperative sentence	8
Negative sentence	2

Structural Classification of Language Behaviours	
Paragraph	Code-switching (100)
Phrase	Code-switching (1005)
	Neologism (18)
Noun	Neologism (16)
	Code-mixing (10)
	Conceptual metaphor (4)
Adjective	Neologism (6)
	Code-mixing (3)
	Conceptual metaphor (1)
Verb	Code-mixing (2)
	Neologism (1)

We sorted out some examples of code-switching and code-mixing by analyzing the first dimension of the political discourse on social media web pages, along with political neologisms and conceptual metaphors.

Let us examine one of the examples of code-switching, namely, the Facebook status of an education expert, one of the influential persons, which refers to the current political situation in Georgia. The parliamentarian's full name has been changed to her/his initials since we are interested in language behaviors, not individuals.

Example 1

„ს. ქ. მხოლოდ ერთი წელია, რაც პარლამენტარია. მას ათთვიანი საკანონმდებლო საქმიანობისას 1140-ჯერ დადებითად და მხოლოდ 2-ჯერ აქვს უარყოფითად ხმა მიცემული საკანონმდებლო ინიციატივებისთვის. წარმოიდგინეთ, თვეში საშუალოდ 114-ჯერ იწევს ხელს ადამიან ოცნების ინიციატივების მხარდასაჭერად. ასეთი კარიერული "მიღწევების" მქონე ადამიანის პირით ესაუბრება ქართული ოცნება დასავლეთს და ქართულ საზოგადოებას იმის შესახებ, რომ თურმე ვენეციის კომისია არაკომპეტენტური და მიკერძოებულია.

ამ ამბავმა ჩემი ბავშვობის ანეკდოტი გამახსენა:[1]

Вопрос: Что такое КПСС?

Ответ: Набор глухих согласных."

"A set of voiceless consonants" of the Soviet political party (Коммунистическая партия Советского Союза (КПСС) used in the joke in the given example metaphorically describe the parliamentarians who are manipulated and like marionettes follow the instructions. Code-switching sometimes "functions to announce specific identities and create certain meaning" (Johnson, 2000, p. 184). This example depicts the interrogative and declarative sentence types. The function of this code-switching behavior is to rewind the political past of Georgia and remind people of the malignant nature of the USSR. The Russian language is used satirically.

As for the quantitative data, I will first analyze the demographic data.

Table 4. Demographic Data and Education of The Respondents (Quantitative Research)

Demographic Data and Education	Values	Results
Gender	Male	29 (26%)
	Female	81 (74%)
	I prefer not to say	-
Age	18-20	18 (16%)
	21-30	32 (29%)
	31-40	42 (38%)
	41-50	9 (8%)
	51-60	6 (6%)
	61 and more	3 (3%)
Nationality	Georgian	107 (97%)
	Armenian	3 (3%)
Higher Education level received in Georgia.	Master's Degree 52 (48%)	
	Bachelor Degree 36 (33%)	
	PhD 18 (16%)	
	High school diploma 4 (4%)	
Type of living areas the respondents spent most of their life	Urban 29 (26%) Rural 6 (6%) The capital city (Tbilisi) 75 (68%)	

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[1] "S. Q. has been a parliamentarian for only a year. During her ten-month legislative activity, she has voted for legislative initiatives positively 1140 times and negatively only 2 times. Imagine, an average of 114 times a month, a person raises her hand to support the Georgian Dream's initiatives. On behalf of a person with such career "achievements", the Georgian Dream speaks to the West and the Georgian society about the fact that the Venice Commission is incompetent and biased.
This story reminded me of a joke from my childhood:
Question: What is the CPSS?
Answer: Answer: A set of voiceless consonants."

According to the collected data, most respondents were female (74%). As for their age, respondents from 31 to 40 were in the majority (64%). Most research participants have completed their master's degrees (48%). Type of living areas the respondents spent most of their lives in the capital city (68%). After the demographical questions, the research participants were asked three questions to clarify the neologisms and metaphors referring to 1. Georgian Dream and its supporters; 2. opposition parties and their supporters, neutral Georgians; 3. current political atmosphere in Georgia.

Table 5. Mark All Phrases/Words That Are Used in Social Networks Referring to the "Georgian Dream" Party and Its Supporters (You Can Mark More Than One Word/Phrase)

The most frequently used words/phrases are	The least frequently used words/phrases are
• Qotsi (101/92%)	• Bidzinisti (75/68%)
• Rusetume (95/87%)	• Mona (70/64%)
• Qotsbanda (84/76%)	• Qotskhrova (68/62%)
• Putini's mona (84/76%)	• Rusi (62/57%)
• Ivanishvili's mona (82/75)	• Usamshoblo (52/47%)
• Ruseti's mona (82/75%)	• Moni's mona (50/46%)

The table illustrates the frequency and validity of neologisms related to the Georgian dream and its supporters. As we can see, the shortened form "Qotsi" of the party "Georgian Dream" and "Rusetume" (follower of Russia) is utilized most frequently on social media networking websites. We can assume that most of the neologisms related to the Georgian Dream political party are negative and refer to the Russian government or Russian oppression. The neologisms are also characterized by the nature of expressing slavery of Russia or its prey.

Table 6. Mark All Phrases/Words That are Used in Social Networks Referring to Those Citizens of Georgia Who Are Not Supporters of the "Georgian Dream" Party (You Can Mark More Than One Word/Phrase)

The most frequently used words/phrases are	The least frequently used words/phrases are
• Natsi (89/81%)	• Usamshoblo (58/53%)
• Mishisti (85/77%)	• Politicuri medzavi (21/19%)
• Natsbanda (77/70%)	• Mona (24/22%)
• Natskhrova (73/66%)	• Rusetume (6/6%)

The table illustrates the frequency and validity of the neologisms referring to the opposition parties and their supporters, shortly those Georgians who do not share the ideology of the Georgian Dream. The most used word (conceptual metaphor) is "Natsi" (81%), which is the shortened form of the united national movement (in Georgian Natsionaluri Modzraoba). Natsi is metaphorically used to refer to the non-governmental supporters who want to obtain the qualities of Nacism. As for "Mishisti" (follower of Misha Saakashvili), this corresponds to the former president of Georgia, who is used for manipulating the supporters. As we can see from the results, by analyzing the neologisms and metaphors used in social media, the governing political party is much more associated with Russia than the opposition or neutral voters.

Frequency of Usage in %
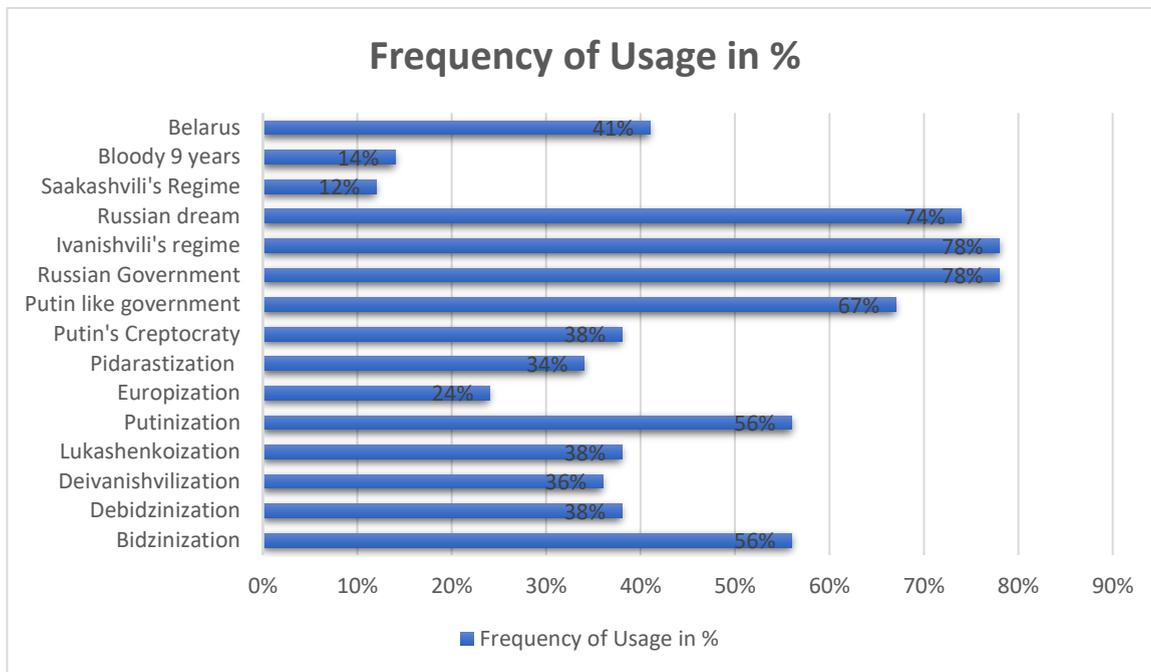
Graph 1. Mark All Phrases/Words That Are Used in Social Networks to Indicate the Current Political Situation in Georgia (You Can Mark More Than One Word/Phrase)

The graph depicts the frequency of neologisms and metaphors utilized in Georgia's current political situation. Some collocations most frequently used are the Russian government (78%), the Putin-like government (78%), and the Russian dream (74%). Unfortunately, we are more associated with Belarus and Lukashenkoization than with Europization.

While filling out the questionnaire, respondents could add their answers to characterize the government, the opposition parties, the neutral Georgians, and the current political situation of Georgia. Here are the suggested responses:

- Shuashisti (someone in between) – the voter who does not support any parties, neither the Georgian Dream nor the United National Movement, nor tries to stay apolitical to avoid further discussions.
- Belarusization – the political process that Georgians are currently going through with the help of the governing party, i.e., becoming isolated from the civilized world.

The quantitative data and the qualitative analysis gave us a more comprehensive picture of the lexical neologisms used in the political discourse. They encouraged me as a researcher to make objective assumptions and conclusions.

Conclusions

The study depicted that code-switching in political discourse is an interpersonal strategy that can be used to create, strengthen, or destroy interpersonal boundaries. Thus, it functions as a discourse strategy for pragmatic and strategic purposes.

Our humble endeavor was to address the outcomes of propaganda and its underlying causes, which reside in language

and action. It is important to acknowledge that suppressing the ability to theoretical imagination paves the way for political madness. If enlightenment fails to incorporate a reflection on this regressive aspect as an integral part of itself, it risks straying from its intended path. Thus, as thinkers, we are morally responsible for being "truth-tellers." As citizens, we must differentiate between fact and opinion; as individuals, we hold an existential duty to assert our presence within the public-political sphere as engaged, thinking, speaking, and acting beings. Every human must protect the public political space—or polis—which defines our existence and humanity, particularly in the face of political propaganda.

Consequently, the results show that there were 1275 (neologisms - 106 posts, metaphors - 49 posts; CS - 1105 cases and CM -15 cases) Facebook and Instagram posts typed in only Georgian and Georgian together with either in English or in Russian. The most frequent topics revolve around the EU integration process and demonstrations protesting the law on foreign agents. The collected examples incorporate more CS (1105 cases) (mostly exclamatory (1005) and interrogative (45) sentence types) than CM (15 cases) (nouns (10), adjective (3), verb (2) behaviors. There were some examples of neologisms (overall 41 - 16 nouns; 1 verb; 18 phrases, six adjectives; and five conceptual metaphors found referring to the Georgian politicians and current political situation in Georgia depicted on Facebook and Instagram posts (neologisms (106 posts), metaphors (49 posts). Moreover, users' attitudes toward the languages are vivid, as mentioned above. Namely, English is used chiefly positively, forming a community of sharing positive attitudes towards Georgia's integration into the EU; furthermore, by using the English language, pro-European Georgians, on the one hand, form public opinion, on the other hand, distance themselves from opposing political parties and their supporters. The Russian language is used sarcastically to remind Georgians what they went through and that returning to the USSR will not bring any progress for the country. Based on quantitative and qualitative research results, the Georgian language has dominancy, primarily because it is a mother tongue. However, most logically, the speakers' messages should be immensely comprehensible for different social classes of Georgians. It is used to persuade potential voters, insult opponents, cover scandals, and form public opinion.

People who can take turning steps in Georgian politics are Georgian youth; they are the ones who frequently use social media networking websites daily. Therefore, politicians are becoming too active on these platforms to impact Georgian youngsters' political views and beliefs. Thus, studying this discourse is vital for visualizing the country's political atmosphere. On the one hand, we have 85% of Georgians who strive to become Europeans; on the other hand, officially, we have the political party, the so-called Georgian Dream, with conspiracy theories against the invisible enemies - the USA and EU. By analyzing neologisms and metaphors, the quantitative research results showed that the governing political party is much more associated with Russia than the opposition or neutral voters.

Historically, the real enemy of Georgians has always been Russia. All those language instances have functions of:
- insulting opponents
- distancing themselves from contradictory ideology.
- disguising the truth;
- covering scandals;
- forming of public opinion;
- persuading potential voters.

Political discourse is a powerful tool that supporters use under the political party's influence to self-present themselves and form desired societal opinions. Politicians use it to influence voters. Therefore, manipulations of words through native or foreign languages are constantly being implemented in political discourse to gain power over society.

Recommendations

As for future research, style-shifting would be interesting since most posts about upcoming elections and the law were in Georgian.

Notes

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Integrating Individuals with Disabilities into the Workforce: A Human Capital Perspective on Employment Challenges

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Abstract: Individuals with disabilities play a crucial role in contributing to productivity within the employment sector, which, in turn, supports the economic growth of a country. However, the contribution of this workforce remains a subject of dispute for some, due to the persistent negative perceptions surrounding this group. Therefore, this study aims to examine the challenges faced by individuals with disabilities in securing employment. Additionally, the study explores environmental and social factors, such as the influence of family and employers in the hiring process for employees with disabilities. A cross-sectional survey design was employed, with a focused interview method adapted to gather in-depth information. The study's participants included individuals with disabilities, their caregivers, and employers. Thematic analysis was applied to identify emerging themes inductively and systematically. The findings offer valuable insights for stakeholders developing employment policies for individuals with disabilities. Furthermore, these findings provide recommendations for the Ministry to deliver targeted support, such as the necessary education and skills training, to enhance the workforce participation of individuals with disabilities.

Introduction

The issue of the participation of individuals with disabilities in the labor market is often a heated topic of discussion, as they frequently face various challenges in securing suitable employment. Although their potential to contribute to productivity in the workforce should not be underestimated, individuals with disabilities are often marginalized due to negative societal perceptions of them. Globally, countries are working to integrate individuals with disabilities into the workforce by providing equal and fair opportunities, in line with human rights principles. However, this process is not easy due to many barriers in terms of social environment and discriminatory attitudes that still exist among employers and society (Schur et al., 2021).

One of the key factors shaping society's views of individuals with disabilities is the perception of employers, who often question the capabilities and productivity of workers from this group. According to a study by Lunt et al. (2020), social stigma and fear of workplace adaptations often serve as the main barriers for employers to hire individuals with disabilities. Employers tend to view individuals with disabilities as less productive or unable to perform tasks efficiently. This negative perception can lead to discrimination in hiring processes, preventing individuals with disabilities from accessing equal employment opportunities. A study by Schur et al. (2021) shows that about 33% of employers in the United States believe that individuals with disabilities cannot meet the demands of high-risk jobs. Additionally, according to Lunt et al. (2020), around 40% of individuals with disabilities report facing difficulties in finding employment due to employers' perceptions of their limited abilities. This indicates that the stigma against individuals with disabilities is a serious issue that needs to be addressed to ensure they have equal opportunities in the workforce. The lack of access to suitable education and skill training is another issue that hinders individuals with disabilities from obtaining employment. Without relevant skills and sufficient training, individuals with disabilities struggle to compete in the increasingly competitive job market. A study by Hwang and Park (2023) found that only 20% of individuals with disabilities in developed countries have adequate access to professional training or further education that could help enhance their employability. This statistic highlights the lack of resources and support in providing education and training that could better prepare them for the workforce. For example, in Malaysia, according to the Department of Social Welfare (2021), only about 15% of individuals with disabilities receive recognized specialized skills training, which hinders them from competing with non-disabled individuals in the employment sector.

An unfriendly and non-inclusive work environment is also a significant issue preventing individuals with disabilities from joining the workforce. Many workplaces do not provide the necessary facilities for individuals with disabilities, such as physical accessibility, appropriate assistive devices, and workplace support systems. According to a study by Moore et al. (2022), more than 60% of individuals with disabilities report that their workplace does not provide an environment conducive for them to work effectively. The study also shows that only 25% of employers provide specific accommodations such as suitable seating, mobility paths, or hearing aids. Without these proper facilities, individuals with disabilities cannot perform their tasks effectively, limiting their opportunities to continue working and advancing in their careers. In Malaysia, data from the Public Service Commission (2022) indicates that only 18% of public sector organizations provide full accessibility facilities for individuals with disabilities in the workplace.

In terms of government policies, various initiatives have been implemented to improve employment opportunities for individuals with disabilities. However, there is still much room for improvement, particularly in providing more inclusive and friendly workplaces for individuals with disabilities. According to a study by Hwang and Park (2023), the government needs to offer more incentives to employers to hire individuals with disabilities and provide relevant training and skills to ensure they are ready for the workforce. Overall, this study will contribute to a deeper understanding of the challenges faced by individuals with disabilities and offer suggestions for improving existing policies and programs to enhance their participation in the country's workforce.

Furthermore, the challenges faced by individuals with disabilities also involve the support provided by their families and social environment. Families play a crucial role in encouraging and providing emotional support to individuals with disabilities as they navigate the challenging world of employment. A study by Moore et al. (2022) shows that strong family support can increase the self-confidence of individuals with disabilities and help them face the challenges of finding a job. However, this support does not only come from families but also from government policies that can empower individuals with disabilities through better skills training and education.

Although many studies have been conducted on the challenges faced by individuals with disabilities in the labor market, there is a lack of research that specifically focuses on the social and work environment factors influencing the effectiveness of workplace inclusivity programs. Most existing studies focus more on employer perceptions or government policies without giving adequate attention to the interactions between individuals with disabilities, their families, and communities in shaping their employment opportunities. For example, the study by Schur et al. (2021) emphasizes employer discrimination but does not examine how family and community support can influence hiring decisions for individuals with disabilities. There is also a lack of studies discussing the impact of accessibility facilities and workplace adaptations on the productivity and well-being of disabled workers in more depth. Therefore, further research involving a more holistic perspective, including social and cultural factors in the workplace, needs to be conducted to provide a clearer picture of the real challenges faced by individuals with disabilities in their efforts to secure fair and inclusive employment. Consequently, the research aims to examine the challenges faced by individuals with disabilities in obtaining employment, taking into account the environmental and social factors that influence the hiring process.

Literature Review

Studies on the challenges faced by individuals with disabilities in the job market show that social stigma and discrimination remain major barriers. According to research by Schur et al. (2021), approximately 33% of employers in the United States believe that individuals with disabilities are unable to meet the demands of high-risk jobs, contributing to the lack of job opportunities. Similarly, in Malaysia, according to data from the Department of Social Welfare (2021), nearly 40% of individuals with disabilities report facing difficulties in securing employment due to negative perceptions of their abilities by employers. A study by Lunt et al. (2020) emphasizes that this stigma arises from employers' fear that individuals with disabilities will struggle to adapt to the competitive and risky work

environment. This social stigma must be addressed through education for both the public and employers about the true capabilities of individuals with disabilities.

In addition to employer discrimination, the lack of access to relevant education and skill training is also a major challenge for individuals with disabilities in obtaining employment. Research by Hwang and Park (2023) shows that only 20% of individuals with disabilities in developed countries have sufficient access to professional training that can enhance their employability. In Malaysia, statistics from the Department of Social Welfare (2021) state that only 15% of individuals with disabilities receive recognized, specialized skill training. This creates a gap in their ability to compete with non-disabled individuals in the job market. Furthermore, the lack of educational programs that provide industry-focused skills means that individuals with disabilities have difficulty fully utilizing their potential, leading to their marginalization from the rapidly developing workforce.

An inclusive work environment also impacts the participation of individuals with disabilities in the job market. A study by Moore et al. (2022) found that more than 60% of individuals with disabilities reported that their workplaces did not provide the necessary facilities to work effectively, such as physical accessibility and appropriate assistive tools. This is supported by data from the Malaysian Public Service Commission (2022), which shows that only 18% of public sector organizations provide full accessibility facilities for individuals with disabilities. Without these facilities, individuals with disabilities face difficulties in performing their tasks, which subsequently affects their productivity and employability. Therefore, employers must provide a supportive work environment to ensure that they can work to their full potential. Further research on family and social support also highlights its important role in helping individuals with disabilities cope with employment challenges. Research by Moore et al. (2022) shows that strong family support can boost the self-confidence of individuals with disabilities, which in turn influences their decision to attempt to find employment. This support is not only emotional but also practical in providing information or referrals to suitable job opportunities. While family support can help, studies indicate that support from the community and government is also crucial. Policies that provide relevant training and skills can help individuals with disabilities improve their employability, enabling them to compete in an increasingly competitive job market.

In terms of government policies, various efforts have been made to encourage the inclusion of individuals with disabilities in the workforce. Research by Hwang and Park (2023) stresses the need for more government incentives for employers who hire individuals with disabilities, including financial assistance to provide accessibility facilities in the workplace. Additionally, according to research by Lunt et al. (2020), policies that support individuals with disabilities by providing greater access to skill training and educational opportunities need to be strengthened. The government must also ensure that the policies introduced address existing barriers and provide more opportunities for individuals with disabilities to secure quality jobs.

Overall, the studies conducted by Schur et al. (2021) and Lunt et al. (2020) focus on the issue of employer discrimination without delving deeply into the social and environmental factors that influence hiring decisions. These studies often overlook the perspective of family and community in shaping employers' attitudes toward individuals with disabilities. Therefore, more holistic research is needed to better understand the interaction between individuals with disabilities, their families, and employers in influencing hiring decisions. More studies should be conducted to

explore how accessibility facilities and workplace adaptations can affect the productivity and well-being of employees with disabilities. Further research will help develop more effective policies to enhance the participation of individuals with disabilities in the workforce, thus making the job market more inclusive and fairer for all parties.

Methodology

A cross-sectional survey design was employed using a qualitative research approach to delve into the phenomenon to examine the challenges faced by individuals with disabilities in securing employment. Additionally, the study explores environmental and social factors, such as the influence of family and employers in the hiring process for employees with disabilities. A qualitative approach allows researchers to explore questions that aren't easily quantifiable, providing insight into the human experience Cleland, (2017). This approach enables researchers to grasp the everyday realities surrounding a social phenomenon, addressing significant questions as they naturally unfold. By adopting a qualitative methodology, the researcher gains a deeper understanding the challenges faced by individuals with disabilities in securing employment base on social and environment factors.

The sample of this study consists of 12 informants who are graduates of vocational education and individuals with disabilities (PWD). They were selected based on specific criteria, including their PWD status and vocational education background. This sample size aligns with the recommendation of Braun & Clarke, (2016), who suggest that qualitative studies should have a minimum of 12 participants to achieve data saturation. Purposive sampling, as advised by Merriam & Tisdell (2016), was employed in this study to gather focused data based on specific criteria related to the research scope.

For data collection, this study utilized semi-structured questions. These questions were developed based on a thorough review of the literature, expert feedback, and observations from past case studies related to the research scope. The set of questions, exceeding 10 in number, covered areas such as background profiles, challenges faced by individuals with disabilities, and social and environment factors. Thematic analysis was used to answer the objective of the study. The systematic procedure to conduct thematic analysis methods follows the procedure recommended by Merriam & Tisdell (2016). There are several steps to conduct thematic analysis, i.e. (1) Transform the data from audio to verbatim transcript; (2) Read and familiar with the data; (3) Identify the theme with the inductive method; (4) Identify the theme with inductive method; (5) Categories to a valuable theme; and (6) Writing the finding. All the process makes the qualitative data more valuable and interpretation with strong evidence to highlight the phenomena.

Results and Discussions

The study's findings are outlined through a summary encompassing participants' profile, to examine the challenges faced by individuals with disabilities in securing employment. Also explores environmental and social factors, such as the influence of family and employers in the hiring process for employees with disabilities in Malaysia. The details of the findings are elucidated as follows:

Table 1: Informant profile

Informant (I)	Gender	Impairment
I1	Male	Blind
I2	Male	Deaf
I3	Male	Blind
I4	Female	Physical
I5	Female	Deaf
I6	Male	Physical
I7	Female	Physical
I8	Female	Slow leaner
I9	Male	Slow leaner
10	Male	Physical
I11	Female	Blind
I12	Male	Physical

Table 1 outlines the total number of informants in this study, which is 12 individuals. Regarding gender distribution, the majority of participants are male (7 individuals), while the remaining participants are female (5 individuals). Additionally, all participants in the study who are graduate from vocational education training. Further insights from the thematic analysis are presented in Table 2 and Table 3 below:

a. Challenges faced by individuals with disabilities in securing employment

Individuals with disabilities (PWD) face numerous challenges when it comes to securing employment, with one of the primary obstacles being societal stigma and discrimination. Employers often hold misconceptions about the abilities of PWD, believing that they are less capable or require excessive support. Research by Bédard et al. (2023) found that despite legal protections, PWD in Canada still face hiring biases due to perceived productivity concerns. These negative attitudes are not just prevalent in Canada but also exist globally, as shown in a study by Jenkins and McKenzie (2023) in Canada, where employers often hesitate to hire individuals with disabilities out of concern about their work efficiency. This discrimination limits opportunities for PWD, who may be fully capable but are overlooked due to unfounded biases, further entrenching their exclusion from the workforce.

Another significant challenge that PWD face in securing employment is the lack of accessible workplaces and reasonable accommodations. While legislation in many countries' mandates accessibility, it is often insufficiently implemented or not enforced. According to the European Union Agency for Fundamental Rights (2022), a large proportion of individuals with disabilities in Europe are still denied appropriate workplace accommodations, such as modified workstations or assistive technology. This lack of accessibility forces many PWD to either accept unsuitable jobs or remain unemployed. In the United States, a similar trend is observed, where the physical and digital work environments are not universally designed to cater to diverse needs, as noted by Kanter and Levey (2022). Employers often fail to provide necessary adjustments, either due to lack of awareness or financial concerns, which puts PWD at a disadvantage in competitive job markets.

Additionally, PWD often struggle with limited access to education and training opportunities, which hinders their employability. Many educational institutions fail to provide the necessary support systems, or the programs are not inclusive of diverse learning needs. A study by Chong et al. (2023) in Singapore highlighted that students with disabilities often face barriers in pursuing higher education, leaving them underqualified for many job opportunities. This educational gap means that even if PWD want to pursue careers in specific fields, they may not have the skills required to compete with their peers. Similarly, in the UK, McIntyre and Wilson (2023) found that individuals with disabilities often face a dual burden of discrimination, both during their education and upon entering the workforce, making it exceedingly difficult for them to attain meaningful employment.

The intersectionality of disability with other social factors, such as gender and race, also exacerbates the challenges faced by PWD in the job market. Individuals with disabilities who are also from marginalized groups often face compounded discrimination. Research by Trenton and Murray (2024) in Europe showed that women with disabilities, in particular, experience both gender-based and disability-based discrimination, making them more likely to be unemployed or underemployed. This phenomenon is also observed in countries like the United States, where studies by Foley and Luntamo (2023) reveal that Black and Hispanic individuals with disabilities face disproportionately high unemployment rates, due to compounded racial and disability-related biases. Thus, the challenges faced by PWD are not only shaped by their disability but also by other aspects of their identity, such as race and gender, further entrenching social inequality.

Lastly, the lack of supportive policies and programs to assist PWD in the workplace remains a pervasive challenge. Despite the existence of legal frameworks such as the Americans with Disabilities Act (ADA) in the U.S. and the Disability Discrimination Act in the UK, enforcement and awareness remain low. In Malaysia, a study by Liew et al. (2023) found that the lack of governmental incentives for businesses to hire PWD and the insufficient implementation of policies further hinder their employment prospects. Similarly, in Australia, Schwab and Hensley (2024) note that while employment services for PWD exist, they are often underfunded and lack effective outreach. As a result, PWD are not sufficiently supported in navigating the employment process, which reduces their chances of finding and maintaining employment. This systemic issue highlights the need for stronger enforcement of disability-inclusive employment policies globally, as well as increased funding and awareness to ensure PWD have equal access to work opportunities.

b. *The Influence of Family in Employment for People with Disabilities (PWD)*

Family plays a crucial role in the lives of individuals, especially for those with disabilities (PWD). In the context of employment, the support provided by the family to PWD individuals can influence their decisions to seek employment and achieve success in their careers. According to a study by Hassan et al. (2023), the family often serves as the primary source of motivation and encouragement for PWD individuals, providing the confidence needed to face challenges in the workforce. Emotional and material support from the family helps PWD individuals to persevere despite facing stigma and discrimination in the workplace. Therefore, the role of the family as a support system is vital in helping PWD individuals overcome barriers in the job recruitment process and their adaptation to the work environment.

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Moreover, the understanding and acceptance of the family regarding the physical or mental conditions of their disabled family members can significantly impact their employment achievements. Families that understand the challenges faced by PWD individuals are more willing to provide the necessary support, whether psychologically or in practical assistance. A study by Azman and Noor (2022) indicates that non- judgmental family support and acceptance of the individual's disabilities can enhance their self-confidence in dealing with social and employment situations. This confidence encourages them to be more active in seeking job opportunities and engaging with society without fear or shame.

However, there are also cases where the family acts as a barrier to the career development of PWD individuals. This occurs when the family holds narrow views regarding the abilities of PWD individuals or when they are overly protective, preventing them from facing the real challenges of the workforce. In some cases, families may believe that PWD individuals are incapable of working or are forced to take fewer challenging jobs, thus limiting their opportunities for growth. Research by Rahman et al. (2021) states that excessive protection from the family, driven by sympathy, can hinder PWD individuals from reaching their full potential.

Additionally, the influence of the family can also be seen in the role they play in supporting or hindering educational achievements, which in turn affect the qualifications for employment. Numerous studies show that family support in guiding PWD individuals to obtain higher education increases their opportunities in the job market. Conversely, families that pay little attention to the importance of education often result in PWD individuals lacking the skills required in the job market. References from Ismail and Zainal (2024) indicate that without adequate education, PWD individuals are at risk of being marginalized from the mainstream workforce.

Finally, the influence of family in PWD employment is not limited to emotional and material support but also extends to influencing job choices and the work environment. Families that understand and recognize the needs of PWD individuals are more likely to seek suitable and disability-friendly employment opportunities and encourage employers to offer greater opportunities. Along with the growing societal awareness and government policies regarding the rights of PWD individuals, the role of the family in preparing PWD individuals to face employment challenges is becoming increasingly important. According to a study by Liew et al. (2023), families that actively seek information on laws and employment incentives for PWD individuals can strengthen the chances of PWD individuals entering the job market more easily and fairly.

c. *The Influence of Employers in the Employment of Persons with Disabilities (PWD)*

Employers play a crucial role in shaping employment opportunities for persons with disabilities (PWD). In this context, the attitude of employers towards PWD directly impacts the rate of recruitment and retention of PWD workers in the workplace. A study by Lim et al. (2023) shows that many employers in Malaysia still hold prejudices and negative perceptions about the capabilities of PWD. They often doubt the ability of PWD to perform certain tasks, causing individuals with disabilities to be marginalized from job opportunities. Therefore, changing employers' attitudes is essential to ensure that PWD can have broader access to career opportunities and professional development. If employers gain a deeper understanding of the potential of PWD, they can create a more inclusive work environment

and provide space for PWD to grow. Similar findings were reported in a study by Hassan and Green (2023), which stated that employers worldwide still face significant challenges when it comes to hiring PWD workers.

Furthermore, most employers in Malaysia still lack an understanding of the special needs of PWD employees. According to a study by Aziz and Zakaria (2022), the lack of knowledge and training on how to engage with PWD workers often prevents employers from creating a disability-friendly environment. For example, employers may not provide accessible facilities, such as suitable pathways for wheelchairs or adapted work equipment. As a result, PWD workers may face physical difficulties that affect their performance. Therefore, it is important for employers to enhance awareness and training regarding the employment needs of PWD, so that they can create a comfortable and productive space for PWD workers. Kanter & Levey (2022) also emphasize that employers in the United States need more training to understand the types of support that can be offered to PWD workers to ensure their success in the workplace.

However, there are also employers who are more open and compassionate towards the employment of PWD. A study by Tan and Siti (2024) shows that employers who recognize the social and economic benefits of involving PWD workers are more likely to offer more job opportunities. PWD employees often bring different perspectives and specific skills that can enhance productivity and create a more diverse work environment. By promoting inclusivity, employers not only fulfil their social responsibilities but also open opportunities for innovation and creativity in the workplace. However, these efforts require ongoing support from the government in the form of incentives and policies that encourage employers to hire PWD workers. According to Murray and Trenton (2024), employers in Europe are also increasingly recognizing the advantages of PWD workers in bringing creativity and innovation that are crucial for organizational advancement.

Additionally, the influence of employers can also be seen in the performance management of PWD employees. Many employers are still hesitant to assess the performance of PWD employees based on the same criteria as other workers due to concerns about their performance and productivity. According to a study by Wong and Tan (2023), the lack of a fair evaluation system for PWD employees leads to difficulties in offering career advancement opportunities to them. In some cases, PWD workersmay face subjective evaluations, which can result in their marginalization in the promotion process or rewards distribution. Therefore, employers need to ensure that the performance evaluation system is fair and inclusive, taking into account the unique strengths of PWD workers without any form of discrimination. A study by Foley and Luntamo (2023) in Australia also shows that fair performance evaluations are crucial to ensure that PWD workers are not denied promotion opportunities based on their true abilities.

Lastly, the influence of employers in the employment of PWD also involves the employers' approach to welfare and ongoing support for PWD workers. For example, employers who provide continuous support, such as flexible working hours or psychological support services, can enhance the well-being of PWD workers in the workplace. A study by Ibrahim et al. (2022) shows that employers who provide training programs or counselling sessions for PWD workers can help them overcome challenges at work and improve their performance. This support benefits not only the PWD workers but also improves the overall work environment in the organization. With the right support, employers can fully harness the potential of PWD workers and provide them with opportunities to advance in their

careers. Schwab and Hensley (2024) suggest that employers worldwide should pay attention to the ongoing support needs of PWD workers, providing equal and non-discriminatory career development opportunities.

Conclusions

In conclusion, individuals with disabilities (PWD) face various challenges in obtaining fair and equal employment opportunities. The main challenges include social stigma and discrimination that hinder their chances of employment. Negative perceptions about the abilities of people with disabilities, particularly regarding productivity and efficiency, continue to persist among employers, despite laws that protect their rights. Furthermore, the lack of accessibility in the workplace and the insufficient provision of appropriate special facilities also make it difficult for people with disabilities to adapt to the work environment. Without adequate support from family and employers, individuals with disabilities are often marginalized in the job market, making it harder for them to reach their full potential.

The role of family in the work life of people with disabilities is crucial in providing moral and material support. Families that understand and accept the physical or mental condition of the disabled member will help them feel more confident and motivated in seeking employment opportunities. On the other hand, families that are overly protective or have negative views towards the abilities of people with disabilities may hinder their development. Therefore, non-judgmental support from the family, and a more open approach to the needs of people with disabilities, plays a significant role in ensuring that these individuals can face workplace challenges more courageously and optimistically. The education they receive with family support also enables individuals with disabilities to acquire the qualifications needed to compete in an increasingly challenging job market.

The influence of employers is equally important in determining the success of individuals with disabilities in the workplace. An open attitude and willingness from employers to provide an inclusive work environment can create more opportunities for people with disabilities. Training and awareness regarding the special needs of disabled workers must be enhanced to avoid inequality in the provision of facilities and performance assessments. Employers who understand the diversity and unique potential of employees with disabilities not only comply with the law but also foster a more creative and productive work culture. Therefore, to increase the participation of people with disabilities in the workforce, collaboration between families, employers, and authorities is key to creating more fair and equal opportunities for this group.

Acknowledgements

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Transformation Of Discarded Materials for The Production of Mandarin Essential Oil

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Abstract: In Peru, one of the main problems in mandarin processing plants is the inadequate management of waste, despite a significant portion being in optimal condition for market sale. A study in a local processing plant showed that the average waste generation remained constant at 2% over several months. This research proposes addressing this issue through the production of essential oils extracted from mandarin peels and analyzing their benefits. Essential oils have a wide range of applications in medicine, therapy, and the food industry, making them a multifaceted option. The steam distillation method, chosen for its high efficiency and ease of use, proved effective in obtaining high-quality oils from mandarin peels, enabling the reuse of peels to produce a valuable product. The primary aim is to leverage mandarin processing plant waste in Peru and transform it into value-added products. This approach is expected to reduce losses and promote more efficient resource management in the mandarin processing industry in the country.

Introduction

Azeddin et al. (2021) stated: "During the last decade, the world has been generating a large amount of mandarin waste." The process starts from the collection, where mandarins are obtained from agricultural areas. In this initial stage, the first waste is generated because fruits are harvested at an immature stage, and some mandarins are also damaged during transport to the plant. Later, at the facilities, the fruits go through a selection process where they are inspected based on their characteristics, mainly size, color, and variety. Those that do not meet the criteria are excluded from further processing. However, these discarded fruits have suitable properties for transformation into various products, aiming to utilize them effectively. These citrus wastes, rich in bioactives, can be used to provide new products to the market while respecting the environment (Masyita et al., 2022).

Lu Ying, Chunhua, and Siyi (2019) explained that oils extracted from mandarin peels can be obtained through hydrodistillation and cold pressing processes. In their studies, they experimented with different processes on three types of citrus fruits—Valencia Orange, Ponkan, and Eureka Lemon—to investigate their volatile constituents and antioxidant activity. According to the results, the hydrodistillation method yielded higher oil outputs and more oxygenated chemicals, whereas the cold pressing method retained more hydrocarbon terpenes (Lawrence, 2023). Considering the above, the following question arises: Is it viable to transform mandarin waste into essential oil through the steam distillation technique? The added benefits of this solution range from economic advantages to social impacts that can benefit farmers and producers by adding value to the waste, besides demonstrating the greater efficiency of the steam distillation method.

Materials and Methods

For the transformation of waste generated in mandarin processing plants into a new product, in this case, essential oil, an experimental design was employed by manipulating variables under rigorously controlled conditions in the chemistry and thermodynamics laboratory at the University of Lima to discover how essential oil is obtained from mandarin peel (Abdallaha et al., 2022), (Grajales et al., 2000)

This study was designed under the methodological approach of the quantitative focus, examining a problem (Giulia et al., 2022), (Creswell et al., 2013), considering data obtained from the company under study, specifically the amount of waste during a production period, and quantifying the relationship between the amount of essential oil that can be obtained from mandarin peels from the waste. Other results, such as essential oil extraction time and utilization percentage, were also considered.

The technique used for extracting essential oil from mandarin peels was the steam distillation process. (Lawrence 2023) stated: "Steam extraction is an official and widely used method for extracting essential oils from plants. This method represents 93% of essential oil extractions and can take between 1 and 10 hours, depending on factors such as extraction time, temperature, pressure, and material type. In this extraction system, plant material is exposed to a steam current without prior maceration. The applied heat breaks down the plant material cells and releases the essential oil. The steam, saturated with volatile compounds, is then condensed, and the essential oil is recovered by decanting the water/oil mixture" (Anna et al., 2021).

The materials used in the laboratory transformation process included 100 ml flasks, 10 cm hoses, 500 ml beakers, and 100 ml bottles. Equipment such as heating mantles and a condenser tube using water as a cooling agent was also used. The raw material required was mandarin peel. For the test, 200 grams of peels from varieties known as Malvasía or Deleite, Satsuma, and Miyahuasi were used. The variables used in this study were mandarin waste as the independent variable and essential oil production in the health industry as the dependent variable.

The methodology also included evaluating the quality of the obtained essential oil through physicochemical analysis, such as refractive index determination, relative density, and chemical composition using gas chromatography-mass spectrometry (GC-MS). These analyses allowed comparison of the results with the standards established in the

Peruvian Technical Standard (NTP 319.095), ensuring the quality of the final product. The experimental process was conducted in three main stages: raw material preparation, essential oil extraction, and result analysis. Each stage was designed to optimize the extraction of mandarin essential oil, ensuring the quality and quantity of the final product.

In the first stage, called raw material preparation, fresh mandarin peels from different varieties—Malvasía, Satsuma, and Miyahuasi—were collected. The peels were washed with distilled water to remove soil residues and other contaminants, a crucial step to ensure that no impurities interfere with the extraction process. After washing, the peels were air-dried in a controlled environment to prevent microorganism proliferation and the oxidation of volatile compounds present in the essential oil. Subsequently, 200 grams of peels were carefully weighed for each trial, ensuring uniformity across all tests.

In the second stage, essential oil extraction was carried out through steam distillation. A standard distillation setup was used, consisting of a steam generator, a distillation flask where the raw material was placed, and a condenser to cool the steam and recover the essential oil. The steam generated passed through the peels, carrying the volatile compounds. This process was conducted for 3 hours for each trial under controlled temperature (around 100 °C) and pressure (approximately 1 atmosphere) conditions. The process duration and extraction conditions were selected based on previous studies demonstrating their effectiveness in maximizing essential oil yield without decomposing active compounds.

Figure 1 - Materials for Oil Extraction

Note: Facilities for conducting the experiment, 2023

Finally, in the third stage, the extracted essential oils were collected in amber glass bottles to protect them from light and minimize property degradation. The bottles were stored in a cool, dark place to preserve the essential oil's quality. Once collected, the oils underwent detailed physicochemical analysis to assess their quality. Tests for density, refractive index, and chemical composition were performed using gas chromatography-mass spectrometry (GC-MS). Additionally, the results obtained were statistically analyzed to determine the influence of different mandarin varieties and extraction conditions on the essential oil yield and quality.

This statistical analysis included mean comparisons and variance tests to identify significant differences between samples. The results established correlations between the type of mandarin used, the essential oil yield, and the final product's physicochemical properties, providing a solid basis for future research in optimizing this process.

Results

To obtain essential oil from mandarin peels using the steam distillation method, a thorough experimental design was carried out to compare its yield with other extraction methods. This process employed a system of two connected distillation flasks: one containing water and the other holding mandarin peels. The selection of materials and proportions was crucial to achieving high efficiency in extracting the essential oil.

The experimental protocol involved adding 20 ml of water to the first flask, while the second flask contained 1 kg of mandarin (approximately 150-200 grams of peel). This setup was subjected to steam distillation at a controlled temperature for an average of two hours. During this process, the steam passed through the mandarin peels, resulting in the release of essential oil, which was then condensed and separated from the water. Upon completion, a mixture of water and oil was collected in the condenser. This mixture was decanted, yielding 17 ml of a liquid solution, from which 2 ml of pure essential oil were extracted.

This procedure was repeated several times to ensure repeatability and consistency of results, varying the proportions of peel and water, as well as the distillation times. The data obtained were compared with those from other extraction methods, such as cold pressing and maceration, which require longer times and larger amounts of plant material to achieve similar or even lower yields. In contrast, steam distillation proved more efficient in terms of the quantity of essential oil extracted in less time, making this method a more attractive option for industrial-scale production.

At the molecular level, it was confirmed that the essential oil of mandarin extracted by this method retains its main bioactive compounds, such as limonenes, which are responsible for its aromatic and therapeutic properties. This finding was confirmed through gas chromatography analysis, which identified the components of the essential oil and verified its quality.

Moreover, various pressure and temperature conditions were explored, finding that a pressure of 1 atmosphere and a temperature of 95°C were optimal for maximum essential oil extraction without significant degradation of volatile compounds.

This experimental analysis also included an evaluation of the impact of distillation time. The results indicated that, with shorter distillation times (around one and a half hours), the amount of essential oil recovered did not exceed 1.5 ml, while extending the time to two hours resulting in 2 ml of essential oil. However, exceeding this time did not yield a proportional increase in the oil volume, suggesting a saturation limit of the plant material.

The results demonstrate that the steam distillation method is not only effective and quick but also suitable for producing high-quality essential oils with low operational costs, making it a viable method for implementation in the

industry.

Table 1. Comparison of Essential Oil Extraction Methods

Method	Mandarin Peels (grams)	Oil Obtained (Milliliters)	Time Elapsed (Hours)
Steam Distillation	200	3	2
Cold Pressing	200	1	2
Hydrodistillation	200	1.6	2

Additionally, the characteristics that essential oils must have to be considered as such, based on the Peruvian Technical Standard (NTP 319.095): "ESSENTIAL OILS. Sweet orange essential oil, cold-pressed," obtained from the INACAL portal, are detailed.

Table 2. Characteristics of an Essential Oil Based on the Peruvian Technical Standard

	MIN.	MAX.
RELATIVE DENSITY	0.842	0.99
REFRACTIVE INDEX	1.470	1.476
POLARIMETRIC DEVIATION	+94°	+99°

The results obtained from the five tests conducted in the laboratories where we carried out the research yielded the following data.

Table 3: Results Obtained from Sample Analysis

Sample No.	Mandarin Variety	Laboratory Temperature	Results Obtained (ml)	Relative Density	Refractive Index	Polarimetric Deviation
1st Sample	Malvasia	22°C	3 ml	0.865 kg/m³	1.43 nD	92°
2nd Sample	Malvasia	22°C	2.8 ml	0.882 kg/m⁴	1.45 nD	91°
3rd Sample	Miyahuasi	22°C	3.5 ml	0.845 kg/m²	1.47 nD	98°
4th Sample	Miyahuasi	22°C	3 ml	0.835 kg/m³	1.46 nD	95°
5th Sample	Miyahuasi	21°C	3.2 ml	0.940 kg/m³	1.47 nD	96°
6th Sample	Miyahuasi	21°C	3 ml	0.965 kg/m⁴	1.475 nD	97°
7th Sample	Satsuma	22°C	0.5 ml	0.824 kg/m¹	1.44 nD	93°
8th Sample	Satsuma	22°C	1.0 ml	0.945 kg/m²	1.46 nD	95°
9th Sample	Satsuma	21°C	0.9 ml	0.925 kg/m³	1.475 nD	95°
10th Sample	Satsuma	21°C	0.7 ml	0.890 kg/m⁴	1.47 nD	98°

In the analysis of the results obtained from the various tests conducted, significant variability is observed in the quantity and quality of the essential oil extracted from the different mandarin varieties used. In this study, two varieties of mandarin were employed: Miyahuasi and Satsuma, which were harvested at different times of the year, a factor that could also influence the observed yields.

A noticeable difference between these varieties is the thickness of the peel. The Miyahuasi mandarin has a considerably thicker peel compared to the Satsuma variety, which allows for better retention and release of essential oils during the distillation process. This characteristic was key to obtaining a higher volume of essential oil from the Miyahuasi variety, as it was observed that thicker peels act as a barrier that better preserves volatile oils, thus facilitating their release through steam distillation. Experimental results showed that from 1 kg of Miyahuasi peel, approximately 20% more essential oil was obtained than from 1 kg of Satsuma peel under the same distillation conditions.

In addition to peel thickness, other factors influenced the amount of essential oil extracted. The harvest season was another relevant aspect, as mandarins of the Miyahuasi variety harvested during the peak season (at the end of the harvest) contained higher concentrations of essential oils compared to those harvested earlier in the season. This is likely due to the greater maturity of the fruits, which leads to a higher concentration of volatile compounds in the peel. The physicochemical parameters analyzed included density, refractive index, and solubility in ethanol, which are essential for classifying the obtained oil as a quality essential oil. Regarding density, both the Miyahuasi and Satsuma varieties showed values within the standard ranges for citrus essential oils, confirming that the obtained oil has the appropriate consistency for such products. The refractive index also remained within the expected limits, indicating that the essential oil retains its purity and has not been altered during the distillation process.

Regarding solubility, it was observed that the essential oil obtained from Miyahuasi mandarins exhibited higher solubility in ethanol, suggesting a higher concentration of active compounds in the peel of this variety. This could have implications for its use in cosmetic or pharmaceutical products, where ethanol solubility is a determining factor for product formulation. In addition to these physical parameters, chromatographic analyses were performed to evaluate the chemical composition of the essential oil. The predominant compounds in both varieties were limonenes, which are responsible for the characteristic citrus aroma of mandarin essential oil, but other terpenes such as γ-terpinenes and α-pinene were also identified, contributing to the therapeutic properties of the oil. The Miyahuasi variety, due to its larger quantity of peel, also showed a higher concentration of these compounds, giving it greater value both in terms of aroma and antioxidant and antimicrobial properties. These findings suggest that peel thickness and harvest season are key factors for optimizing the extraction process and improving the quality of the essential oil obtained, which in turn can have a significant impact on the essential oil industry, where the purity and concentration of bioactive compounds are fundamental.

Discussion

The primary objective of this study was the transformation of waste from processing plants to obtain essential oils, with a focus on mandarin oranges. When comparing the results obtained with previous studies, the article

"Comparative Study of Peels Essential Oil Constituents of Some Citrus Species" provides a relevant framework, as it focuses on the composition and yield of essential oils obtained from citrus peels, including mandarin. In their study, using distillation and pressing techniques, they obtained an average yield of 1.8 ml of essential oil per 200 grams of mandarin peel. In contrast, the results from our study using steam distillation showed a higher yield, reaching 3 ml of essential oil per the same amount of peel and processing time, representing a 66.6% increase in yield. This result highlights the efficiency of steam distillation compared to other methods used (Figueira et al., 2021).

On the other hand, Giulia et al. (2022), in their analysis of antioxidant properties and essential oil yields from mandarin peels at different stages of maturation, provide additional comparative data. The authors observed that using mature mandarin peels, the yield of essential oil averaged 2.5 ml per 200 grams, while in earlier stages of maturation, it was only 1.2 ml. These results are consistent with those obtained in our study, where the Miyahuasi variety, with thicker and more mature peels, produced an average yield of 3 ml, while the Satsuma variety, with thinner and less mature peels, yielded only 0.7 to 1.0 ml on average (James et al., 2022).

Both studies confirm the conclusion that peel thickness and fruit maturity significantly affect essential oil yield. In this regard, the study emphasizes the importance of using varieties like Miyahuasi to maximize the production of essential oils in industrial processes.

Moreover, variations in the physicochemical properties of the obtained oils were observed. Compared to the Peruvian Technical Standard (NTP 319.095), the essential oils obtained in the study met the established quality standards. For instance, the average relative density of the oils from the Miyahuasi variety ranged from 0.845 to 0.965 kg/m³, while the refractive index ranged from 1.43 to 1.475 nD, which is consistent with the limits of 0.842 to 0.99 kg/m³ and 1.470 to 1.476 nD indicated by the standard. These values also align with the results obtained by Giulia, who also highlighted a similar refractive index in their oils from mature mandarin.

One of the main limitations encountered during the project was the availability of different types of mandarins at different times of the year. The first sample was obtained in November, a period during which the Deleite and Miyahuasi varieties predominated, both having thicker peels. However, during these months, these varieties were either scarce or in immature stages. Considering this, we decided to use another mandarin variety, Satsuma, which has thinner peels. Due to this characteristic, the number of essential oils obtained was limited, with yields ranging from 0.5 to 1.0 ml per 200 grams of peel, compared to the 3 ml obtained from the Miyahuasi variety (James et al., 2022). This variability in the availability and characteristics of mandarins is a crucial factor to consider in studies like this, as it directly affects the quantity and quality of the essential oils obtained.

Conclusions

The production of essential oil is a technologically viable solution when using the steam distillation method, providing an alternative for processing companies by transforming their by-products or waste into a value-added product. Instead of discarding these residues, companies can utilize them profitably, generating additional income and reducing environmental impact.

It is essential to comply with the characteristic parameters established by the Peruvian Technical Standards 319.095 to obtain high-quality essential oils. These parameters provide crucial information about the characteristics of the oils obtained and allow us to determine whether they meet acceptable performance standards.

Recommendations

It is recommended to continue studying ways to improve the efficiency of the steam distillation method by adjusting variables such as temperature and distillation time to increase essential oil yield and reduce operating costs. Additionally, exploring new applications of mandarin essential oil in industries such as cosmetics, pharmaceuticals, and food could be beneficial, evaluating its potential as a natural preservative or an ingredient in personal care products. To maximize the utilization of waste in mandarin processing plants, it is suggested to analyze the economic feasibility of scaling up this process to an industrial level, considering investment in equipment and associated operating costs.

On the other hand, it is important to conduct an environmental impact and carbon footprint analysis of the extraction process to ensure sustainability while exploring alternatives for managing by-products generated during distillation. Furthermore, long-term tests should be carried out to assess the chemical stability of the essential oil under different storage conditions, as well as to investigate methods to improve its preservation and prevent the degradation of its bioactive compounds.

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5S Implementation Experience in a Day-care Center in the City of Lima-Peru. A Case of Action-Research

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Abstract: The objective of the research was to describe how the application of the 5S methodology promotes that educational spaces are tidy and clean of pedagogical resources to interact in them and achieve efficient learning and teaching processes. The research question was posed: How does the application of the 5S methodology promote that educational spaces are pedagogical resources to interact in them and achieve efficient learning and teaching processes in a day care center? The methodology used was Action Research, developed in four phases, and the methodological design was experimental and transversal. The results of the initial audit showed 45% compliance with the 5S program, with disorderly spaces, and lack of knowledge of the tool. After implementation, the final audit showed 79% compliance, as a result of training, organization and use of spaces by delimiting furniture and improving the cleaning plan, among others. According to the perception survey responses, 71.4% of teachers believe that an orderly and clean classroom influences student learning. 86.67% of parents believe that order in the classroom helps their children feel more secure and comfortable.

Keywords: 5 S, Action-Research, Day-care center, Early Childhood Education, Continuous Improvement.

Introduction

The Peruvian Ministry of Education (2006) defines the Cuna as: "A school-based educational institution of the first cycle of the Initial Education level of the Regular Basic Education (RBE) that provides a comprehensive service for early childhood from 90 days to 2 years 11 months of age, with the purpose of offering them the possibility of developing in an appropriate and timely manner respecting their level of maturity."

Therefore, they recommend that all environments must be kept in proper hygienic and maintenance conditions, being responsible the director of the Educational Institution; as well as "conservation of furniture, equipment and infrastructure and manage the acquisition and / or donation of furniture and equipment of the crib" (Ministry of Education of the Republic of Peru, DIRECTIVA No. 073-2006-DINEBR-DEI).

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According to Ministerial Resolution No. 587 - 2023-MINEDU, "Educational spaces must be accessible, flexible and designed and organized according to the pedagogical proposal of each educational level and modality. They become pedagogical tools and/or resources when the teacher and students interact in them, during the teaching and learning processes, based on their interests, needs and characteristics. They are organized and implemented, in a safe and accessible way, in order to promote curiosity and exploration of students" (Ministry of Education of the Republic of Peru, Ministerial Resolution No. 587-2023-MINEDU, Article 1)

The Technical Standard set forth in Vice-Ministerial Resolution No. 004- 2024 - MINEDU in section 5.1. 3 (page 5) states that "during the entire day in which the education and day care service is provided, the teacher carries out actions that favor the learning and comprehensive development of children; for which he/she plans the organization of space, furniture, educational materials and interactions, within the framework of the Early Education Curricular Program (Ministry of Education of the Republic of Peru, Vice-Ministerial Resolution No. 004- 2024 - MINEDU, Article 1).

To address the organizational and resource challenges that some day-care centers face, it's crucial to adopt methodologies that promote efficiency in a child development-friendly environment. In this way, implementing tools such as the 5S methodology can make a significant difference. Although the tool is known to be applied in industrial environments, Shankar and Venkataraman (2019) argue that, the application of 5S can be implemented in various environments, regardless of the size or type of organization, such as homes, schools, communities, among others.

The 5S methodology fosters in workers the habit and respect for order and cleanliness, as a way of achieving a pleasant work environment, and facilitating access to tools and materials, with the purpose of achieving productivity and efficiency (Rey, 2005). It is important, therefore, that the leader of the organization expresses its commitment to the 5S program through a policy, objectives aligned with the strategies and an action plan to carry it out and maintain its continuity (Díaz & López, 2023).

The first "S", Seiri, focuses on selecting only what is necessary for the activities being performed, eliminating unnecessary objects (Karthik & Silksonjohn, 2019). The second "S", Seiton, promotes that each thing has a specific place facilitating its quick and efficient location (Gupta & Chandna, 2019). The third "S", Seiso, alludes to the need to keep the place clean and tidy, eliminating sources of dirt that can spread diseases (Michalska & Szewieczek, 2007). For its part, the fourth "S", Seiketsu, seeks to maintain what has already been achieved with the application of the previous three "S" by establishing rules and procedures to maintain standards (Nava-Martínez et al., 2017). Finally, the fifth "S", Shitsuke, promotes discipline by cultivating responsibility and commitment, actively, with respect for rules and encouraging good habits (He & Shao, 2019).

Education is crucial for the development of a country, as it generates the knowledge, skills and values needed by future professionals to drive economic growth (Chourasia and Nema, 2019). In this context, good practices of 5S methodology implementation should be transferred from teachers to students by fostering key skills such as self-discipline and responsibility, which are essential for their academic and personal success.

Mena and Vera (2012) applied the 5 S methodology starting with trainings to the stakeholders of an educational institution and then the development of each "S" with the support of teachers achieving to establish standards for the improvement of teaching.

Action-research in education is a study that teachers conduct to make better judgments and actions in their field of competence after completing the study. Anselma et al. (2019) emphasize that participatory action research empowers children by developing their abilities to identify problems in their environment, propose solutions, and make informed decisions. In that way, children can be sought to be involved in the implementation and maintenance of the 5S methodology in their educational environment.

Girmanová et al. (2022) indicate that the growing demand for quality education is driving stakeholders to actively consider quality management in several areas: curricula, teacher training, educational processes, student assessments, and the quality of resources and the environment in which the service is provided.

Ghazala (2008) points out that, seeking improvement in education, the implementation of the 5 S's was chosen as a solution, starting with a diagnosis and creating an action plan, and then evaluating the measures applied, finally executing the feedback by involving the teachers so that they feel involved in the process.

In other service organizations such as restaurants where cleanliness and order are very important, this methodology has also been applied as reported by Orynycz et al. (2020) to organize and optimize workstations, improving their efficiency and reducing production times, as well as to optimize the available work space as reported by Alva et al. (2020).

The implementation of the 5 S's in the crèche can be carried out considering the University-School relationship because it creates a link that benefits both students and institutions in teacher training, research, community support among others to achieve educational quality (Galdames, 2024; Goldrine et al., 2024).

Considering the above, the research question was posed as follows: How does the application of the 5S methodology promote educational spaces as pedagogical resources to interact in them in order to achieve efficient learning and teaching processes in a day-care?

The objective of the research was to describe and demonstrate how the application of the 5S methodology promotes those educational spaces are tidy and clean pedagogical resources to interact in them in order to achieve efficient learning and teaching processes in regular basic education in Peru.

Method

Regarding the methodological design of the research, this is experimental, which is carried out in a day-care center in the city of Lima which has 5 classrooms, 2 offices, 2 toilets, a warehouse, a storage room and playground with recreational garden, observing aspects of order and cleanliness in the educational establishment, to finally evaluate

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the variation of these aspects obtained after the improvement. In addition, this research uses a cross-sectional design, that is, the data are collected at a single point in time, in this case in the year 2023 (Hernández-Sampieri & Mendoza, 2018).

The methodology applied is Action-Research, which consists of action, observation, reflection and evaluation of a process in a cyclical manner conducted by the same agents involved (Bisquerra, 1989). Action-research is a way of knowing and solving a situation by means of strategies agreed upon by those involved (Sarramona, 2023). In addition, it's a training tool that provides greater autonomy, improves collaborative skills and the development of observation and analysis skills (Guerra et al., 2017).

This study consists of 5 phases shown in Figure 1 considering the way it was developed in the research of Garrido-Fonseca et al (2024):

Methodology Implementation - Action

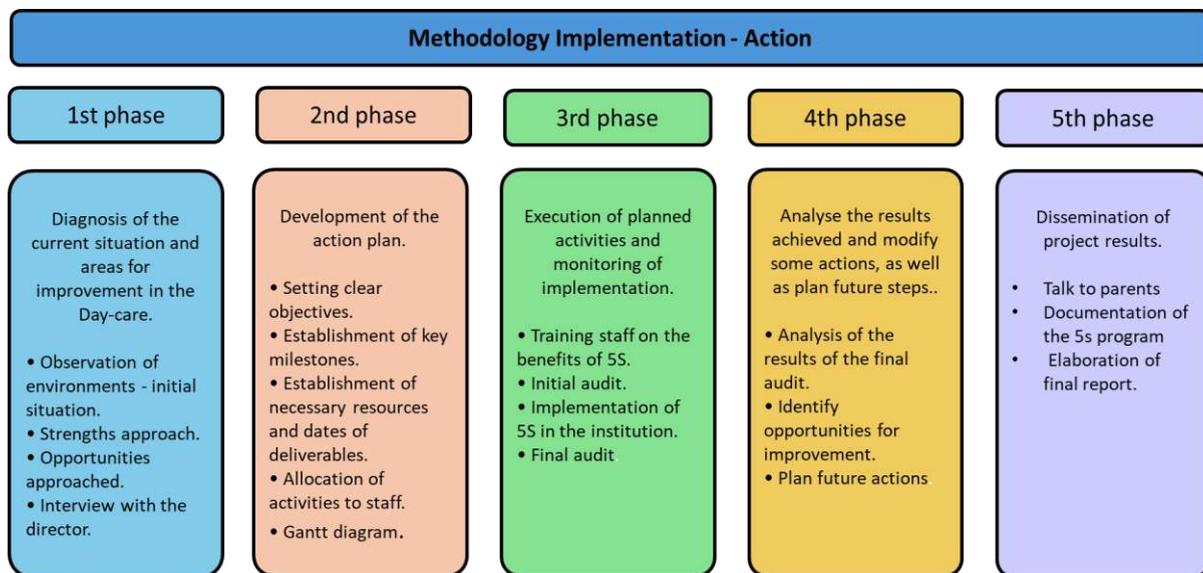| 1st phase	2nd phase	3rd phase	4th phase	5th phase
Diagnosis of the current situation and areas for improvement in the Day-care. • Observation of environments - initial situation. • Strengths approach. • Opportunities approached. • Interview with the director.	Development of the action plan. • Setting clear objectives. • Establishment of key milestones. • Establishment of necessary resources and dates of deliverables. • Allocation of activities to staff. • Gantt diagram.	Execution of planned activities and monitoring of implementation. • Training staff on the benefits of 5S. • Initial audit. • Implementation of 5S in the institution. • Final audit.	Analyse the results achieved and modify some actions, as well as plan future steps.. • Analysis of the results of the final audit. • Identify opportunities for improvement. • Plan future actions	Dissemination of project results. • Talk to parents • Documentation of the 5s program • Elaboration of final report.

Figure 1. Methodology Implementation – Action

Results

Each of the phases of the Action -Research methodology has been developed where each stage played a key role in the experimentation having a significant impact on the order and cleanliness of the day-care to provide a better service.

Phase 1

It was observed that the day-care had well laid out spaces, adequate infrastructure and highly qualified teaching staff with certification in early childhood education. However, many teachers were unaware of the 5S methodology in the educational environment. In addition, the storeroom was identified as the most disorganized area with a lot of space occupied due to the constant movement of materials for daily activities. Despite having resources, several were dilapidated or in disuse. After an interview, the director recognized the importance of implementing the 5S tool to

maintain an organized and clean environment and agreed to the creation of a 5S committee to oversee the correct application of the methodology and ensure its continuity over time.

Phase 2

In this phase, the planning of the activities was presented, considering the necessary resources. To optimize the organization, a Gantt diagram was developed, considering dates and resources, considering 5 key stages: Start of the intervention, Coordination meeting, Implementation of the 5S program, Project monitoring and Project closure. It was determined that the total duration of the project would be approximately six months, at which time the final report would be submitted to the director of the institution and the dean of the university's Faculty of Engineering.

Phase 3

In this phase, the activities planned were carried out, starting with the initial audit, where various areas such as classrooms, offices, kitchen, warehouse and bathrooms were evaluated with the support of students trained in the methodology of the industrial engineering course. At the conclusion of the audit, an average compliance rate of 45% was obtained, with the fifth S being the lowest scoring, with only 23% compliance, due to the lack of self-evaluations and monitoring of the 5S program. With respect to the first S, the presence of unusable or damaged objects in drawers and shelves, as well as misplaced items, was noted. In relation to the second S, although some objects have an assigned space, they aren't properly identified. Regarding the third S, although there is a cleaning plan, it lacks sufficient detail to identify the sources of contamination, those responsible and the frequency of cleaning. Finally, regarding the fourth S, visual controls were observed to exist, but many were out of date, which could generate erroneous information.
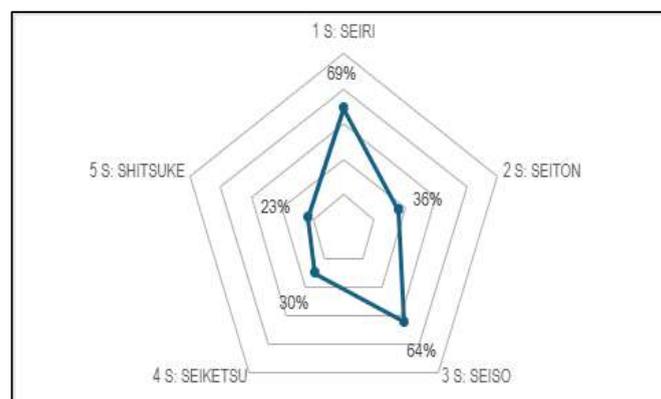

Figure 2. Radar Diagram of The Initial Audit

After the initial audit, the implementation of each 'S' was carried out as follows:
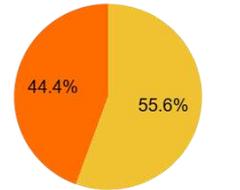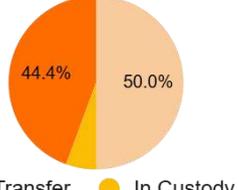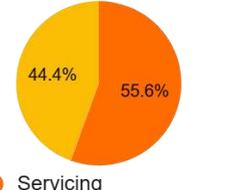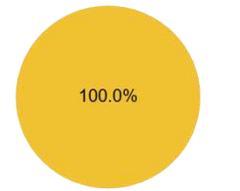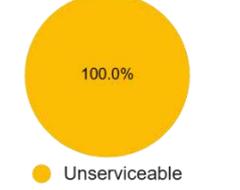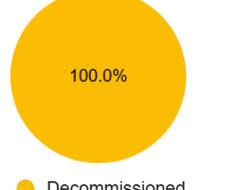
Seiri (Sorting)

In a day-care center, this means sorting toys, educational materials and supplies. Eliminating items that are unused or in disrepair not only frees up space but also reduces the risk of accidents. It also makes it easier to find materials needed for daily activities and ensures that only safe and child-friendly items are used. During its implementation,

which focused on the organization and identification of necessary and unnecessary goods, a classification of objects into capital goods and current goods was carried out, resulting in 28 items of the former and 11 of the latter. In this process, the capital goods were classified in three states: good, fair and bad, without considering the current goods, as these are returned to the parents at the end of the year.

As a result, 18 items were found to be in good condition, 7 in fair condition and 3 in bad condition. In addition, as can be seen in the following table, a classification criterion, an action plan and the destination of each item were established. It was observed that around 50% of the elements in good condition and 100% of the elements in fair condition will receive maintenance to ensure their functionality and prolong their useful life. On the other hand, items in bad condition, such as chairs and shelves, will be decommissioned.
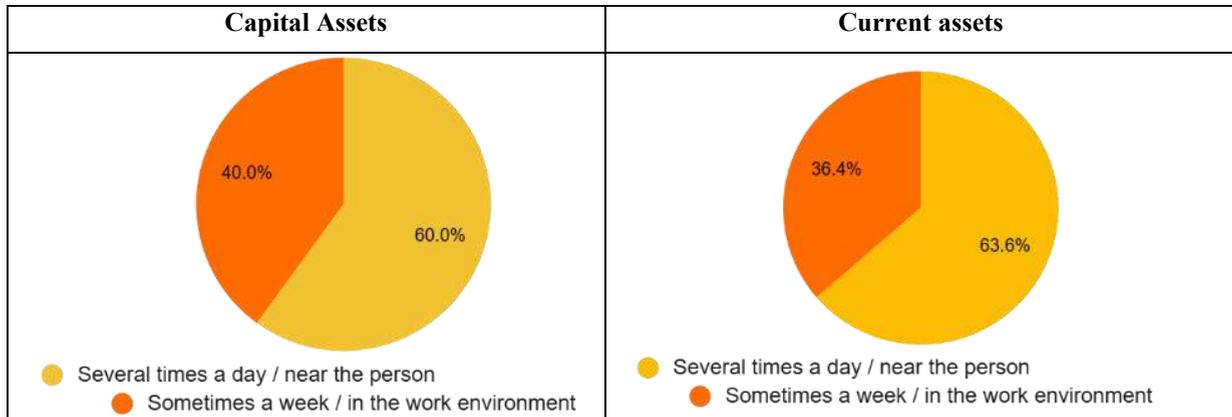
Table 1. Classification of each Element

Capital Assets	Classification Criteria	Action Plan	Destination
Element in good condition	55.6% Recoverable, 44.4% N/A	50.0% Transfer, 44.4% N/A, In Custody	55.6% Servicing, 44.4% N/A
Element in regular condition	100.0% Recoverable	100.0% Repair	100.0% Servicing
Element in bad condition	100.0% Unserviceable	100.0% Delete	100.0% Decommissioned

Seiton (Order)

In a day-care center, this involves organizing toys by category, keeping cleaning supplies in designated areas, and ensuring that each educational resource has its place. Order in the environment contributes to a quieter and less chaotic environment, which benefits both children and staff. In the implementation of this S, the different assets were ordered, and a place was determined for each one, taking into account their frequency of use. To carry out this activity, a matrix of frequency of use and destination was used, classifying the items into capital goods and current goods, with a total of 20 capital goods and 11 current goods. In the following table, between 36% and 40% of the goods are used several times a day, so they should be located near the teacher. On the other hand, the rest of the items will be placed in the work area, as they are used a few times a week.

Table 2. Frequency of Use and Destination

Capital Assets	Current assets
40.0% / 60.0% ● Several times a day / near the person ● Sometimes a week / in the work environment	36.4% / 63.6% ● Several times a day / near the person ● Sometimes a week / in the work environment

In addition, the different elements and areas were labelled in order to facilitate the quick visualization and accessibility of the objects used by both teachers and students in their daily lives.

Table 3. Initial and final status of the application of labelling

Before	After

Seiso (Cleaning)

In a day-care center, this involves not only cleaning spaces and equipment on a daily basis, but also regular inspections to identify hygiene problems. Constant cleaning prevents illness and ensures a safe environment for children. In the implementation of 3S, focusing on cleaning, it was necessary to improve the existing plan, identifying the areas to be

cleaned, the frequency, the persons assigned and registering observations, such as the use of specific products or adjustments in the assigned frequency.

Seiketsu (Standardization)

In a day-care center, this may include the creation of checklists for cleaning, standardized routines for organizing materials and clear guidelines for supply management. Standardization ensures that all staff members follow the same practices, which contributes to greater consistency in the service and care provided. Labelling matrices were created that assign a specific color to each area, making it easier to visualize items. This system helps to quickly identify where objects are located and to which area they belong. In addition, each area was delimited using yellow tape to mark the spaces where furniture and equipment should be located. This signage not only maintains order, but also improves accessibility, ensuring that everyone knows where each item should be. In the case of the equipment storage area, the space was optimized by 30%, reducing the time spent searching for materials by 20%. In the case of the classrooms by 5%.

Shitsuke (Discipline)

Fostering discipline means that each team member must adhere to established practices, collaborate in the implementation of the 5S and remain proactive in identifying areas for improvement. Therefore, documentation of the steps to follow to implement each of the 5S and the classification and frequency of use matrices of the elements that belong to the day-care are included In addition, a panel is incorporated that facilitates the visualization of the implementation of each S, where the matrices and the results of each one can be observed. Training for teachers as well as for parents is also included, to encourage the application of these practices at home. Finally, after the implementation of the 5S tool in the da-care with the involvement of all staff, an external auditor (a qualified teacher from the university) carried out a final audit, thoroughly reviewing each environment and objectively rating the criteria of each S. As a result, an average of 79% was obtained in the correct application of the tool, which can be seen in Figure 7.
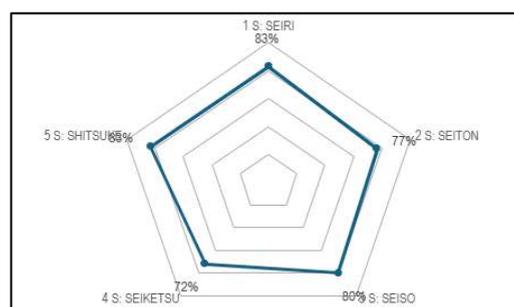

Figure 3. Radar Diagram Final Situation

Phase 4

In this phase the results obtained are taken into account, showing a significant improvement in the organization and the working environment. When comparing the results of the initial audit with those of the final audit, the percentage

of each environment has increased between 76% and 88%. In contrast, the initial range varied between 31% and 64%.

The table below shows the percentage improvement for each of the 5S, which demonstrates that the implementation of this tool has contributed to optimizing the environment for both teachers and students. This change reflects the positive impact of the program on the efficiency and organization of the day-care center.

Table 3. Initial and Final Situation

S	Initial Situation	Final Situation
1 S: SEIRI	69%	83%
2 S: SEITON	36%	77%
3 S: SEISO	64%	80%
4 S: SEIKETSU	30%	72%
5 S: SHITSUKE	23%	83%
Percentage Final	**45%**	**79%**

However, there are still opportunities for improvement that will be addressed in the future, among them, the application of the tool in the 'yellow' classroom, which was occupied by furniture; in addition, it is necessary to improve the cleanliness and organization of the area destined for cleaning implements.

In order to know the perception of teachers and parents about the implementation of the 5S project and its benefits, the day-care center conducted a survey of 100% of teachers and 95% of parents, with the following results:

- 71.4 % of teachers believe that a tidy and clean classroom influences students' learning.
- All teachers consider that the implementation of the 5S can improve an educational environment.
- Lack of time and students' resistance make it difficult to maintain the 5S in the classroom.
- 80% of parents rate the order in the classroom as excellent and 20% as good.
- 93.33% of parents believe that a clean environment is important for their child's development.
- 86.67% of parents consider that order in the classroom helps their child to feel more secure and comfortable.

It is important to note that the implementation of this tool was possible thanks to the university-school relationship and the funding provided by the University of Lima, with the total investment amounting to approximately S/ 2,800.

Phase 5

In this phase, the necessary activities were carried out to reflect on the importance of implementing the tool. In addition, the documentation of the 5S program was completed, both in the 5S binder and on the 5S Panel, to achieve wider dissemination. The 5S implementation manual was also improved so that it can be disseminated and used by stakeholders. Finally, a final implementation report was prepared to be submitted to the authorities of the Faculty of Engineering of the University of Lima.

Discussion

5S is a tool borrowed from industry, but it can also offer maximum value to the clients of educational systems by consuming few resources and eliminating waste (LeMahieu et al., 2017) to optimize in this case the service in a day-care center for children in the city of Lima-Peru, organizing not only the working environment, but also the teaching-learning spaces.

In the same educational context, the implementation of the 5S methodology in a higher education library has proven to be very effective; this strategy has optimized spaces and resources, halving the time students spend searching for books and reducing the time it takes to issue them, as well as obtaining 20% more usable space according to Chourasia and Nema (2019). In addition, the application of the 5S in the field of early education can be equally beneficial by organizing the materials that children will use during the day, facilitating access to them and promoting a more orderly and stimulating learning environment, considering what Medina Zurita (2011) stated, contributing to the child's concentration in the classroom.

Ensuring a safer, healthier and more hygienic environment in schools has great potential to improve health and education as stated by McMichael (2019), which translates into a positive experience for children and their families, so the application of this 5S tool in the day-to-day management of schools will also reinforce these aspects.

Implementing the 5S using the Action-Research methodology has been beneficial because it has involved all stakeholders (teachers, children, parents of the crèche, as well as teachers and university students) in the process of change. In addition, it has been a beneficial didactic strategy because it has introduced the 5S tool in a practical way and this has strengthened other competencies of the teachers such as teamwork and management of the learning process (Núñez-Rojas et al., 2021).

The interventions carried out in the day-care center were permanently evaluated with the director of the institution as the project leader considering what was exposed by the teachers and parents, as well as the research carried out by Anselma, et al. (2019); therefore, the Action-Research methodology can be very effective to improve educational services, as it allows for reflection in action and constant adaptation to real needs and promotes a collaborative approach to problem solving, according to the results of this research.

The research was limited by the lack of previous experience of other published research where 5S has been applied in regular basic education institutions, as well as the time available to undertake the improvements because classes could not be interrupted.

Conclusion

The application of the 5S's supports compliance with the country's legal educational regulations to maintain proper hygienic conditions, as well as the conservation of the furniture, equipment and infrastructure of the place, thus ensuring a safer, healthier and more orderly environment that is essential for the teaching-learning process of the

children.

This study is also based on the university-school relationship because it supports the implementation of improvements in regular basic education institutions, as well as reinforcing the 5S methodology in a practical way in the students of the Industrial Engineering course. In this way, the experience in this day-care is evidence that any organization interested in improving its educational quality can benefit significantly from the application of the 5S methodology by making better use of its spaces and resources. As future activities, training on the 5S tool will be carried out for teachers from other educational institutions, reinforcing the university-school relationship.

Recommendations

It is advisable to develop a plan that includes training, role assignment and regular audits, which will allow progress to be monitored and good practices to be maintained. These practices can be extended to homes and other settings, fostering a culture of order and discipline in the community.

Funding

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Improvement proposal for the preparation and assembly processes of Smart Box considering Lean Methodologies

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Abstract: This research aims to address the operational challenges faced by a medium-sized metal-mechanical company in Lima, Peru, specifically in the preparation and assembly processes of the Smart Box. The Smart Box is an innovative smart lock to prevent tampering with electric meters, ensuring secure and authorized designed access. Despite its potential, production inefficiencies have resulted in bottlenecks and waiting times, causing a 20% delay in weekly deliveries, equivalent to 16 undelivered units out of a planned 80. These delays stem from poorly optimized workflows, inadequate tool organization, and delays in raw material supply chains. To address these issues, Lean methodologies, including the Kaizen philosophy and the 5S tool, were implemented. The Kaizen approach facilitated the identification and elimination of non-value-adding activities, while the 5S methodology emphasized workplace organization, order, and cleanliness. These interventions reduced production times by 13%, minimized waiting times between 10% and 15%, and decreased defective products. Additionally, simulation through Arena software validated a potential 21% increase in weekly production capacity, raising the output from 75 to 95 units per week. The research highlights the significance of Lean tools in improving operational efficiency, reducing waste, and enhancing production sustainability. Recommendations include extending Lean practices to other stages of production, considering local manufacturing for imported components to reduce delays, and implementing continuous training to sustain improvements. These findings serve as a benchmark for applying Lean methodologies in similar industrial contexts.

Keywords: Smart Lock, Lean Methodology, Kaizen, Optimization, 5S, Production Efficiency

Introduction

In the last years there has been a noticeable loss of energy and lack of control over electrical connections managed by companies responsible for supplying electricity to homes. Jiménez et al. (2014) argue: "Approximately half of the LAC [Latin America and the Caribbean] countries have electricity losses above the average of 17%. The annual cost of these losses is estimated between USD 11,000 and USD 17,000 million (in 2012, the equivalent of 0.19% and 0.3% of Latin America's GDP)" (p. 10).

Companies providing products to meet this security need have been forced to propose efficient solutions that meet the requirements of the electric sector organizations, one of these solutions is the creation of a smart lock. According to Wei (2020), this product has high-quality features that enhance the security of distribution equipment, simplify staff operations by improving operability, and facilitate maintenance, eliminating issues caused by lost keys.

In Peru, a medium-sized company has developed a smart lock model that connects via Bluetooth and Wi-Fi to a mobile application that acts as controller for the user. Once assembled and properly programmed, it is installed in an electric meter box. The primary goal of this, is to allow only those authorized by the electric company to access it, ensuring that light meters are not tampered with and preventing illegal connections and other activities that financially harm the company (Personal communication, Garmendia, September 5, 2022).

The company has found it cost-effective to outsource the manufacturing of parts to reduce costs due to the economic difference between local production and outsourcing to China, where these activities are carried out. Once the product is assembled, it is imported by sea to Lima, where the company continues the preparation and assembly process of the Smart Box. To optimize processes where bottlenecks and waiting times for operator availability have been identified, the company proposed implementing a Lean continuous improvement methodology to ensure product efficiency and profitability, aiming for continuous process improvement. It was identified that there are additional expenses of approximately USD 1610 for every 1,500 units produced, and process delays occur due to queues of products waiting at least half an hour to be processed by an operator, causing significant delays in the final delivery to the customer.

According to Vargas and Camero (2021), "The results of the application of Lean Manufacturing can generally be seen in improved productivity, sales index, increased profitability and customer and employee satisfaction." (p. 259). Miranda et al. (2021) conducted a case study on the application of the Lean methodology to correct errors and reduce the number of defective pieces in quality control. They reduced the number of defective pieces from 3.96% to 2.71% by identifying that the root cause was poor distribution and organization of the raw material warehouse, applying tools like 5S and Kaizen (p. 121). Chilon et al. (2017) studied the application of 5S in a water bottling company, achieving a 29% increase in productivity, similar to Monar (2008), who recorded a 22.93% increase in the steel transformation process.

Method

Esteban (2018) states that "Applied research is aimed at solving the problems that arise in processes involving any human activity" (p. 3). The presented research was empirical and quasi-experimental. According to Montgomery (2017), experimental design is an important tool for engineers and scientists that is used to design and develop both products and processes and improve them as well. Since their implementation could significantly reduce the time and cost of the processes through a better functioning of them. (p. 7)

The Kaizen philosophy, which defines seven steps for improving an organization's processes, was applied as the methodology for the case. The process begins by selecting the problem, understanding it, and planning the goals. Then, a schedule is developed to implement improvements, the root causes are analyzed, and respective solutions are proposed, selected, and scheduled. Next comes the implementation of these solutions, followed by standardization and ensuring the solutions remain in place (Bonilla et al., 2020).

In conjunction with the Lean methodology, the 5S tool was employed. This tool aims for cleanliness and order in the workspace, standardizing the area by delimiting zones, using usage cards for devices, etc. (Manzano & Gisbert, 2016). In this research, the 5S tool was implemented with a solution proposal involving procedures of organization, sorting, reorganization, and cleaning. The research followed a mixed-method approach, collecting information from the company's 2021 database to analyze and propose improvements.

The study population consisted of a total of 1,500 Smart Box locks produced by the metal-mechanical company, with a sample of 80 units from the weekly production.

Results

With all the information gathered about the production process, the Kaizen methodology was applied to the selected case study to determine how to undertake the improvement. The actions taken at each step are presented as follows:

Step 01: Select the problem

In this initial diagnosis, the following indicators were found:

Percentage of defective electromagnetic locks:

$$\frac{Defective\ electromagnetic\ locks}{Total\ electromagnetic\ locks} = \frac{5}{240} * 100\% = 2.083\%$$

With this value, we can identify that defective lock deliveries represent only 2% of the total locks. However, since the exact quantity of this product is received, the defective locks must be returned to the supplier for replacement. This process of returning the item and receiving a new one takes approximately 4 to 5 months, which causes delays in the delivery of the Smart Box.

Percentage of Smart Boxes not delivered on time:

$$\frac{Smart\ Boxes\ not\ delivered\ on\ time}{Smart\ Boxes\ requested\ by\ the\ client} * 100\% = \frac{5}{80} * 100\% = 6.25\%$$

Due to several factors, both internal to the process and external, such as material shipments from suppliers, 6.25% of the weekly Smart Boxes are not delivered. While this may not represent a highly significant percentage on a weekly basis, it becomes a considerable figure when looking at the client's demand for a lot of 1,500 units. This results in delays in the final delivery of the lot by one or two weeks, depending on the availability of materials, resources, and workers availability.

Step 02: Comprehension of the problem and planning a goal

In Figure 1, the current Operation Process Chart (OPC) of the Smart Box production process is observed. The graph shows each of the activities that raw materials go through to become part of the product. In most of these processes there are waiting times, there is also defective raw materials and a return of the product by the customer.
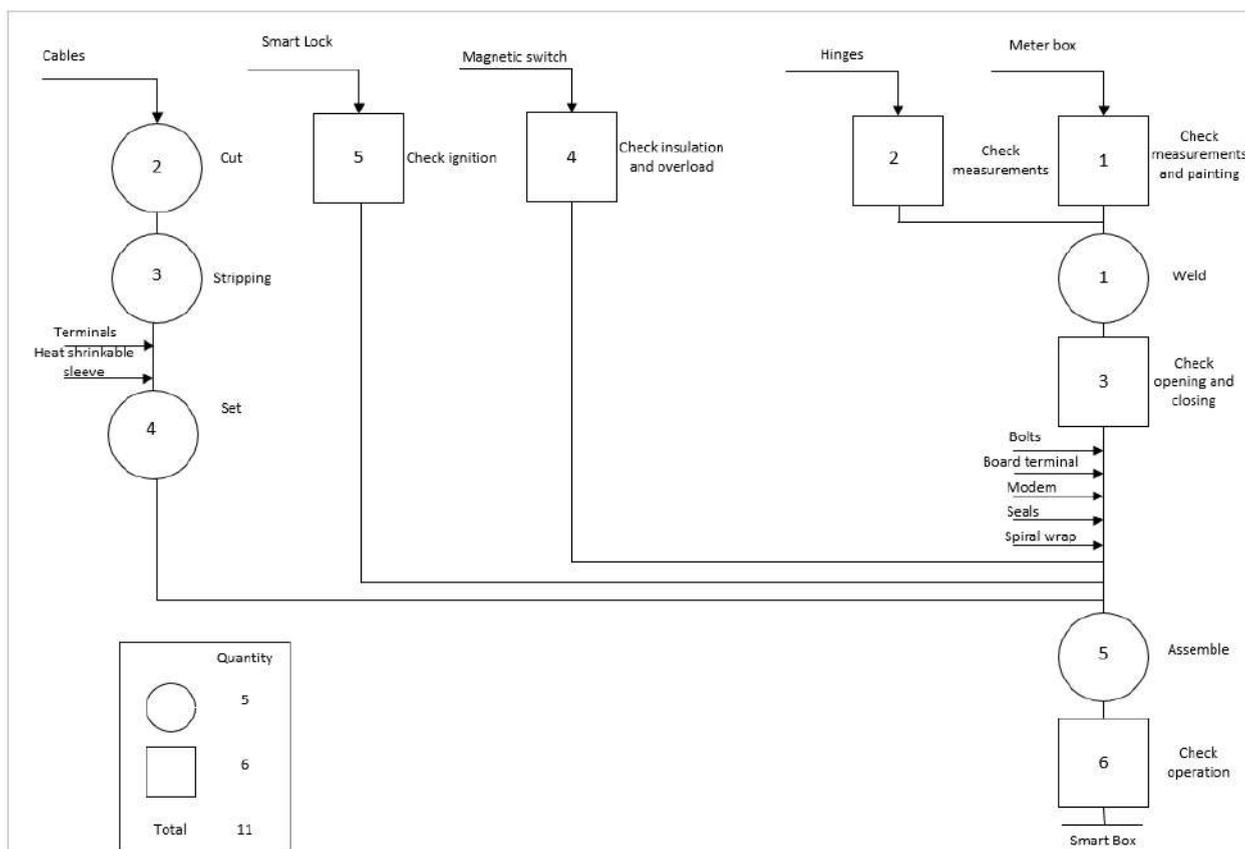

Figure 1. Operation Process Chart (OPC) of the Smart Box Production Process

Step 03: Preparation of the project development schedule

As the next step, schedules were created for both the improvement proposal project and its implementation, involving

16 activities over a period of 16 weeks. According to this schedule, the commitment and participation of the staff are crucial to facilitate and execute the project continuously and progressively. The goal is to improve time efficiency and reduce costs in the preparation and assembly stages of the production process.

Step 04: Analysis of the causes of the problem

Through visits to the company, the necessary information was gathered to understand the problems affecting the production process of the batch that is sent to the customer weekly, consisting of 80 units of Smart Boxes.

In Figure 2, we can see the problem and its potential causes up to a second level of the 6Ms present in production processes.
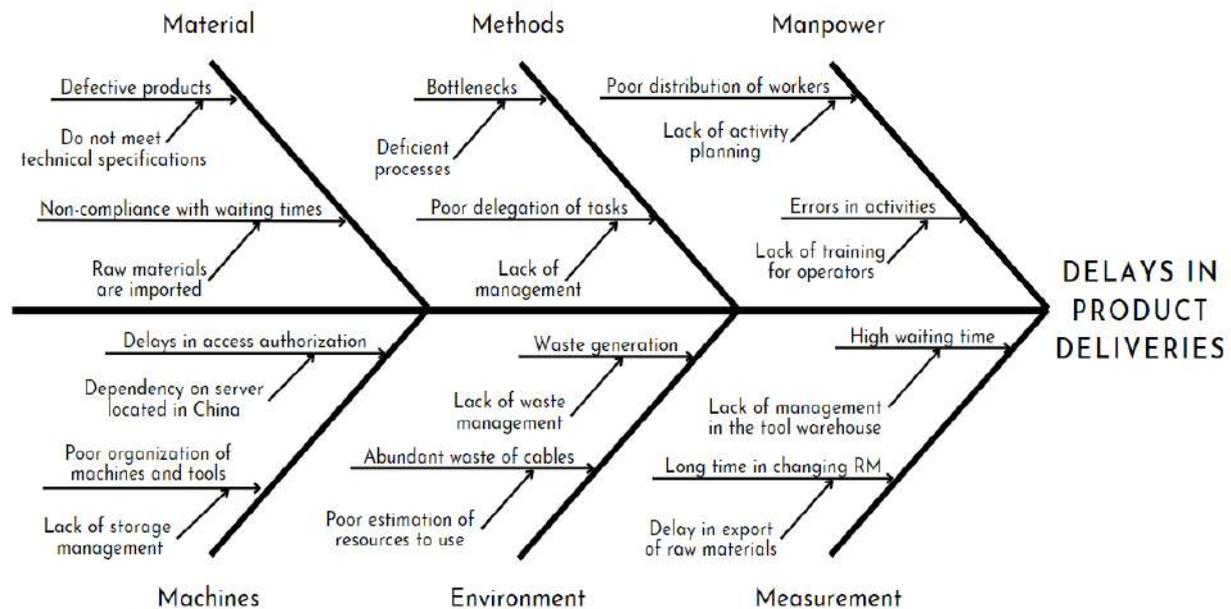
Figure 2. Ishikawa Diagram for the Smart Box Production Process

The most representative causes were identified through the analysis of the Smart Box production process and meetings with the staff involved in the processes to pinpoint errors and their potential root causes. Additionally, efforts were made to understand their impact and frequency. Once the most relevant causes were selected, their effects on the Smart Box production process were calculated and it was observed that the main causes of delivery delays for the Smart Box are primarily attributed to inefficient processes, poor management of tool storage and delays in the importation of raw materials. However, the lack of planning of activities, the inadequate time control and the poor estimation of resources also are causes for the problem.

Step 05: Proposal, selection and programming of solutions

The decision is to implement the 5S methodology. Initially, an audit was conducted to understand the current situation of the company, and the results are displayed in the radar chart.

Figure 3. Initial diagnosis with 5S methodology

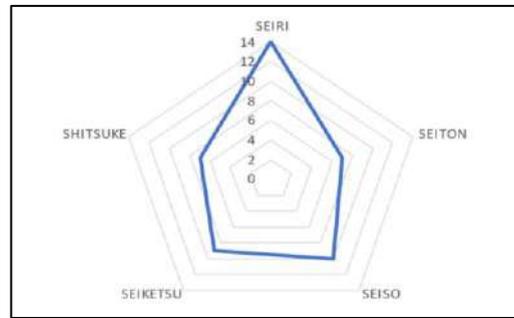The audit percentage was found to be 47%, indicating that the company's level of compliance with the 5S methodology is low across several of the evaluated "S" stages. It is necessary to focus primarily on the Seiri stage, which involves sorting. With the collected information, the development of the 5S methodology's five steps for the case study proceeded as follows:

Phase 1: Sorting (SEIRI)

The elements in the work area need to be classified and unnecessary items removed. This involves identifying what does not add value or hinders production activities. It is recommended that every tool should be identified based on their necessity and frequency of use.

Phase 2: Organization (SEITON)

In this phase, the locations of the tools were reorganized to facilitate the operators' work. To achieve this, shelves, drawers, and workbenches were previously numbered and labeled for easy identification.

Figure 4. Labeled Shelf

Phase 3: Cleaning (SEISO)

For this phase, bins or containers should be placed for sorting waste directly from the workbenches. Waste will be divided into two categories: items that will not be reused and items that can be recycled. This approach will help prevent waste from falling on the floor, reducing potential accidents and will free up workspace by keeping the workbenches clear, it will also improve waste management. Workspace cleaning will be handled by the company's maintenance personnel.

Phase 4: Standardize (SEIKETSU)

In this step, we designed the technical specifications for the metal meter holder box, in which we included the material of the product itself, the function and all of the characteristics it should have, such as the height, width, depth, texture, resistance and packaging. We included the type (variables or attributes), the level of criticality, how to measure the values and the type of inspection for them.

Phase 5: Discipline (SHITSUKE)

Along with the implementation of 5S improvements, a reorganization of each operator's activities was proposed, addressing another issue within the company: poor organization and distribution of operators. First, a list of all the activities was made, including the specific tasks and the time each one takes. Also, we numbered the eight operators and wrote which operator was responsible for each task. While doing this exercise, it was shown that the longest task was made by only one operator and the tasks that were easier or took the less amount of time, had multiple operators assigned.

Following this diagnosis, the functions of the eight operators were reorganized as follows to increase their efficiency in daily tasks. This reorganization is expected to reduce the hours spent on certain activities, assuming that the operators are trained to perform these tasks effectively.

Table 1. Proposal to improve the distribution of functions per operator

Activities	Tasks	Time (hrs)	Operator							
			1	2	3	4	5	6	7	8
Materials Review	Check box measurements	2	X	X	X					
	Check hinge measurements					X				X
	Check switches						X	X		
	Check locks								X	X
Box Conditioning	Cut cables	1	X							
	Strip cables	1	X							
	Fix terminals	1		X					X	
Welding	Welding hinges	8			X		X			
Inspection	Check opening and closing	1				X				
Assembly	Assembly of parts to the box	14	X	X	X	X	X	X		
Inspection	Final verification of Smart Box	12							X	X

Step 06: Implementation and verification of results

To assess the operational benefits achieved through the 5S improvements, a simulation was conducted using the Arena software, which was designed as follows:
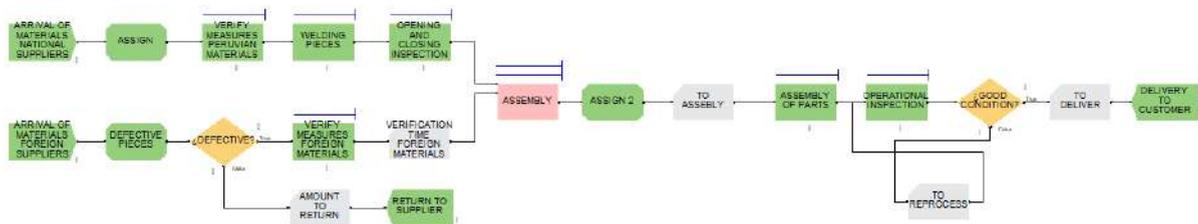
Figure 5. Simulation model in Software Arena

In the current situation of the company, the planned process for producing 80 units per week does not meet the target, as confirmed by the Arena software, which shows only 75 units per week. Daily, the company should produce a total of 16 Smart Boxes to meet the weekly goal of 80 units. However, this target is not achieved due to defective materials, reprocessing, and delays in the queues at each procedure.

The production time of the Smart Box is visible, as well as the queue time for each process, which is intended to be reduced through the proposed improvements. After implementing the improvements described in the previous steps, there was a reduction in process times for inspections, verifications, welding, and assembly by between 10% and 12%, depending on the process. This improvement is due to the operators being able to verify the product more quickly with easier access to necessary tools and having them readily available for welding and assembly.

Overall, a 13% improvement in total production time was achieved, with the time reduced from 31.25 minutes to 27.17 minutes. Additionally, the number of reprocessed Smart Boxes decreased to 2 units, indicating a reduction in defective products. Furthermore, the reduction in waiting times is also notable, with the greatest reduction being the verification of measurements of the materials from Peru with a decrease of 63%. Other activities that reduced their times were the assembly of the with 43%, welding pieces with 18% and the verification of measurements of foreign materials with 15%.

The company aims to increase its orders to suppliers with the goal of manufacturing 100 units per week. With the proposed improvements in place, if they wish to increase their planned production, the number of Smart Boxes they would be able to deliver per week is projected to be 95 units, according to the simulation results from the Arena software.

By implementing the improvements and continuously monitoring the processes, the company will enhance its profitability and achieve greater efficiency without overburdening its employees. This is because they will be able to produce more products within the same amount of time.

Finally, the cost associated with implementing the 5S improvements in the production process would be approximately 343.07 dollars. This would be a one-time cost that the company should consider, as once the improvement is established and standardized, only ongoing monitoring will be required to ensure the process remains efficient.

Step 07: Normalize and establish control

A procedures manual for the improvements will be developed in collaboration with the company to standardize the steps to follow. This manual should be shared on an informational bulletin board that is accessible to all employees or areas involved in the process.

The manual will detail both the improvements reflected in the process through the implementation of the Kaizen methodology and the 5S tool. It will also outline how prior training, implementation, and ongoing monitoring contribute to making the process more efficient through the committed efforts of each employee.

Discussion

This improvement aligns with findings by Chilon et al. (2017), who observed productivity increases of 29% in a bottling company. Additionally, the reduction in non-conforming pieces was confirmed, both in raw material reception, thanks to technical specification sheets, and in the final product (Smart Box), with a decrease from 6.25% to 5%. This is consistent with Miranda (2021), who, through the application of Lean methodologies, identified defective items before dispatch to reduce them.

The application of Kaizen and 5S also resulted in reduced waste due to better management and control of scrap, lowering the labor load and reducing productive time by 13%, as mentioned earlier. This agrees with Suárez et al. (2011), who achieved process time reductions of 10% to 15%, varying by process and operator availability.

In comparison to productivity increases described by authors like Tapia et al. (2017), the 65% improvement was not achieved. This may be due to improvements being applied to only two of the Smart Box's processes. Additionally, part of the process is performed abroad, which limits the study and the company's ability to fully realize potential benefits. If the processes were conducted locally, it could lead to benefits such as reduced waiting times for returns of non-compliant raw materials.

Conclusion

The use of engineering tools and methodologies such as Kaizen and 5S enabled a comprehensive diagnosis of both waste generation in the process and the assignment of operators to fulfill their tasks. The results demonstrated a 13% reduction in production times, making the company's proposed goal of increasing weekly production to 100 units feasible. With the proposed improvements, production is expected to rise from 75 units per week to 95 units, representing an additional 20 units after implementing improvements such as tool reorganization, element identification, and constant cleaning of the work area to avoid obstructions. The application of the 5S methodology demonstrated increased productivity in the work processes, resulting in a 21% increase in Smart Box production compared to current levels.

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Enhancing Learning Experience with Interactive Content: A Pilot Study in Designing Job Application Skill Lesson Plans Using Moodle H5p

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Abstract: This study aims to enhance the teaching and learning of job application skills through the design and implementation of interactive content using Moodle H5P. The primary objective of the study is to assess the design of H5P content and the methodology of surveys, ensuring the validity and effectiveness of the instrument. The research employs a quantitative approach, by means of survey to explore how well H5P is received by students in an asynchronous learning environment. The participants were the students enrolled in a communication course in a Malaysian public university. The study took place in an online learning environment, providing flexible and accessible learning experiences for students. The expected outcome is to provide evidence-based recommendations for the design and implementation of interactive content in teaching job application skills. The significance of this study lies in its potential to make a significant impact on the teaching and learning of job application skills and contribute to the literature on the effectiveness of technology-enhanced learning in this area. By providing a more comprehensive and structured approach to teaching job application skills, this research seeks to offer a more effective and efficient way of developing these skills through technology-enhanced learning.

Keywords: Moodle; H5P; Interactive Content; Job Application Skills

Introduction

The spread of the COVID-19 pandemic has sped up the use of numerous online learning tools. With the increased usage of several modern technologies, such as artificial intelligence, augmented reality, and many more, teaching and learning have never been the same. Many higher education institutions in Malaysia employ their own Learning Management Systems (LMS), such as Moodle, as the foundation for teaching and learning. However, not many Moodle users are aware of the H5P capability, which allows for the creation of interactive materials.

The H5P feature in Moodle allows instructors to include interactive materials in their classes. H5P is an internet tool for creating interactive content that can improve the standard of instruction and learning. H5P enables users to create and distribute interactive content including presentations, quizzes, interactive movies, and photos, and more. Due to H5P's complete integration with Moodle, users can easily add H5P content to specific pages, activities, or courses. H5P is a great tool for involving students in the learning process since it provides a variety of material kinds, including drag-and-drop activities, interactive films, and timelines. With H5P, teachers can quickly produce and distribute interesting content, and learners can engage with it and monitor their development.

H5P is a fantastic approach to introduce interactive content to the classroom that enhance learning enjoyment. In a recent study, Zakharova (2022) explored H5P with an emphasis on how it affects students' motivation and English language proficiency when used to teach English to master's students. The results in an academic setting show that using H5P has a relative impact on students' motivation and the capacity to improve their English language skills. Similarly, Siregar and Sembiring (2022) examined the creation of interactive learning materials utilising H5P in a pronunciation course. It was discovered that H5P improved student comprehension of the subject matter and increased their enthusiasm for learning.

In this study, the usage of H5P in a lesson on job application skills in a Malaysian higher education institution communication course was examined. While Moodle and H5P have been the subject of studies examining their usage in various educational contexts, there is a dearth of studies examining their use in teaching and acquiring job application skills including writing resumes, cover letters, and video resumes. In addition, empirical studies on the effects of using Moodle and H5P on the standard of instruction and learning in the context of job application skills are still lacking. Therefore, there is a need to explore the potential of using Moodle with H5P interactive content for teaching resume writing and job application skills.

This study was designed based on the preliminary study that was conducted among learners of a communication course to investigate the challenges that learners encountered in the course. Based on the results, the most common challenges that learners faced are lack of familiarity with job application process, language barriers, technological challenges, personal branding, and lack of feedback. By understanding these challenges, teachers can provide guidance and support to help learners develop the necessary skills to complete job applications effectively and increase their chances of success in the job market.

Statement of the Problem

Many students and job seekers struggle with writing effective resumes, which can negatively impact their chances of landing a job or advancing their career. While resume writing is an essential skill, it is often overlooked in traditional academic curricula, leaving individuals unprepared for the job market. This can result in a skills gap, particularly among marginalized groups who may not have access to other resources for resume writing support. According to a study on the significance of resume writing instruction for college students, students who received resume writing instruction were more likely to apply for internships and jobs and to have stronger confidence in their abilities to write successful resumes (Zakharova et al., 2022). However, the study also found that teaching resume writing must be more thorough and systematic, especially for first-year students. Another recent research recommends that existing curricula, including writing classes or job development programmers, should include teaching resume writing (Maynard & Salerno, 2020). According to the researchers, giving students specific criticism and direction on their resumes can aid in their development of critical communication skills and boost their employability.

From the teaching and learning perspective, the process of teaching résumé writing is highly tedious and time consuming for lecturers because lecturers devote a lot of time to consult students individually with their résumé. Moreover, teaching job application skills can be challenging due to several reasons, for example, the complexity of the job application process, limited application experience, the importance of personal branding, language barriers and technological challenges. Hence, this study aims to design lesson plans for job search and application skills using Moodle H5P Interactive Content that could aid lecturers in teaching the topic more effectively. This study is relevant for the teaching and learning of communication courses particularly for undergraduate students.

The development of job application skills is critical for individuals seeking employment and advancing their careers. However, teaching these skills in traditional classroom settings can be challenging due to time and resource limitations. As such, the current study seeks to explore the use of technology-enhanced learning to address these challenges and provide a more effective and efficient approach to teaching job application skills. The purpose of this study is to identify how well H5P is received by students in an asynchronous learning environment. Moreover, this study serves as a pilot study to assess the design of Moodle H5P content and the methodology of surveys, ensuring the validity and reliability of the instrument.

Literature Review

One of the features in Moodle is called H5P. With the assistance of H5P, instructors can produce interactive materials such as presentations, tests, games, and multimedia without the requirement for programming knowledge. HTML5 Package, or H5P, can be included into Moodle in three different ways: directly through a link or embed code from H5P.com, through H5P plugins, and thirdly through Learning Tools Interoperability (LTI) (Sinnayah et al., 2021). As all content categories are available on Moodle after integration, instructors can choose the interactive content they want to include in their lessons. H5P has several features that make it simple for instructors to design a tailored learning environment for their classes. Any mobile device can gain access to H5P whenever and anywhere (Addhiny, 2021).

Despite various studies being conducted on Moodle H5P in numerous courses, studies exploring the use of H5P in language teaching and learning are still limited. Among the H5P studies on language teaching and learning was conducted by Wicaksono et al. (2021). The qualitative study explored learners' perception of the use of H5P in the learning of the English language course. The study was conducted in 6 weeks using H5P and it was found that the use of H5P had a relatively significant effect on learners' motivation, affecting the improvement of learners' language skills. The study also underlined the importance of internet connectivity when using H5P because all activities in H5P depend on internet connectivity. The internet connection issue has always been one of the greatest challenges that instructors and learners face in an online learning environment (Noor et al., 2020). Lack of stable internet access can hinder learners to engage and participate. Not only that, but insufficient internet connectivity could also affect learners' interest and achievement in using H5P. Notwithstanding these drawbacks, H5P can be a useful instrument for improving instruction and learning if used carefully and strategically. Therefore, careful attention and planning should be put regarding internet connectivity so that successful H5P teaching and learning can take place.

In terms of the effects of using H5P on vocabulary enhancement, Dhini and Ardiasih (2021) investigated learners' feedback on the use of H5P in learning listening skills. The findings showed that using H5P could foster greater listening skills and offer profound listening activities. Meanwhile, Muñoz Candela (2021) evaluated the impacts of using Dialog Cards, Memory Game, and Interactive video on the vocabulary acquisition of English language learners and found that H5P has the potential promote greater vocabulary acquisition in a second language learning context. A large selection of interactive exercises is available from H5P for use in online learning environments. H5P has proven effective in a range of educational settings. Among the situations in which H5P has proven especially effective is a study conducted by Wehling et al (2021) and Rama Devi et al. (2022). Wehling et al (2021) conducted a study to design an efficient method for using open-source H5P interactive tools for interactive flipped classroom models. The study investigated two approaches for converting an otolaryngology curriculum that was lecture-based into interactive Moodle videos. One strategy had medical professionals monitoring the quality of the content, while the other used technicians to handle the work. The latter greatly lessened the workload of medical professionals without sacrificing the calibre of the content. Efficient raw material editing reduced the amount of time needed for video processing, and the H5P tools made it simple to convert videos into online content. The study offers insights into curriculum design and emphasises the potential of flipped classroom frameworks in medical education. The results highlight how affordable it is to edit lecture recordings and how outsourcing work can save time without sacrificing quality.

Rama Devi et al. (2022) conducted a mixed-method approach study among engineering students to create interactive video content using the H5P tool and integrating it into the learning management system (LMS) Moodle. The goal of this research was to determine whether interactive video content made with the H5P tool can improve students learning in a classroom environment. The purpose of the study was to quantify the effects of interactive content-enhanced active learning experiences on students' conceptual understanding and subsequent improvement in exam performance. The findings revealed that the use of interactive video content made with the H5P tool has a positive impact on students' learning outcomes. Better comprehension of concepts and improved performance on final exams were facilitated by the content's engagement and interactivity. According to the study, using interactive content makes it easier to pinpoint students' areas of difficulty so teachers can work with them to improve learning outcomes. Moreover, the incorporation of H5P into the Moodle Learning Management System is regarded as an advantageous

instrument to aid educators and learners in producing captivating and productive educational resources.

H5P can improve online education in several ways. It provides a variety of interactive exercises that can enhance the interest, interaction, and engagement of online learning. To improve students' learning experiences, educators can use H5P to create interactive videos, tests, flashcards, dialogue cards, and other interactive activities. Students can easily access and interact with the content by integrating these activities into learning management systems (LMS) like Moodle. Additionally, H5P offers opportunities for group work and community building in online classes by letting students collaborate on assignments. H5P activities can also be modified and adjusted to fit the course's unique learning objectives. In general, H5P can help build a more participatory learning environment. Additionally, H5P offers opportunities for group work and community building in online classes by letting students collaborate on assignments. H5P activities can also be modified and adjusted to fit the course's unique learning objectives. All things considered, H5P can help develop an online learning environment that is more dynamic and interactive.

Other than language teaching and learning context, H5P has also been applied in other educational settings. For instance, using a survey to examine the key factors that influence the success of e-learning systems in terms of user satisfaction and performance, Al-Fraihat et al. (2020) has conducted a study among students in one of the Middle East universities. Data were collected from the users of the e learning system to indicate the elements that made e-learning system a success based on two frameworks- Technology Acceptance Model (TAM) and the DeLone and McLean Information Systems Success Model. The results showed the most significant factors influencing e-learning system success were perceived ease of use, perceived usefulness, and system quality. In addition, the study found that user satisfaction mediates the relationship between these factors and e-learning system success. Furthermore, the study also found that prior experience with e-learning systems has a significant impact on perceived ease of use and perceived usefulness. The study has several implications for e-learning system designers and educators. For example, the findings propose that e-learning systems should be designed to be easy to use and should supply high-quality content and functionality. In addition, the study highlights the significance of user satisfaction and the role it plays in e-learning system success. Overall, the study offers valuable insights into the factors that influence the success of e-learning systems and can be used to guide the design and implementation of e-learning systems in the future.

H5P has great possibility to improve learning in any educational contexts, regardless of whether it is in blended learning mode or stands on its own mode (Acar & Kayaoglu, 2020). In a similar vein, Masrom et al. (2023) suggested that H5P could improve student learning outcomes and experiences in a range of academic settings, such as nursing, anatomy and physiology, and English language instruction. Numerous studies have investigated its role in teaching and learning; however, studies that have explored H5P are still limited, particularly in the context of language learning (Addhiny, 2021). As there is little evidence on how H5P could be used to facilitate learning, it is highly important to supply further insights on this matter, which is the aim of the study.

Research Model

Drawing from the literature review, this study will utilize the Multidimensional Conceptual Model for Evaluating E-learning System Success (EESS Model) developed by Al-Fraihat et al. (2020). In recognition of the importance of

interaction in providing a quality e-learning experience, the interaction construct will also be incorporated into the model's quality dimension. Figure 1 provides an illustration of the research framework employed in this study.
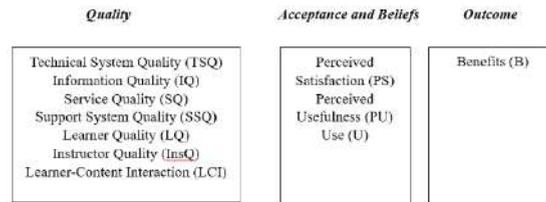

Figure 1. Research Framework

Methodology

Design and Participants

This study employed a survey to implement quantitative design. Surveys are frequently used in educational research to collect data because they enable researchers to gauge participants' attitudes and opinions on many topics. Twenty-six undergraduate students taking a communication course at a public technical university in Malaysia were purposely identified as the participants. All the participants provided their consent to participate in the study upon receiving information about the project. This study used an online survey because it enables researchers to gather student perspectives more quickly. After the participants had finished learning about the topic of job application skills, the survey was given to them.

Instrument

To justify a diverse range of measures to be included, several papers were analyzed to determine the instrument for this investigation. Each construct's measures were modified from previously vetted instruments and tailored to the study's setting. Ten measures were adapted from Al-Fraihat et al. (2020) namely Technical System Quality, Information Quality, Service Quality, Support System Quality, Learner Quality, Instructor Quality, Perceived Satisfaction, Perceived Usefulness, Use and Benefits while the measures for Learner-Content Interaction were adopted from Masrom and Nik Mohd Alwi (in press). The questionnaire consists of 49 items, each graded on a 6-point Likert scale from strongly disagree to strongly agree. Table 1 presents the number of items for each measure.

Table 1. The Measure and Number of Items

	Measures	No of items
Quality	Technical System Quality (TSQ)	6
	Information Quality (IQ)	7
	Service Quality (SQ)	4
	Support System Quality (SSQ)	1
	Learner Quality (LQ)	5
	Instructor Quality (InsQ)	4
	Learner-Content Interaction (LCI)	5
Acceptance & Beliefs	Perceived Satisfaction (PS)	4
	Perceived Usefulness (PU)	4
	Use (U)	4
Outcome	Benefits (B)	5
Total number of items		49

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Results and Discussion

Descriptive Statistics

Descriptive statistics were used to analyze the basic features of the data obtained in the study using summary and statistical tables. The first section of the survey analyzed the demographics field of the respondents (gender and age). The information will be represented by the frequency and percentage. Apart from that, the evaluation of the respondent's feedback regarding the effectiveness of integrating H5P interactive content into online education, providing recommendations for improvements, enhancing student engagement, and learning outcomes, and shaping the future design and implementation of online learning platforms are from the second section of the questionnaire. The table below is used to evaluate the feedback on H5P in learning job application skills, following Vate-U-Lan & Masouras (2018).

Table 2. Explanation of 6-point Likert Scale

Scale	Weighted mean interval	Verbal Interpretation
6	5.17 – 6	Strongly agree
5	4.33 – 5.16	Agree
4	3.49 – 4.32	Slightly agree
3	2.67 – 3.5	Slightly disagree
2	1.83 – 2.66	Disagree
1	1.00 – 1.82	Strongly disagree

The reliability analysis was used to measure the scale of reliability and to provide information on the relationship between individual items of the scale. Intra-class correlation coefficients may be used to compute inter-rater reliability estimates. This process follows the rule of thumb for Cronbach's alpha must exceed 0.6 and above (Sekaran, 2016). Once the questionnaire was fully collected, a statistical method, namely Exploratory Factor Analysis (EFA) was conducted to explore the elements (questions) and the dimensions between variables (factors) and respondents. This is to discover the underlying structure of a relatively large set of variables. The primary objective of this technique is to identify the underlying relationships between the variables measured. To analyze the EFA, SPSS software is applied to the principal components to get a more accurate reading when each factor is represented by multiple measured variables in the analysis (Fabrigar et al., 1999). There are two steps in conducting the analysis in the principal components which are [1] data summarization and identifying the structure and [2] data reduction.

In the data synthesis and identification structure, the manifest variables are expressed based on common factors, unique factors, and errors of measurement. Each unique factor influences only one manifest variable and does not explain the correlations between the manifest variables. In these cases, each item in all the components (motivation, satisfaction, perceived value, and perceived expectation) was tested.

However, in the data reduction, factor loadings are used to measure the influence of a common factor on a manifest variable to be more significant. To obtain the correct items in the manifest variable, factor loadings were rotated using varimax rotation. The items were measured by looking at the value of the loading factor. If the item is less than 0.6 (Sekaran, 2000), then the item needs to be removed from the manifest variable. The higher the factor loads, the more significant the factor is.

Table 3. Respondent's Demographic Profile

Respondent's demographic profile	Attribute	Frequency (n)	Percentage (%)
Gender	Female	8	30.8%
	Male	18	69.2%
Age	21 -22	11	42.3%
	23 - 24	11	42.3%
	24 and above	4	15.4%

In the questionnaire, Section B was constructed with a Likert 6-point scale from strongly disagree to strongly agree (strongly disagree = 1 to strongly agree =6). In this section, eleven components are Technical System Quality, Information Quality, Service Quality, Support System Quality, Learner Quality, Instructor Quality, Perceived Satisfaction, Perceived Usefulness, Use, Benefit, and Learner-Content Interaction. Each component describes between four to seven items respectively. The findings of mean and standard deviation for each item are presented in Table 4. Based on the results, most of the respondents agreed with the effectiveness of integrating H5P interactive content into online education.

Learners' Feedback

Table 4 shows the learners' feedback in terms of the mean and standard deviation for each item.

Table 4. The Mean and Standard Deviation

Item	Description	Mean	Std. Deviation	Interpretation
	TECHNICAL SYSTEM QUALITY			
1	It is easy to use H5P	4.85	0.784	Agree
2	It is easy to understand the structure of H5P and how to use it	4.73	0.874	Agree
3	H5P includes the necessary features and functions I need	4.85	0.784	Agree
4	H5P is flexible to interact with	4.85	0.784	Agree
5	All components within H5P are fully integrated and consistent	4.77	0.765	Agree
6	H5P does not crash frequently	4.62	0.852	Agree
	INFORMATION QUALITY			
1	H5P has provided me with sufficient and required information	4.73	0.919	Agree
2	Information and resources needed from H5P are always accessible	4.96	0.662	Agree
3	Information from H5P is in a form that is readily useable	4.88	0.864	Agree
4	Information in H5P is concise and clear	4.81	0.939	Agree
5	The structure of H5P is well organized into logical and understandable components	4.92	0.744	Agree
6	The content of H5P is up to date	4.81	0.849	Agree
7	I perceive the design of H5P (e.g., fonts, style, colour, images, videos) to be good and meets the quality standards.	4.73	0.874	Agree
	SERVICE QUALITY			

1	There are enough and clear instructions/training about how to use Moodle	4.81	0.939	Agree
2	H5P provides proper online assistance and help.	4.73	0.874	Agree
3	H5P provides interactivity	4.85	0.834	Agree
4	H5P provides me with different learning styles (e.g., flash animation, video, audio, text, simulation, etc.) and they are interesting and appropriate in my study	4.69	0.884	Agree

SUPPORT SYSTEM QUALITY

1	If it is optional, I would still prefer to use H5P as a supportive tool in the module	4.77	0.710	Agree

LEARNER QUALITY

1	I believe it is good to use H5P	5.08	0.688	Agree
2	I have a positive attitude toward using H5P	4.88	0.816	Agree
3	I am not intimidated by using H5P	4.65	0.846	Agree
4	My previous experience with e-learning systems and computer applications helped me in using H5P	4.96	0.824	Agree
5	I am able to perform tasks in H5P successfully	4.85	0.784	Agree

INSTRUCTOR QUALITY

1	I use H5P as recommended by my instructors	5.04	0.871	Agree
2	I think an instructor's enthusiasm about using H5P stimulates my desire to learn	4.73	0.919	Agree
3	I think communicating and interacting with instructors are important and valuable in completing the activities	4.88	0.816	Agree
4	Generally, my instructors have a positive attitude to the utilization of H5P	4.96	0.720	Agree

PERCEIVED SATISFACTION

1	I am satisfied with the performance of H5P	4.88	0.653	Agree
2	I enjoy using H5P in my study	4.92	0.845	Agree
3	H5P satisfies my educational needs	4.92	0.744	Agree
4	Overall, I am pleased with the experience of using H5P	5.00	0.748	Agree

PERCEIVED USEFULNESS

1	Using H5P enables me to accomplish my tasks more quickly	4.81	0.801	Agree
2	Using H5P improves my learning performance	4.88	0.653	Agree
3	Using H5P helps me learn effectively	4.85	0.834	Agree
4	Overall H5P is useful	5.08	0.688	Agree

USE

1	I use Moodle frequently	5.23	0.815	Strongly agree
2	I depend on Moodle in my study	4.81	0.981	Agree
3	I use Moodle regularly	5.08	0.796	Agree
4	On average, I spend a long time on using Moodle	4.58	0.902	Agree

BENEFITS

1	Using H5P has increased my knowledge and helped me to be successful in the module	4.88	0.711	Agree
2	H5Pis a very effective educational tool and has helped me to improve my learning process	4.81	0.849	Agree
3	H5P makes communication easier with the instructor and other classmates.	4.65	0.936	Agree
4	H5P saves my time in searching for materials and cuts down expenditure such as paper cost	4.77	0.815	Agree

5	H5P has helped me to achieve the learning goals of the module	4.81	0.801	Agree
	LEARNER-CONTENT INTERACTION			
1	The course materials helped me to understand the content.	5.00	0.693	Agree
2	The course materials stimulated my interest for this course.	4.85	0.732	Agree
3	The course materials helped relate my personal experience to new concepts or new knowledge	4.73	0.827	Agree
4	It was easy for me to access the course materials.	4.81	0.849	Agree
5	It was not convenient to access the course materials. (reversed item)	4.31	1.158	Slightly agree

A descriptive analysis was performed to identify the means and standard deviation of the eleven measures as presented in Table 4. To recapitulate, the views regarding the measures were rated on a Likert scale ranging from "strongly disagree" (1) to "strongly agree" (6). Based on the descriptive statistic, the highest mean score (M=5.23, sd= 0.815) was for "I use Moodle frequently" while the lowest was "It was not convenient to access the course materials" (M=4.31, sd= 1.158) The findings also show that the items with the second highest mean were "I believe it is good to use H5P" and "Overall H5P is useful "(M=5.08, sd=1.0.688.) while the second lowest mean was "On average, I spend a long time on using Moodle" (M=4.58, sd=0.902).

The respondents evaluated H5P as having a favorable impact on their learning, as evident by the remaining questions' mean scores, which ranged from 4.65 to 5.04. Previous studies on H5P also shown the belief that H5P had a promising influence on learning. For instance, increase motivation (Zakhrova, 2022) and promotes English language skills (Siregar & Sembiring, 2022). Moreover, learners' views on the use of H5P is generally positive (Wicaksono et al., 2021). The use of H5P was found to develop listening skills (Dhini & Ardiasih, 2021) and enhance greater vocabulary acquisition among learners (Muñoz Candela, 2021). This has proven the potential of H5P as a valuable tool for teaching and learning with the potential for adaptability in various education contexts.

Meanwhile, Table 5 shows the Cronbach's α obtained to verify the internal consistency. According to Sekaran (2016), the alpha value for all domains is acceptable because it has exceeded the value of 0.6 as recommended by most researchers. Thus, all the indicators remained in the measurement model except support system quality. The indicator was removed because the items in this component were insufficient.

Table 5. Reliability Analysis

Instrument	Items	Cronbach Alpha
Technical System Quality	6	0.935
Information Quality	7	0.933
Service Quality	4	0.851
Learner Quality	5	0.935
Instructor Quality	4	0.919
Perceived Satisfaction	4	0.940
Perceived Usefulness	4	0.868
Use	4	0.820
Benefit	5	0.954
Learner-Content Interaction	5	0.841

Table 6 shows the data reduction procedure using Explanatory Factor Analaysis (EFA) for all items. Based on results,

Support Quality System was deleted since the component only has one item which means the component did not support the EFA procedure. Meanwhile, the items having factor loading below than 0.6 were deleted from further analysis. There were two items excluded from the component which was item 7 (Information Quality) and item 5 (Learner-Content Interaction). The results are shown in Table 6 (a) and Table 6 (b).

Table 6 (a). Explanatory Factor Analysis

TECHNICAL SYSTEM QUALITY		INFORMATION QUALITY		SERVICE QUALITY		LEARNER QUALITY		INSTRUCTOR QUALITY	
Items	Factor Loading	Items	Factor Loading	Items	Factor Loading	Items	Factor Loading	Items	Factor Loading
1	0.953	1	0.878	1	0.787	1	0.881	1	0.893
2	0.887	2	0.862	2	0.854	2	0.933	2	0.933
3	0.932	3	0.880	3	0.795	3	0.876	3	0.861
4	0.918	4	0.939	4	0.893	4	0.911	4	0.911
5	0.737	5	0.951			5	0.860		
6	0.791	6	0.864						

Table 6 (b). Explanatory Factor Analysis

PERCEIVED SATISFACTION		PERCEIVED USEFULNESS		USE		BENEFITS		LEARNER-CONTENT INTERACTION	
Items	Factor Loading	Items	Factor Loading	Items	Factor Loading	Items	Factor Loading	Items	Factor Loading
1	0.943	1	0.908	1	0.852	1	0.949	1	0.876
2	0.907	2	0.951	2	0.753	2	0.926	2	0.918
3	0.962	3	0.781	3	0.829	3	0.910	3	0.853
4	0.890	4	0.769	4	0.806	4	0.938	4	0.939
						5	0.892		

Implications and Future Studies

The importance of this study lies in examining how Moodle H5P may improve teaching and learning on job application skills. This study can provide educators with useful information regarding the advantages of utilising these tools to produce interactive content that can raise student engagement, motivation, and learning results. Furthermore, this research can help create efficient and effective training methods for job application skills that can accommodate the preferences and needs of certain learners. The study's use of Moodle H5P interactive content attempts to give students a more interesting and approachable method of job training. Additionally, this research can help create efficient and effective training methods for job application skills that can accommodate the preferences and needs of certain learners. The research could also aid in the creation of efficient online teaching techniques that improve students' employability. The results of this study may potentially guide the creation of next online courses and professional development programmers that emphasize on honing job application abilities. Overall, by improving the quality of instruction, this study has the potential to significantly help educators to design more effective materials for their learners throughout the course and beyond. However, this study has several limitations. Firstly, this study used a survey to collect information from the participants. Future research should aim to collect qualitative information,

such as through observations or interviews, to better investigate how and why. Secondly, while this study only studied 11 variables, other variables will need to be explored in subsequent studies. The quantity of respondents is unquestionably insufficient if the actual study is to be conducted, hence more respondents will be required for the actual study.

This study has implications for policymakers, educators, and instructional designers working in the field of online education. The favourable response to H5P indicates that it has the potential to be an effective teaching and learning tool. Teachers can use H5P to improve students' motivation, engagement, and language proficiency. To maximise the efficacy of H5P integration, instructional designers should consider the specific elements mentioned in the study, such as Learner-Content Interaction, Information Quality, and Technical System Quality. Given that H5P has the potential to improve student learning experiences, policymakers might find it beneficial to support its wider adoption in online education. The study offers a basis for additional research and development in the integration of interactive content such as H5P as online education develops.

Conclusion

The results of this investigation offer significant perspectives on the efficacy of incorporating H5P interactive materials into virtual learning environments. The reliability analysis guarantees the internal consistency of the measurement model, with a strong Cronbach's alpha exceeding 0.6. With a careful data reduction process highlighting important factors, the Exploratory Factor Analysis (EFA) clarifies the underlying relationships between variables. High mean scores across several dimensions indicate that respondents strongly supported the integration of H5P, highlighting its beneficial effects on learning. These results are supported by earlier research, which highlights H5P's capacity to improve motivation, language proficiency, and all-around positive learner experiences. The study makes a significant contribution in that it acts as a pilot study for the survey methodology and content design of Moodle H5P, thereby guaranteeing the validity and reliability of the instrument in asynchronous learning environments.

Acknowledgment

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Gen AI to Understand Programming Errors

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Abstract: When undergraduate students are starting to learn their first programming language, they usually feel themselves overwhelmed by the sheer amount of information that appears in the IDE. Students are faced with different colors, a list of warnings, hints on how to deal with errors, and an output with a list of errors the compiler found in their code. However, even if students know which error to attend first, they need to clearly understand what the error is referring to. Unfortunately, newcomers to programming usually do not understand the error reports generated by compilers. As an attempt to help students to understand errors when programming, and to better learn how to program, we propose to use Generative AI tools. Students were asked to program a series of exercises. When they found an error, reported by the compiler, that they did not understand, they had to use a Generative AI tool that would explain the error to them. We tested this hypothesis with undergraduate students that were learning procedural programming for the first time. Analysis of the results showed no significant improvement of the test-group over the control-group. However, test-group students reported feeling more in control with programming than control-group students.

Keywords: Educational innovation, Higher education, Generative Artificial Intelligence, programming errors, Learning programming

Introduction

When undergraduate students are starting to learn their first programming language, they usually feel themselves overwhelmed by the sheer amount of information that appears in the same programming environment or Integrated Development Environment (IDE) (Lahtinen, Ala-Mutka, & Järvinen, 2005). Students are faced with different colors at the same line, a list of warnings, some hints on how to deal with errors, and usually an output with a list of errors that the compiler found in their code (Becker et al., 2019; Denny et al., 2021). Students will try to make sense of all of this information, but they generally fail to detect and understand one of the most critical parts of the compiler's feedback: the description of the errors.

Advanced programmers will usually read first the list of errors in order to be able to fix a problem with their code. They understand and have learnt the syntax and semantics of the intended programming language (Chmiel & Loui, 2004). However, even if students know which error to attend first, they need to clearly understand what the error is referring to. Unfortunately, newcomers to programming usually do not understand the error reports generated by compilers. These errors are usually expressed in a language that is almost dependent on the programming language.

As students are still learning this programming language, the error, usually, does not have a meaning they can grasp (McCall & Kölling, 2019).

The core issue in this situation is that a newcomer to programming (a novice programmer) has not yet developed an understanding of what programming is (McCall & Kölling, 2019; Lister et al., 2004). The novice programmer does not have a mental model that is able to understand the compiler diagnostics when analyzing a program. Error messages produced by a compiler are usually full of technical jargon, sometimes cryptic, and assume familiarity with the programming language syntax and semantics; concepts that a novice programmer has yet to learn (Barik et al.,2017). For instance, an error message in Python like "IndentationError: expected an indented block" assumes the student understands the concept of indentation and its use in Python. This lack of knowledge, and sometimes ambiguity for some errors, generates an extra burden, increases the cognitive load on novice programmers. Instead on focusing on learning the core concepts of programming, students struggle to try to understand and decipher the errors reported by the compiler.

Unfortunately, the challenge for novice programmers gets worse and worse. As errors do not usually appear alone. They appear as part of a series of errors that usually "cascade" over another (Becker et al.,2018). The compiler does not stop when finding the first error, it continues to "spout" errors until the end of the analysis has been done. With such a list, novice programmers usually feel that the last error line is the best to start with. Furthermore, error message quality varies greatly depending on the IDE being used (Denny et al., 2021). Some IDEs have an "assistant" to try to help understanding an error. Many IDEs only report the error for the programmer to interpret (Rahman, Yeasmin & Roy, 2014).

Another issue that must be taken into account, is the fact that when students struggle to understand feedback from the compiler, their frustration increases (Batra & Atiq, 2023). This fact can lead to decrease self-motivation and efficacy. As a long-term consequence, students may be discouraged from further pursuing computer programming or, even, computer science. Therefore, tackling this problem, by helping novices' programmers in understanding error generated by compiler analysis, is a critical task in their learning endeavor.

Research has shown that helping novices' programmers to better understand compiler error messages has had better learning outcomes (Becker, 2016). Error messages should be enhanced with more descriptive and interactive error feedback. It would help students to improve their debugging efficiency, reduce the time and cognitive effort required to resolve errors (Nienaltowski, Pedroni & Meyer, 2008). Overall, novice programmers would acquire more systematic and effective problem resolution abilities.

As an attempt to help students to understand errors when programming and to better learn how to program, we propose to use Generative Artificial Intelligence (GenAI) tools. These kinds of tools have recently shown to be able to describe, and in a way, to explain abstract concepts (Baidoo-anu & Owusu Ansah, 2023; Liuging et al, 2025). Also, GenAI tools are freely available and on demand, allowing people to use them as they need and whenever they do (Kimmel et al 2024). So it is the hypothesis of this research that a Gen AI tool would be able to explain to a novice programmer

the meaning of an error reported by compiler analysis. Therefore, students should be able to learn programming in an easier manner than those who only use the list of errors reported by the compiler.

In the rest of this paper, we present our study. First, we describe our methodology. Then we proceed to present the results that were obtained with students. An analysis of the results follows. Finally, we draw some conclusions and propose some directions to follow to continue this research work.

Method

As it was discussed in the Introduction, for new programmers, novices learning to program, it is difficult to understand the errors that a compiler tool provides when compiling a code. Not being able to properly understand and correct those errors hinders novices progress and demotivates them in their learning. The most common solution to this issue is that students consult a senior programmer, mentor or teacher as to clarify their doubt. However, this is not always the case, as sometimes students are learning alone and, in the best situation, are pair learning or programming (Williams et al., 2002).

As an attempt to help in this kind of circumstances, we propose the use of Generative Artificial Intelligence (GenAI) tool that would act as a type of "limited mentor" to the learner. GenAI tools have demonstrated to be efficient to explain abstract concepts (Baidoo-anu & Owusu Ansah, 2023; Liuging et al, 2025) and are, usually, available on demand (Kimmel et al, 2024).

GenAI tool

The selection of the Generative Artificial Intelligence tool had to first, be a tool that can be used online. Second, be free for anyone to use. Third, be able to respond to queries about programming in Python (more on this issue in the next section). And finally, be able to explain abstract concepts in different ways. Given these restrictions, for this work, we decided to use ChatGPT-4, as it complies with these four requirements. Furthermore, this GenAI tool has the possibility to share link of the interaction in case further analysis is required. The image in Figure 1 shows this GenAI tool dealing with a question about an error when programming in Python.

As it can be observed in Figure 1, the GenAI tool first receives the question regarding an error when programming in Python. It then proceeds to describe the "Possible Causes & Fixes" for this error. In the figure, three explanations are presented. First a description of the possible cause is presented, followed by a possible fix. However, this explanation is not very clear, as it requires students some degree of programming knowledge. Therefore, the learner must ask the GenAI tool to explain further its reply. The image in Figure 2 presents such detailed explanation.

Figure 2 shows the same list of "Possible Causes & Fixes" that Figure 1 presents. However, it is clear that in this second figure, the GenAI tool is adding more detail in the explanation so the student is able to comprehend its argument even if the student has few knowledge of programming. In both of these figures, the complete interaction

with the GenAI tool is no shown as this figure as just to demonstrate the way that the GenAI tool is able to help a student when learning how to deal with errors reported by the compiler.
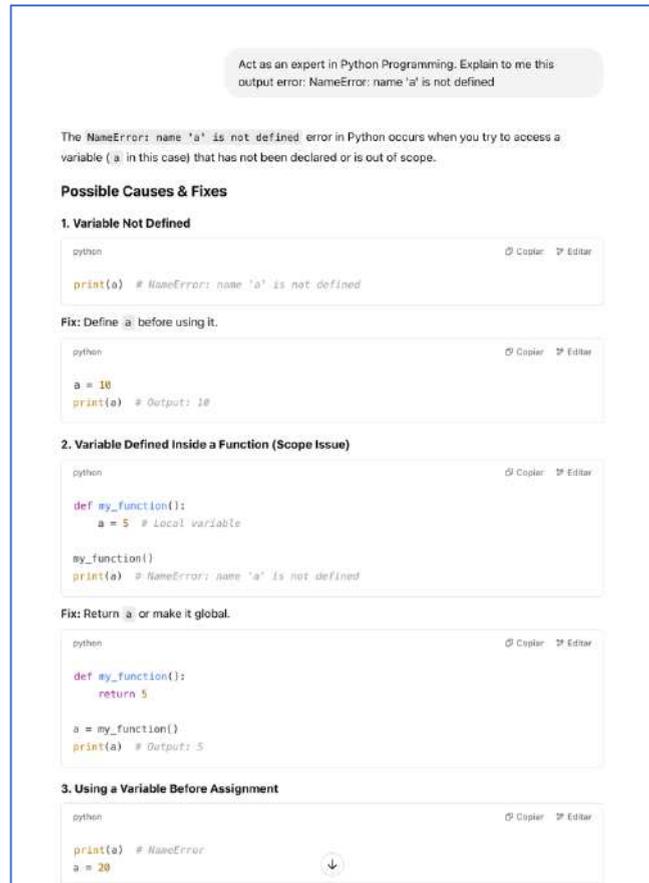

Figure 1. GenAI Tool Answering Output Error.

Student selection

For this research work, we selected students that were beginning to learn Structured Programming in Python. In our university, Python is the first programming language that students learn. We had access to three groups. All of these groups were in the first semester of an 8-semester undergraduate degree. All of the students in these groups were studying an Engineering degree, but not a degree related to Computer Engineering. Given that we had access to only 3 groups, we decided that 2 groups were going to be used as "Control Group" and only one group was going to be used as a "Pilot Group".

Tasks performed by students

The aim of this study was to shed some light into how to help students learn easier and faster to program. As discussed before, students in this situation find compiler errors very difficult to interpret. So learning to understand this type of errors is very important when learning a programming language.

Figure 2. GenAI Tool Explaining in More Detail

For the selection of the types of errors that were going to be presented to students in the Pilot Group, we decided to use a list provided by a lecturer in this area, who has more than 10 years of experience lecturing these kinds of beginner programing groups. The types of errors were:

1. Bad indentation
2. Variable not defined
3. Use of "=" instead of "=="
4. Uneven number of parameters in a function call
5. 'NoneType' returned

All of these type of errors are common errors when beginning to program and are crucial to understanding the way in which Python works.

Pre- and Post-Tests

Before the study started, all the groups, "Control Groups" and "Pilot Group", presented a Pre-Test. The Pre-Test had 6 programming exercises. The test was graded on a 100-point scale. The first 5 exercises had a value of 16 points and the final, and most difficult, exercise had a value of 20 points. Each of the programming exercises were presented using an online IDE named "Trinket" (https://trinket.io/). Figure 3 shows an example of this IDE as presented to students in this research work.
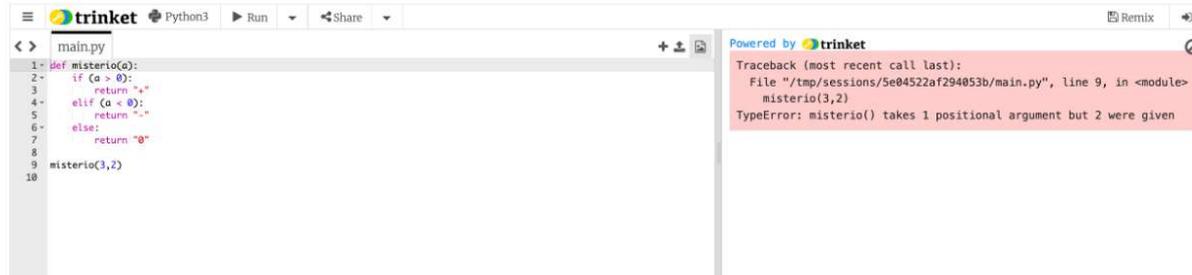
Figure 3. Example Of an Exercise Using Trinket

As it can be observed in Figure 3, on the left side students found a programing exercise and on the right side the IDE displayed the result of running the code. Each of the programming exercises were already coded. But, none of the programming exercises ran. All of them had one of the five types of errors discussed before. Students had to understand the code, debug it, and fix it.

After the students submitted their work, a lecturer graded manually all of the submissions. When grading, for each programing exercise, students could be graded the full grade (16 points) or the minimum grade (0 points). In other words, either the student was able to fix the code presented, or he was not able to fix it.

After students presented the Pre-Test, they continued with their lectures normally, in both the "Control Groups" and the "Pilot Group". Once students were ready for the post-Test. All of the groups presented this test. The Post-Test was designed exactly in the same way as the Pre-Test, but for the programming exercises. The programming exercises in the Post-Test were different in their content, but maintained the same types of errors and number of exercises as in the pre-Test.

Activities for the Pilot Group

As discussed before, to help students to understand errors when programming and to better learn how to program, we proposed to use Generative Artificial Intelligence (GenAI) tools. The use of the GenAI tool selected (ChatGPT), was when students were solving exercises by themselves, alone. Students were required to program a series of exercises. We asked students that when they were programming, if they found an error that was reported by the compiler, and if they did not understand the meaning of the error, they had to use the GenAI tool that would explain the error to them. Afterwards, they had to attempt to finish programming the exercise. The most important part was that students prompted the GenAI for an explanation of the error, until they felt comfortable with the answer, and were able to finish solving the exercise.

After the Pre-Test, students in the Pilot Group were given two programming activities as homework. One activity was after 3 weeks into the semester, and the other activity was after 6 weeks into the semester. Both activities were the same activities required for students in the Control Groups. However, the activities for the Pilot Group had the request and instructions on how to use the GenAI tool in their homework.

Results

As it has been mentioned before, we tested our hypothesis with undergraduate students that were learning procedural programming for the first time. Both, the test-group and the control-groups had a similar number of students and were in their first semester of studies.

Pre-Test Results

As commented in previous sections, Pre-Test were graded manually by a lecturer. The following figure (Figure 4) shows the results of all the groups in the Pre-Test.
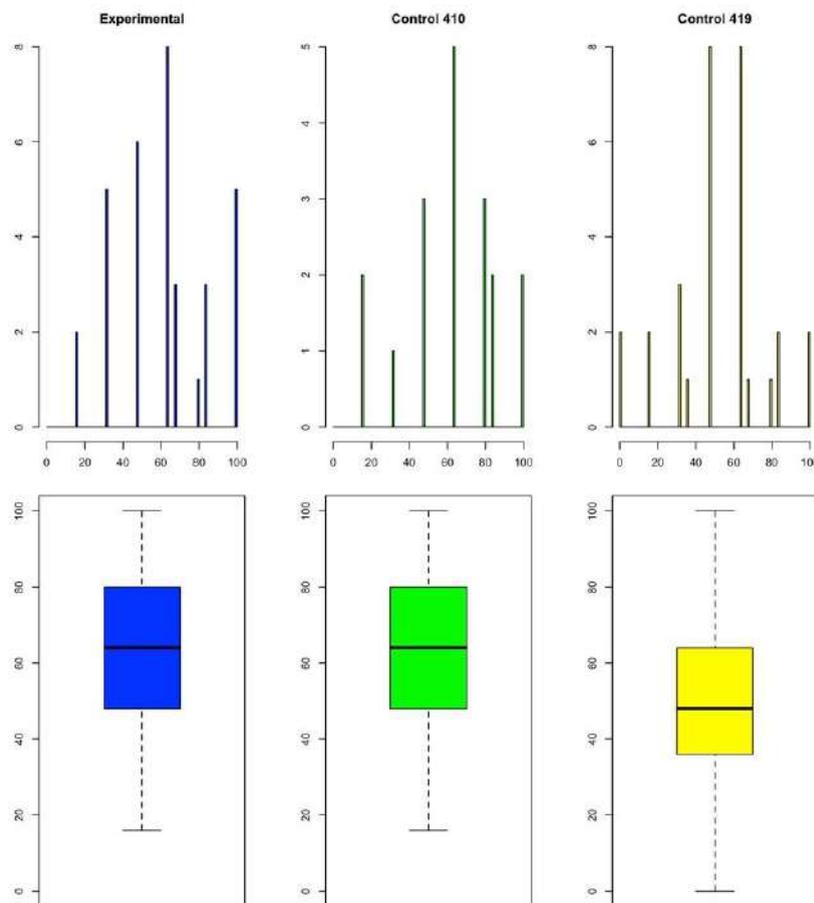
Figure 4. Pre-Test Results: Histograms and Boxplots.

Visual analysis shows easily that the Pilot Group and the Control 410 Group are similar. However, this is not easy to perceive for the Control 419 Group in Figure 4. Therefore, a T-test was performed to evaluate if groups were similar to each other. Pilot Group vs. Control 410 Group had a p-value of 0.820, Pilot Group vs Control 419 Group had a p-value of 0.159, and Control 410 Group vs Control 419 Group had a p-value of 0.165. All the groups are statistically equal, though Control 419 Group had a little bit less knowledge at the beginning of the course.

Post-Test Results

Post-Tests were also manually graded by a lecturer. Figure 5 shows the results of this test.
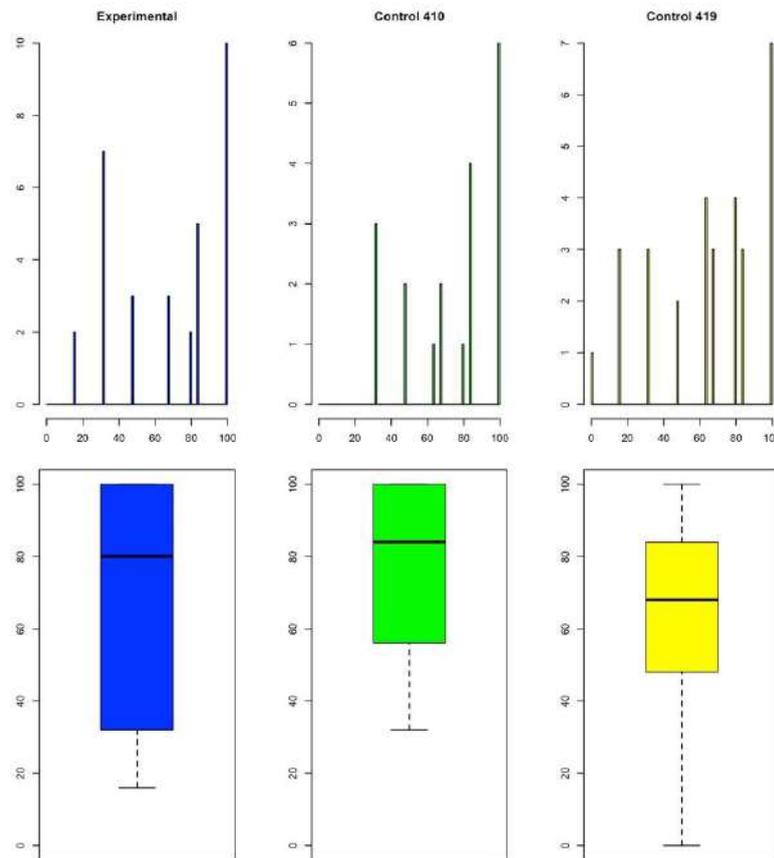
Figure 5. Post-Test results: Histograms and Boxplots.

Visual analysis show that groups might be different between each other. Also, it shows that variance changed from the Pre-Test results. The statistical results are the following: Pilot Group's variance 886.65 with a SD of 29.78, Control 410 Group's variance 628.21 with a SD of 25.06, and Control 419 Group's variance 891.24 with a SD of 29.85. T-test statistical analysis generated the following results: Pilot Group vs. Control 410 Group had a p-value of 0.456, Pilot Group vs Control 419 Group had a p-value of 0.741, and Control 410 Group vs Control 419 Group had a p-value of 0.296. So none of them were statistically different from each other.

Same Group Results

The previous subsections showed results when comparing groups between each other. In this subsection, the results of comparing the same group between its Pre-Test results and its Post-Test results is given. Individual results can be seen in Figures 4 and 5. For the T-test statistical analysis, the Pilot Group had a p-value of 0.319, the Control 410 Group had a p-value of 0.189, and the Control 419 Group had a p-value of 0.069.

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Survey

Students in all the Pilot Group were given a survey about their experience using GenAI as a tool to understand errors when programming. Participation in the survey was optional. Almost all students answered (32). The following table (Table 1) shows each question and the percentage of students who answered 4 in a 4-Point Likert scale, being 4 the "completely agree" value.

Table 1. Survey Questions

Question	Percentage
1. Was it easy for you to ask ChatGPT what you wanted to ask?	53.10
2. Were the answers ChatGPT gave you easy to understand according to what you wanted to know?	34.40
3. Did the answers ChatGPT gave you help you better understand the topics covered in the course?	68.80
4. Do you think using ChatGPT to fix bugs in your programs helped you learn?	68.80
5. Do you think you had trouble asking ChatGPT exactly what you wanted to ask?	25.00
6. Considering all your previous answers, how useful did you find using ChatGPT to fix errors in your programs?	78.10
7. Considering all your previous answers, how useful did you find using ChatGPT to learn Python programming?	65.60

Analysis of the results However, test-group students reported feeling more in control with programming than control-group students

Discussion

The results obtained in our Pilot Study showed no significant improvement of the Pilot Group over the Control Groups. The Pre-Test showed that all groups had basically the same level of knowledge (the Pilot Group and the Control 410 Group were the most similar). In the Post-Test, this similarity continued. Even the Pilot Group and the Control 410 Group remained the most similar. However, in the Post-Test, students in the Pilot Group showed the biggest variance from all groups. So an effect of the use of the GenAI in this group could be inferred.

The answers in the survey could be the key to this variance in the Pilot Group. In questions, 3 and 4 (see Table 1), students report a feeling of being helped by the GenAI to understand the topics covered in the course and to fix bugs in programs. Of course, not all the students had this feeling (about 5% of them "completely disagree"). These students, who were not satisfied with the use of the GenAI can cause this variance in the post-Test.

Furthermore, in question 6, students reported finding the GenAI useful to fix errors in their programs, and, more importantly, in question 7, students reported feeling that the GenAI helped to learn programming. Figure 6 shows the complete graphs of the answers to these two questions (question 6 to the left, and question 7 to the right). Text in the graphs is the original presented to students in Spanish.
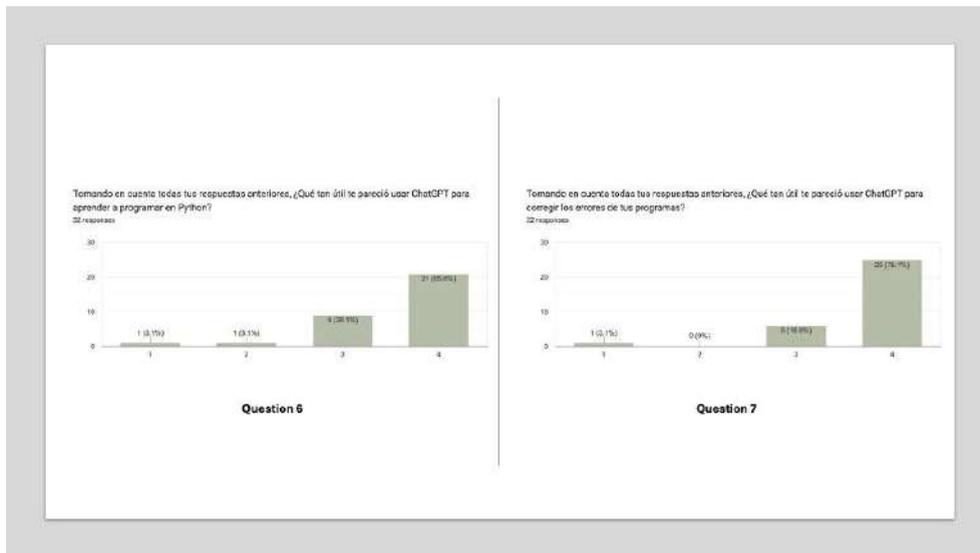

Figure 6. Questions 6 and 7.

From these two graphs in Figure 6, it can clearly be seen that students in the Pilot Group felt that using the GenAI tool was helpful for them in learning programming. Most of the students answered a value of 3 or 4 (more than 93%), only one person completely disagreed.

Conclusion

This work proposed to help students to understand errors when programming and to better learn how to program, with the aid of Generative Artificial Intelligence (GenAI) tools. We tested our hypothesis with students that were beginning to learn Structured Programming in Python. The results obtained in our Pilot Study showed no significant improvement of the Pilot Group over the Control Groups. The knowledge of all groups was statistically the same, but some differences were detected between groups.

The students in both Control Groups had an improvement. This improvement is expected in any regular course. So it is safe to say that the "normal" teaching method is working as planned and students are learning. On the other hand, in the Pilot Group, students also improved. Some part of this improvement can also be explained by the regular teaching method used. However, as the results of the Survey show, the use of a GenAI tool, by this group of students, helped them to better understand concepts and make them learning easier. The use of this GenAI tool as a type of tutor companion (Ramirez Uresti, 2024), allowed students to have a type of scaffolding when learning new abstract concepts.

Nevertheless, more research is necessary into how to help students to learn more effectively and easy with the use of

GenAI tools. These types of tools can be present 24/7 as support or as an artificial substitute teacher or tutor. This kind of Generative AI tutors (GenTutor) could prove to be a great addition in the quest of making learning a more productive activity (Ramirez Uresti, 2024).

Acknowledgements

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Customers Assessment of the 7Ps of Marketing Mix: The Case of Flor-San's Handicrafts, Paete, Laguna, Philippines

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Abstract: Officially recognized as the wood carving capital of the Philippines, Paete, Laguna is home to several woodcraft businesses and artist. Among them is Flor-San's Handicraft, a paper maché and wood crafts business, located in Paete, Laguna, Philippines they have been in operation for forty-four (44) years. A log ban was implemented in 2011 that prohibits harvesting trees that naturally grows in forests among them is the Batikuling tree, the favored source of wood by the wood carvers of Paete, Laguna. This is one of the main reasons why the industry has gone down, a lot of woodcraft businesses in Paete, Laguna has shutdown, yet Flor-San's Handicraft remains strong. The goal of this paper was to discover the reasons behind the success and longevity of Flor-San's Handicraft using the perception the of past customers assessing specific elements of Marketing Mix (7Ps). Using a quantitative approach, the researchers used a self-made survey and collect the past customers of Flor-San's viewpoints on the marketing mix (7Ps). Results show that participants ranked the 7Ps of the Marketing Mix as shown here. (1) Product, (2) Price, (3) Promotion, (4) Place, (5) People, (6) Process, (7) Physical Evidence. Based from the findings, a similar study should be conducted with another shop in the area and a larger number of respondents to ensure consistency and validity of the results, for businesses with the same nature as Flor-San's Handicraft, data from this study may be used as a guide to help other businesses in the industry to ensure their longevity and survival, and finally, for the Local Government of Paete, Laguna, it is recommended that more programs be implemented such as finding alternative ways to grow and protect the Batikuling tree, or providing support for scientific research to find alternative sources of wood that suites wood carving.

Introduction

Paete, Laguna, Philippines is officially declared as the woodcarving capital of the Philippines. The peak of the industry was in the 1970's to the 1990's but its history in the town dates all the way back in the Spanish Colonial Era. However, the industry took a big hit when a log ban was implemented in 2011 that prohibits harvesting trees that naturally grows in forests. Among those prohibited trees to be harvested is the "batikuling" (Litsea leytensis Merr.), a tree found mostly in Quezon province and some parts of Laguna, the widely used wood as it has distinct properties such as: it repels termites, soft, light, and durable. Aside from the log ban, a lot of wood carvers have opted to work as Overseas Filipino Workers in cruise lines entertainers curving ice instead of wood, and the younger generations are not interested to learn wood curving, A lot of shops engaged in woodcrafts has closed since then.

One of those who remained in operation is Flor-San's Handicraft, a paper maché and wood crafts business, located in Paete, Laguna, Philippines they have been in operation for forty-four (44) years now. Its business name was derived from the spouses' names— Florentino & Susana. It was established in 1980 when Mrs. Susana, who worked in a treasury office in Makati, decided to start their business while Mr. Florentino, who was a seafarer at that time, decided to go back to their hometown, for them to be able to start their vision. They were the first suppliers of a bunch of customized wooden ducks to Japanese (foreign) customers. Aside from the fact that they were recognized by the different exporters as they were growing, they have decided to step up from being a supplier to main exporters provided their business funds are good enough to cover the requirements of becoming one.

Just like the other businesses, Flor-San's Handicraft encounters couples of trials, challenges, and successions as they continue in the industry. They've been sticking to the traditional operation since then. As the researchers analyzed their current marketing mix, the business stated that (1) their product offering has two variants which are all made to order. They currently offer customized wood-home essential decorations (wall mirror), custom catholic images/figures, which are both made of driftwood, and crafts essential for festivals and occasions (e.g Sta. Claus, Christmas Trees and Christmas balls) that are made from either paper maché or resins. (2) To communicate their business with their target customers, Flor-San's Handicraft has been doing a personal promotion—either a face-to-face presentation or a direct email for prospects. (3) when it comes to price, it is always dependent on the fact of how much the customers are willing to pay for the said made-to-order products. They have been giving discounts and incentives for customers with bulk orders and if so, some of their payments will be 120-160 days after they have received the product. (4) These customers will make purchases by only visiting their physical store or established exhibit. Flor-San's Handicraft doesn't have any mobile applications or active websites to keep in touch with. They've also been working with "middlemen" or "agents" in some specific locations to help them with the distribution. (5)

There are also a few people working inside their offices to keep in touch with the customer's inquiries and concerns. Most of their employees are working hand-to-hand only in production while few are in administrative tasks. (6) When it comes to process, Flor-San's Handicraft has been doing a smooth, efficient and customer-friendly process. Customer inquiries are accommodated quickly. They also have a consultation along with them to make sure that product reviews/experiences are generated after a purchase. And lastly, (7) the physical evidence— despite the traditional way of operating the business, Flor-San's Handicraft has been able to design their warehouses and showrooms properly where customers can walk with convenience, comfort and a welcoming environment.

In a similar study that was conducted by Wavetec (2024), they emphasized that traditional businesses, such as stores and banks, relied heavily on meeting customers in person and following established procedures. However, to remain competitive and manage the impact of digital transformation on old business models, they must adapt and employ technology. Today, digital technology is transforming how organizations work around the world. Everyone, from tiny businesses to big businesses, is attempting to leverage what the digital age has to offer to improve operations and satisfy the requirements of their customers.

This study aims to analyze what has kept Flor-San's Handicraft in operation for more than 4 decades despite a lot of businesses with the same nature closing in Paete, Laguna, Philippines. In addition, the researchers will propose what may be improved in their operation for them to be able to adapt to the digital age to ensure that Flor-sans will continue to remain competitive amidst changing market conditions and revolving technology, to be able to achieve their next revenue goals, expand their reach, increase brand awareness, provide value to the customers, and take any advantage of all the digital marketing can offer, specifically in content marketing using the perception of past customers.

Statement of the Problem

The overall objective of the study is to discover the reasons behind the success and longevity of Flor-San's Handicraft using the perception the of past customers assessing specific elements of Marketing Mix (7Ps). Specifically, this study seeks to address the following:

1. What is the demographic profile of the past customers of Flor-San's Handicraft from January 2022 to January 2023.

2. What are the respondent's assessments on the level of 7Ps of Marketing Mix among the past customers in terms of:

    A.   **Product**
    B.   **Price**
    C.   **Promotion**
    D.   **Place**
    E.   **People**
    F.   **Process**
    G.   **Physical Evidence**

3. Based on the findings, what can be recommended for Flor-San's Handicraft for the improvement of their business?

Conceptual Framework

This study sought to create a marketing mix framework for Flor-San's Handicraft. The input phase comprised data collection of business data such as insights from the customers and elements relating to the marketing mix's 7Ps (Product, Price, Place, Promotion, People, Process, and Physical Evidence).

The researchers employed a quantitative approach to survey and collect the past customer's viewpoints on the 7Ps, after which data were evaluated using descriptive statistics. Ultimately, the goal of this study incorporated all information to create a set of recommendations based on data for improving Flor-San's marketing strategy. That may serve as a foundation for a tailored and comprehensive Marketing Mix Framework designed to enhance the company's current marketing mix that may be used by other businesses with the same nature.

Theoretical Framework

The purpose of this research is to establish marketing strategies and enhance the company's current marketing mix for digital marketing. The marketing mix theory allowed the researchers to uncover the key characteristics that had created Flor-San's traditional success and translate them into digital media to solve the company's marketing problems. According to Singh (2016), marketing is a complicated set of marketing mix solution variables that organizations utilize to sell their goods and services. Furthermore, according to Pruskus (2015), the marketing mix is a collection of important elements and solutions that enable customers to meet their (national) demands and achieve the company's objectives. According to Sereikienė-Abromaitytė (2013), the marketing mix encompasses product, place, promotion, and pricing methods used to reach target markets. "Marketing mix - interrelated actions and solutions to meet consumer needs and to achieve the company's marketing goals, as a whole."

This study sought to create a marketing mix framework for Flor-San's Handicraft by collecting data in relation to the elements relating to the marketing mix's 7Ps (Product, Price, Place, Promotion, People, Process, and Physical Evidence). This included a quantitative survey to collect the past customer's viewpoints on the 7Ps, after which data were evaluated using descriptive statistics.

Ultimately, the study incorporated all information from the quantitative approach to create a set of recommendations based on data for improving Flor-San's marketing strategy. In doing so, it served as the foundation for a tailored and comprehensive Marketing Mix Framework designed to enhance the company's current marketing mix.

METHODOLOGY

Research Design

The researchers utilized a quantitative descriptive approach in conducting this study. Using a survey that assessed Flor-San's Handicraft strengths and weaknesses through the customers' perception across the 7Ps (Product, Price, Place, Promotion, People, Process, Physical Evidence).

Sample and Sampling Design

The researchers employed purposive sampling, which enabled researchers to choose participants who possessed specific characteristics that were most relevant to the research question. Purposive sampling is a type of non-probability sampling in which researchers pick survey participants based only on their personal judgment. For surveys performed using online survey platforms, researchers must have previous knowledge about their study's goal to choose and approach eligible participants properly. Since every survey respondent is chosen based on a certain profile, researchers can use purposive sampling to target a specific segment of the population (Alchemer). 150 respondents were chosen because the average past customers of Flor-San's Handicraft according to their recorded database were ranging from an average of 15 customers in a month, a total of almost 180 customers in a year, from January 2022 to January 2023. Additionally, the number of respondents which is the 150, is above the minimum requirement for 123 that comes with 5% margin of error and 95% confidence level.

Context and Participants

The study took place in Paete, Laguna, a town where Flor-San's Handicraft is located. The respondents of the study were the Flor-San's Handicraft's past customers. It consisted of one hundred fifty (150), either both male or female, who's age ranged from 18 years old and up. These past customers' dates of purchase should not have exceeded 10 years to be considered for the study and came from the recorded database of the said business.

Research Instrument

The research instrument underwent validation by professionals, in collaboration with a statistician. Before proceeding to in the actual data gathering, the researchers conducted pilot testing on thirty (30) individuals, consisting of male and female, who have been past customers of handicrafts to be able to identify problems before implementing the actual full survey. This is the testing ground for tools, techniques, and strategies that will be employed in the main study (Stewart, 2024). Validating a survey instrument was a crucial step in the research process. Face validity and content validity, despite being qualitative approaches, were crucial stages in assessing the extent to which a survey instrument could accurately measure its intended purpose (Science Direct).

The survey utilized a Likert-Scale and was self-administered using an online platform—Google Forms and targeted past customers (both locally and internationally). The survey was intended to be brief (around 10-15 minutes) and examined consumer impressions across the 7Ps of the marketing mix.

Google Forms was frequently utilized in research and surveys due to its wide range of features and user-friendly interface. Users could generate surveys in many forms and gather data from multiple sources. The platform facilitated the collection of data from a sizable sample in a brief period, rendering it a very efficient tool for data gathering. Moreover, Google Forms was completely free and offered features for generating survey forms, collecting replies, and evaluating data. It was very advantageous for educators in instructing and comprehending subjects, since it enhanced student comprehension and boosted student performance. However, Google Forms had certain constraints, such as the lack of mathematical equation capabilities and signal instability in the Google Meet application (Adelia,

2021). Google Forms was a vital tool for academics and educators because of its versatility, accessibility, and ease, making it an excellent instrument for this study.

The content of the Google survey was created by researchers and was solely derived from problem statements. Seeking to collect essential data and information from the participants. Moreover, additional measures were implemented to enhance the accuracy and quality of the survey, specifically considering the ethical considerations for both the researchers and the respondents.

The "Product" section discussed product diversity, perceived quality, and value for money. The second element was Price, which looked at people's opinions of pricing fairness, willingness to pay for specific aspects, and the overall effectiveness of present pricing strategies.

Understanding customer opinions on "Place" required examining the physical retail location's convenience, cleanliness, and operation hours. The "Promotion" segment examined brand awareness and the efficacy of current promotional actions. The "Promotion" part emphasized brand recognition and the efficacy of existing promotional actions. The "Process" section delved into many areas of the client journey, such as simplicity of purchase, order fulfillment efficiency, and payment methods. Finally, the "Physical Evidence" section evaluated the atmosphere and overall impression of the physical store.

This research collected useful data from Flor-San's Handicraft customers and key people using a combination of quantitative surveys and qualitative interviews.

Data Gathering Procedure

A letter of request to conduct the study was prepared to ask for their consent. survey questionnaires were used to gather data., survey questionnaires were distributed to the respondents through Google Forms and were recorded, tallied, and analyzed for the results of the said data. The researchers ensured that data was critically calculated, evaluated, and interpreted to generate accurate conclusions and recommendations.

Data Analysis

As shown in table 1., data acquired from the respondents were tabulated, examined, and interpreted as Strongly Disagree for the mean of 1.00 - 1.80; Disagree for the mea of 1.81 – 2.60; Agree for the mean of 2.61 – 3.40; Moderately Agree for the mean of 3.41 – 4.20;and Strongly Agree for the mean of 4.21 – 5.00. To gather enough data for the study's topic, the following statistical tools were used. Frequency and percentage distribution was utilized to determine the profile of the respondents. Moreover, mean rating was utilized to determine the aim of this study based on the responses of the participants.

Table 1. Range of Mean and Interpretation

Range of Mean	Descriptive Interpretation
4.21 – 5.00	Strongly Agree
3.41 – 4.20	Moderately Agree
2.61 – 3.40	Agree
1.81 – 2.60	Disagree
1.00 - 1.80	Strongly Disagree

To measure the profile of the respondents and (level of the marketing mix), the researchers used the frequency, percent, mean, standard deviation. The frequency and percentage used to determine the profile of the respondents and their percent contribution to this study. Moreover, the mean and standard deviation used to measure the level of perception or response to the marketing mix.

Results and Discussion

This chapter discusses and comprises a variety of important data that were analyzed one by one by the researchers of the study to present the outcomes and results to the presented questions and problems it faces to the readers and future researchers.

The following are the questions that are presented and their answers

Demographic Profile of the Respondents

Table 2. Distribution of Respondents According to Sex

Sex	Frequency	Percent
Male	73	48.7
Female	77	51.3
Total	150	100

As shown in table 2., the customers of Flor Sans Handicraft from January 2022 to January 2023 are almost equally divided with the female composing of 51.3% of the respondents and male comprising the 48.7% of the total respondents.

Table 3. Distribution of Respondents According to Age

Age	Frequency	Percent
18 to 24 years old	5	3.3
25 to 34 years old	29	19.3
35 to 44 years old	79	52.7
45 years old and above	37	24.7
Total	150	100

As shown in table 3., respondents with the age of 35-44 years old comprises 52.7 of the total Number of respondents, followed by the age range of 45 and above comprising 24.7% of the Respondents, while those with the age range of 25-34 years old comprised the 19.3% of the Respondents and lastly the age range of 18-24 years old comprised 3.3% of the total respondents.

Table 4. Distribution of Respondents According to Marital Status

Marital Status	Frequency	Percent
Single	75	50.0
Married	72	48.0
Separated	3	2.0

As shown in table 4., 75 or 50% of the respondents are single; 72 or 48% are married, while only 3 or 2% are separated.

Table 5. Distribution of Respondents According to Level of Income

Level of Income	Frequency	Percent
Below 15,000	57	38.0
15,000 and above	93	62.0

As shown in table 5. majority of the respondents or 62% are earning more than 15,000.00PhP while 38% of the respondents are earning below 15,000.00PhP.

Demographic Profile of respondents: A well-balanced gender profile: Male was 48.7% and female stood at 51.3%. Age distribution points to the fact that the dominant group was between 35 and 44 years (52.7%), and above 45 years (24.7%). The data further reveals 50% are single and 48% are married, indicating that a huge segment of the population whose family responsibilities would not have any bearing on purchasing decisions. It is also characterized by an enormous division in terms of income levels, with 38% earning below 15,000 and 62% above this threshold, hence making for a well-to-do respondent pool.

These findings resonate with the salience of demographic characteristics in relation to marketing strategies; the context of Flor-San's Handicraft establishes the importance of having a deeper understanding of how various aspects of life affect the demand for its products. According to Ahmad et al. (2023), demographics are one aspect that shifts behavior and preferences among consumers. This is particularly very significant in cases like the present where culture forms a rich sector, such as handicrafts. Besides, Al Muala (2012) shows that marketing has to converge with the socio-economic realities of the target market if it is to increase consumer loyalty. Since this population is composed of diverse age and income groups, the required marketing strategy must appeal to the complex tastes and purchasing power of potential customers. This finds an instance in the marketing mix framework, particularly the 7Ps model, which promotes tailored strategies that can be applied to engage with various demographic segments while espousing sustainable practices within the handicraft industry (Dalal & Dalia, 2024).

Assessments on the level of 7Ps of Marketing Mix of Past Customers

Table 6. Product Evaluation of Flor-San's Handicraft

Product	Mean	Std.Deviation	Remarks
When it comes to quality and features, Flor-San's Handicraft is excellent.	4.41	0.84	Strongly Agree
The handicrafts' designs made by Flor-San's are very timely.	4.07	0.96	Moderately Agree
The variety of Handicrafts offered by Flor-San's is wide and appealing.	4.15	0.91	Moderately Agree
Flor-San's Handicraft is truly knowledgeable about which product to create/launch, phase out and innovate.	4.31	0.81	Strongly Agree
Flor-San's Handicraft are aware about the selection of materials based on their products' characteristics.	4.47	0.72	Strongly Agree
Overall Product	4.28	0.67	Strongly Agree

As shown in table 6. the strengths of Flor-San's Handicraft exist within the product itself-on both product quality and innovation, and selection of materials. An average score of 4.41 on product quality is an indication of respondents having strong agreement concerning excellence in Flor-San's products, an affirmation supported by Ahmad et al. (2023), that cultural heritage perseverance pegged on productive quality.

Moreover, the remark that Flor-San is aware of product development and innovation also received the high rating with an emergent interpretation that is an informed strategy about market demand. This resonates with Almeda et al. (2023), who point out that the ability of artisans to be market-sensitive will influence their survival in the market.

In relation to timeliness as one of the design elements of its handicrafts, Flor-San managed a score of 4.07 representing a fair agreement. Although this is a good perception, it also indicates the need to align the handicraft sector with modern trends-an aspect echoed by the challenges that Dalal and Dalia (2024) mention regarding the need to perform continuous market analysis for this industry. However, the range and attractiveness of the products, scoring 4.15, typify the capacity of the brand to meet differing consumer tastes, which is further strengthened by the belief that a diversified product mix can create better market positioning (Khan, 2014).

Respondents rated Flor-San's awareness of material selection at 4.47, a further confirmation of the brand's commitment to quality and authenticity, two key levers of customer loyalty in handicraft (Shafi et al., 2021). At 4.28, the product score as a whole represents a significant agreement that positive attributes are attached to Flor-San products; therefore, consumer feedback must be integrated into strategic decisions.

In a nutshell, the positive appraisal of Flor-San Handicrafts is a good starting point from which this can leverage strengths and strengthen weaknesses, especially about the despatch of designs. The company can capitalize on that by hiring the use of digital marketing methods as proposed by Ghosal and Prasad (2019).

Table 7. Price Evaluation of Flor-San's Handicraft

Price	Mean	Std.Deviation	Remarks
Flor-San's pricing is transparent and easy to understand.	4.04	0.86	Moderately Agree
Prices of Flor-San's Handicraft are fair knowing that they fully consider the labor cost, quality and craftmanship.	4.20	0.81	Moderately Agree
The prices of Flor-San's Handicraft are comparable to the prices of related products offered by competitors.	3.97	0.85	Moderately Agree
Discounts, bundling, vouchers, or any pricing negotiation is always presented in transacting with Flor-San's Handicraft.	4.09	0.92	Moderately Agree
Overall Price	4.08	0.67	Moderately Agree

In terms of pricing strategies in Flor-San's Handicraft, as shown in table 7. the results of the survey generally indicate that consumers quite welcome the idea. In checking the mean score of 4.04 for the statement referring to transparent pricing, such suggests a moderate agreement that customers would welcome the clearcut structure of pricing. This agrees with the findings of Ahmad et al. (2023) as they maintained that transparency in the pricing of traditional craft should really be valued so that these consumers can trust and become satisfied in the products. Another score is at 4.20 for price of fairness, labor, quality, and craftsmanship showing appreciation for intrinsic value of products handmade. That is important since an appropriate price can improve brand loyalty and position in the market (Almeda et al., 2023).

Finally, the comparison of Flor-San pricing with the competitors is scored 3.97, yet another intermediate degree of agreement. This implies that customers perceive Flor-San prices as in line with those in the market, hence validating the positioning of the brand as a risk-free substitute for other craft manufacturers (Anurag & Kaur, 2022). The consistent offering of promotions through discounts, bundling, among other forms of price promotions scored 4.09 and simply proved to what extent the firm is committed to involving their customers and improving perceived value (Dalal et al., 2024). Overall, 4.08 is the summary score on overall pricing, which depicts favorable perception of Flor-San's pricing strategy to the customers.

The most crucial finding is that this upholds the notion that a well-structured pricing strategy not only promotes sales but also plays an extremely important role in the sustenance of the handicraft industry (Dumasari et al., 2020). In the final analysis, the commitment by Flor-San on transparency, fairness, and competition falls in line with the overall marketing principles as illustrated by for example those discussed in marketing mix that stresses a balance in the delivery of value to customers (Kotler & Lee, 2008).

Table 8. Place Evaluation of Flor-San's Handicraft

Place	Mean	Std. deviation	Remarks
Flor-San's Handicraft offerings are easy to see because they are operating in both online and physical stores.	3.60	1.29	Agree
There are website/s I can rely on to have direct access to Flor-San's contact number, location, or sales support.	2.32	1.09	Disagree
Flor-San's has a lot of network partners where I can check out orders.	3.43	1.10	Agree
Flor-San's has no intermediaries or "middlemen."	3.44	1.12	Agree
Overall Place	3.20	0.96	Agree

As shown in table 8. The mean scores rating Flor-San's Handicraft describe a fairly positive view with respect to the accessibility and visibility of their products. They agreed that handicrafts at Flor-San are easy to see since they have both online and physical storefronts (M = 3.60). This hybrid strategy supports modern market strategies of multichannel access, according to Ahmad et al. (2023) where they observe different channels to be used in expanding market access and cultural competence. A huge concern was raised on the use of digital sources for customer service support, where a mean score of 2.32 indicated that the respondents disagreed on the accessibility of reliable online resources to contact details and sales assistance. This gap would expose the handicraft supply chain to the risk of customer disengagement and calls for better digital infrastructure, an essential factor in the digital economy for artisans (Almeda et al., 2023).

Moreover, the agreement (M = 3.43) with respect to having a robust network of partners to check orders reflects the proper positioning of Flor-San within the handicraft supply chain that has reinforced the benefits of a collaborative network as discussed by Civera and Freeman (2019). What is more, since Flor-San sells directly to the customers with minimal middlemen (M = 3.44), this chain has a direct model of sale, which may increase its profit and customers' loyalty because of the opinion held by Al Muala (2012), which claims that there is a reduction in the middlemen, which may result in high consumer trust and consumer satisfaction. These lines generally indicate a relatively favorable disposition of the "Place" aspect of the marketing mix, but there are still some very strong areas for

improvement within these streams of digital accessibility and customer service that can further empower the market position and sustainability of Flor-San in this changing landscape of handicraft marketing.

Table 9. Promotion Evaluation of Flor-San's Handicraft

Promotion	Mean	Std. Deviation	Remarks
Flor-San's are consistent about their promotional strategies in creating interest and awareness among their consumers.	4.07	0.98	Moderately Agree
Flor-San's keeps me updated about their new products and offerings through their social media platforms/ads.	3.76	1.12	Agree
The frequency Of Flor-San's promotion is appropriate.	3.91	0.98	Moderately Agree
Flor-San's promotional materials accurately represent the quality and value of their products.	4.35	0.80	Strongly Agree
Overall Promotion	4.02	0.84	Moderately Agree

Table 9. shows that all these promotional activities of Flor-San's Handicraft are very aligned with modern marketing practices and are managed to effectively engage consumers and build awareness in the brand. On a whole, it is set that the mean rating is 4.02, meaning that the respondents moderately agreed whether the promotions were effective or not. The statement about the representation of product quality and value also received a very high mean score of 4.35. It means that consumers have great confidence in the advertisement tools used by Flor-San's. This outcome indicates the significance of authentic marketing in the handicraft industry; when the value of handicrafts is centered on culture and skill.

Apart from this, Flor San has used social media properly to update their customers about new products as their mean score here was 3.76. This reflects that though the brand is actively engaging with its audience online, there still is a scope for improvement in quality on the frequency and quality of updates. The score for the relevance of promotion intensity was scored at 3.91; hence, it implies a general consensus that the strategies in existence are just rightly timed to be at the given points but call for strategic developments in terms of sustaining interest from consumers (Dalia & Dalia, 2024). In broad terms, the outcome reflects that a powerful marketing mix is vital for winning competitive advantage for the handicraft industry.

According to Al Muala (2012), the interactions of the different constituents of marketing are very critical in delivering consumer satisfaction and loyalty particularly for markets that rely on traditional craftsmanship and cultural heritage. Therefore, the focus by Flor-San on promotion will help retain the current customers while playing a significant role in attracting new customers, forming a sound platform for long-term growth in the digital era.

Table 10. People Evaluation of Flor-San's Handicraft

People	Mean	Std. Deviation	Remarks
We have seen as consumers that Flor-San's employees are supported and well-trained about their role and responsibilities.	4.41	0.70	Strongly Agree
There are people assigned in Flor-San's whom I can easily reach— for inquiries, processing orders, etc.	4.33	0.75	Strongly Agree
All the people involved in sales are knowledgeable about their products and offerings.	4.57	0.62	Strongly Agree
Employees in customer service are very polite in assessing my needs, complaints, and feedback.	4.34	0.78	Strongly Agree
Overall People	4.41	0.57	Strongly Agree

Table 10. shows that the "People" dimension of Flor-San Handicraft scored very high in employee competence and customer service, standing at an average mean score of 4.41, implying a high agreement of consumers that the staff of this craft had received adequate education and assistance. This finding was supportive of the supposition of Ahmad et al. (2023), which stated that proper training among the employees can significantly contribute to the preservation of traditional crafts since they contribute towards the preservation of consumer confidence and satisfaction. The result shows the level to which the customers feel comfortable with Flor-San's staff being aware and capable. For instance, a mean score of 4.57 in sales positions reflects the knowledge of Flor-San's products. It is such high expertise that not only makes customers satisfied with shopping in the store but also consolidates the brand's position in the handicraft market competition.

The convenience to reach personnel who can answer inquiries and process orders also has a mean score of 4.33. To be accessible is significant because communication is the basis of an effective customer relations program (Almeda et al., 2023). It reflects that the firm cared for prompt responses which are seriously involved in creating loyalty and retaining customers. In addition, as the high interest in friendly customer service is indicated by an average score of 4.34, the importance of interpersonal skills in customer satisfaction can be explained. From a practical perspective, such practice is essential in the handicraft industry because consumer purchasing decisions significantly depend upon relationships and consumer experiences (Al Muala, 2012).

Based on the "People" dimension of the marketing mix, Flor-San Handicraft delivers a strong performance that really reflects strategic customer engagement and employee training. Having ensured that the employees are knowledgeable and accessible, Flor-San handcrafted effectively positions itself to adapt to the changed digital space while delivering its cultural heritage.The results of this study are likely to guide the conceptualization of the campaigns that will be

conducted on the company's behalf because marketing researchers argue that the "proper understanding of service providers is a prerequisite for effective marketing activity" (Judd, 1987; McCabe, 2024). Conclusively, findings are suggestive of the fact that an adequately supported workforce positively correlates to customer experiences and brand loyalty within the handicraft industry.

Table 11. Process Evaluation of Flor-San's Handicraft

Process	Mean	Std. Deviation	Remarks
Difficulties in purchasing and checkouts in Flor-San's are very minimal.	4.04	0.90	Moderately Agree
Flor-San'a are highly informative about the order process.	4.29	0.82	Strongly Agree
Order process at Flor-San's includes choices in a variety of payment options, alternatives, purchase decision, and post-purchase evaluation.	4.32	0.81	Strongly Agree
Overall Process	4.26	0.71	Strongly Agree

The purchasing process at Flor-San's Handicraft as shown in table 11. has been described as very smooth and efficient in nature, thus facilitating a customer-friendly experience as validated by its mean score of 4.37. Such a finding is consistent with the previous studies where streamlined purchasing processes are associated with a higher level of customer satisfaction and loyalty (Al Muala, 2012). For instance, customers encountered relatively few problems at checkouts with a score of 4.04, meaning that the company has eliminated or reduced potential barriers to purchasing. With its streamlined process, it is highly important in today's scenario because it can reduce hassle for the customer but also result in repeat business; no question this is one of the keys in maintaining market share (Ahmad et al., 2023).

Transparency about the order process was also guaranteed by Flor-San, bringing a high mean of 4.29. Through this transparency, consumers will be given assurance and thus would engage easily with companies that clearly indicate the precise processes that accompany purchase. Various modes of payment and a post-purchase review that is stringent ensure that the company is in contact with a large array of experience by the customer with a feeling of control and satisfaction. Researchers have found that offering multiple choices of payment increases conversion rates highly, as the consumer likes options according to his or her respective requirements (Dalal et al., 2024).

Generally, the mean score of 4.26 for the process of buying altogether shows the good efficiency of Flor-San in order to arrange for a good customer experience. By embracing strategies targeted at effectiveness and openness, the company is at a better position to respond to the changeful market. This not only propels new clients but also keeps hold of the existing ones, hence being one of the causes of sustainable business growth in a digitized economy worldwide (Nguyen, 2018). Flor-San's proactive step towards upgradation of its purchasing process is an example of

how traditional handicraft entrepreneurs can win against the new challenging wave of 'digital change and changing consumer behavior'.

Table 12. Physical Evidence Evaluation of Flor-San's Handicraft

Physical Evidence	Mean	Std. Deviation	Remarks
Flor-San's physical store or showroom was very pleasant. Whole showroom is neat and clean, products are aligned according to their categories, store color combination illustrates the craftsmanship of Paeteños, etc.	4.47	0.67	Strongly Agree
Flor-San's shop (both physical and online) instills a positive overall impression.	3.87	0.88	Moderately Agree
Flor-San's shop keeps a consistent and visually appealing brand image.	4.43	0.78	Strongly Agree
Their packaging is impressive and protects my ordered products well.	4.67	0.59	Strongly Agree
Overall Physical Evidence	4.36	0.54	Strongly Agree

Assessment of the physical evidence of Flor-San's Handicraft as shown in table 12. reveals a strong agreement from the respondents on their general experience about the shop. The mean score given to the physical store or showroom was 4.47, indicating that customers are in a strong agreement on the presence of a pleasant atmosphere, cleanliness, and proper organization of products, which run concurrent with the conventional craftsmanship presentation standards noted by Ahmad et al. (2023). From the above analysis, it is found that aesthetics of the store, as envisioned by craftsmanship, is essential in reaping the thoughts of customers, thereby emphasizing the role of an attractive physical environment in the improvement of customer experience (Almeda et al., 2023).

In addition, the mean score of 4.43 in consistent and visual appeal of the brand image of the shop emphasizes the importance of branding in handicraft industry. This consistency helps build consumer confidence and loyalty, according to the marketing mix theory, as visual branding remains an important element in purchasing decisions (Al Muala, 2012). Furthermore, the package was impressive, rated 4.67, and showed adequate protection during shipment to the consumers who need such integrity and protection of the product (Shafi et al., 2021).

In general, according to the physical evidence generated by the survey, Flor-San's Handicraft could provide a good impression and strong brand image, hence fitting the extended marketing mix framework of Rafiq & Ahmed, 1995. While it not only creates a great experience for consumers but also provides a major contribution to the effectiveness of the marketing mix, which finally helps the shop to celebrate its competitiveness both in the physical and virtual realms (Cruz, 2019; Dalia & Dalia, 2024).

Recommendations for Flor-San's Handicraft for the Improvement of Their Business

Based on the findings, it is recommended that Flor-San's Handicraft should prioritize its strengths while addressing key areas for improvement, particularly in digital presence and promotional reach. For Product, the high customer satisfaction highlights the value of continuing to focus on quality, craftsmanship, and innovative material selection. Changing designs more often to reflect modern trends could, however, increase attractiveness since some consumers seek fresh options (Ahmad, Khairi, & Legino, 2023; Almeda et al., 2023). Regarding price, as fair pricing was valued but lacked clear market difference, improving openness and conveying Flor-San's pricing value in comparison to rivals will help to increase customer acceptability (Anca & Daniel, 2012). Place is a space with great improvement possibility. A user-friendly website with access to store information, customer support, and order tracking would help close present gaps in digital accessibility and strengthen online engagement, a crucial element for handicraft companies as consumer reliance on digital shopping continues to grow (Knudsen et al., 2021). Since Flor-San was a field with huge future development, it should enhance its social media operations. More consistent and creative advertisement could continue to hold customer interest and increase the exposure of Flor-San because, in this modern digital world (Dalia & Dalia, 2024) brand presence is highly reliant on appropriate use of social media. Flor-San's People and Process elements are strong assets and should remain central to the marketing strategy. The knowledgeable and well-trained employees have contributed significantly to customer satisfaction, supporting the brand's reputation (Al Muala, 2012). The purchasing process was also well-rated, indicating that a smooth transaction experience with multiple payment options is already in place, enhancing convenience and fostering loyalty (Ghosal & Prasad, 2019). Lastly, Physical Evidence is a major strength for Flor-San, with high marks for store cleanliness, branding, and protective packaging. To ensure a cohesive brand experience across all touchpoints, the online store's design should reflect the physical showroom's appeal, bridging digital and physical experiences (Cruz, 2019). By focusing strategically on these digital improvements while maintaining existing strengths, Flor-San can build a competitive and balanced marketing mix framework that meets customer expectations and fosters long-term growth across physical and digital markets.

Summary, Conclusions, And Recommendations
Summary of Findings

The demographic profile of the past customers of Flor-San's Handicraft from January 2022 to January 2023 is well balanced in terms of sex. In terms of age, majority are in the age bracket of 35-44 years old

The participants ranked the seven Ps of the Marketing Mix as shown here. (1) Product: Generally, the respondents highly valued Flor San's products' quality and customizing choices. (2) Price: Based on the installment choices, the respondents expressed good reflections on the flexible price structure. (3) Promotion: The old marketing methodology was appreciated by the long-time customers; however, many of them said there is no proper internet site. (4) Place: The physical stores and store or exhibition venues were appreciated for their accessibility: however, some of the people want more internet access. (5) People: Employees were considered an asset to the client satisfaction quotient because they are professional in nature and skilled in their job. (6) Process: Customer-friendly and efficient

procedures, including the smooth transaction and consultation process were acknowledged in favor. (7) Physical Evidence: The showroom's ambiance was perceived favorably as providing a homely experience.

Rating of the 7Ps by the Respondents: There were several comments concerning the way the 7Ps were executed by Flor-San's Handicraft. The respondents approved of the organization's overall quality of products manufactured; they also appreciated the promptness of the pricing. However, in regard to the promotion and the place, opportunities regarding improvement had to be exhausted with the introduction of e-commerce and other web-based marketing tools.

The interpersonal aspect, in terms of dealing with the interaction of the employees with the customers, was appreciated, and the intangible and procedural aspects made the experience merry for the customers. The overall finding of the 7Ps evaluation of Flor-San's Handicraft as generally positive perception of Flor-San's Handicraft by the respondents, who placed a premium value to product quality, indicated in the appreciation of the carefulness in the details on material used and shows highly standard handicraft industry. The price of the organization was appreciated for being transparent and fair in the pricing setting, which is accessible to the customer and reflective of value in the craftsmanship The People dimension was excellent since the employees of Flor-San had good interpersonal skills, knowledge of the products, and a helpful approach toward the customers' interaction that is very vital for satisfaction and loyalty from the customer.

However, Promotion and Place have scopes for improvement. Although the company's promotion was successful, there definitely exists a clear scope of wider marketing coverage through e-commerce and web-based online platforms in increasing brand value and consumer involvement

Conclusion

The overall objective of the study is to discover the reasons behind the success and longevity of Flor-San's Handicraft using the perception the of past customers assessing specific elements of Marketing Mix (7Ps). Rating of the 7Ps by the Respondents: There were several comments concerning the way the 7Ps were executed by Flor-San's Handicraft. The respondents approved of the organization's overall quality of products manufactured; they also appreciated the promptness of the pricing. However, in regard to the promotion and the place, opportunities regarding improvement had to be exhausted with the introduction of e-commerce and other web-based marketing tools. The interpersonal aspect, in terms of dealing with the interaction of the employees with the customers, was appreciated, and the intangible and procedural aspects made the experience merry for the customers.

Recommendations

1.   For future researchers, the findings of this study may be used as baseline data, it is recommended that a similar study should be conducted with another shop in the area and a larger number of respondents to ensure consistency and validity of the results.

2.   For businesses with the same nature as Flor-San's Handicraft, data from this study may be used as a guide to help them with their business to ensure their longevity.

3.   For the Local Government of Paete, Laguna, it is recommended that more programs be implemented such as finding alternative ways to grow and protect the Batikuling tree, or providing support for scientific research to find alternative sources of wood that suites wood carving.

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Higher Education Students' Readiness for Brisk Ai-Driven Feedback on Essay Writing

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Abstract: There has been a significant surge in interest concerning the pedagogical aspects of Automated Writing Evaluation (AWE) within English as a Foreign Language (EFL) writing research. Given the significance of writing in learning and assessment, educators are increasingly challenged to make informed and deliberate decisions about integrating Artificial Intelligence (AI) tools to support students' writing development. The directions of this research have shifted from considering automated feedback as an alternative to human evaluators to the students' preferences, attitudes, and readiness for AI-driven feedback on their writing. Learners' attitudes and preferences are of vital importance in this process. Correspondingly, the primary objective of the research was to investigate EFL learners' perception and readiness for using automated feedback, such as Brisk Teaching Google Extension, to improve feedback practices and address new challenges teachers and learners face regarding evaluating writing skills. Brisk Teaching is a relatively new tool, and there is almost no research yet done about its utilisation in the EFL context; correspondingly, the present study is the first attempt to shed light on its use and create new knowledge in this field. To obtain valuable data, a mixed method was applied, integrating quantitative (questionnaires) and qualitative (interviews) research approaches. The participants of the study were fifty-six C1 level (Advanced) freshmen and sophomores from International Black Sea University. During fourteen weeks, the participants wrote six essays in Google Docs using the Brisk automated feedback. The results obtained from both surveys and interviews showed that the students have very positive attitudes towards Brisk AI-driven feedback on their essays. The findings showed that the primary advantages of Brisk feedback are its features to highlight areas for improvement, suggesting grammar, word choice, style, and structure recommendations helping learners keep the creative flow going. Another advantage of Brisk feedback is that it is very easy to incorporate changes instantly since it immediately provides all the specific details that help students understand their strengths and weaknesses. It also helps them improve their revision and correction skills. Although, the major advantages, the results showed that Brisk and other automated feedback tools may not always match the students' specific needs or sometimes miss the specific and important aspects of writing that may make automated feedback tools more generic and sometimes less personalized. Overall, the results showed that the learners are completely ready and eager to use Brisk AI-driven feedback in future writing.

Keywords: Writing Assessment, Automated Feedback, AI-driven feedback, Brisk Teaching Google Extension, Writing Skill Development.

Introduction

Writing is a fundamental skill that is of vital importance for learners' academic, professional, and personal growth. Proficiency in writing is crucial for success not only in academic environments but also in the workplace, where leadership and efficiency are frequently associated with effective communication (National Commission on Writing, 2004; Graham & Perin, 2007). Well-developed writing skill also promotes critical thinking since it calls for the structuring of ideas, the evaluation of data, and the clear and convincing presentation of complicated concepts (Kellogg, 2008). On the path of learning and development, feedback is an inseparable and crucial component for EFL learners to improve their writing abilities (Hyland & Hyland, 2019; Weng et al., 2024). Timely and effective feedback not only improves their writing but also boosts their motivation, self regulation, and self-efficacy (Zhang & Hyland, 2018).

The rapid growth of technology in education has produced several instruments targeted at enhancing student outcomes, notably in the area of language acquisition (Han, 2024; Alqahtani, 2024). The incorporation of automatic feedback tools, such as Brisk AI, is a contributing factor in enhancing learners' writing skills. They may recognize and fix mistakes in real-time with prompt responses from AI feedback tools, which can boost their confidence and encourage self-directed learning (Zhang & Hyland, 2018).

A relatively new addition to AI-driven educational tools, Brisk Teaching, is believed to have the potential to improve EFL learners' writing abilities. A brisk Teaching feedback tool can help learners write better in real time by giving them immediate feedback on every aspect of writing. It is somewhat similar to Grammarly or ChatGPT, with the help of which students can continuously modify their work by using the input Brisk AI provides. Consequently, it can foster critical thinking and self editing abilities. This degree of independence has the potential to greatly increase students' self-assurance, self-efficacy, motivation and inclination to write which is crucial for the development of writing.

Brisk Teaching is a Google extension that has gained popularity due to its capacity to perform a variety of teaching duties, including lesson planning, rubric production, and real-time feedback on student writing. The Feedback Generator, a major feature of Brisk Teaching, enables teachers to provide individualized, targeted feedback on students' tasks in real-time. The program detects common faults in grammar, coherence, and arguments, allowing students to gradually improve their writing (Brisk Teaching, 2023). Its AI-powered algorithms accelerate the feedback process, ensuring that students receive timely corrections, which is critical for language learning (Wilson & Roscoe, 2020). Because the Brisk Teaching Google extension is a relatively recent technological novelty, there is a lack of research on its application as well as on its effectiveness in EFL classes. The learners' readiness and perceptions have not been researched either. This study is the first attempt to shed light on EFL learners' attitudes and readiness for using Brisk AI feedback in their essays. Correspondingly, the current research paper aims to create new knowledge

and provide the readers with new insights into the latest trends in automated feedback tools by incorporating Brisk Teaching Google extension feedback tool into Higher Education EFL classes. The research objective is to answer the following research questions:

RQ 1: What are the learners' overall perceptions and attitudes toward using Brisk AI feedback on their essay writing?

RQ 2: What are the advantages and limitations of incorporating the Brisk Teaching Google extension automated feedback tool in English as a Foreign language class in Higher Education Institutions?

RQ 3: What is the learners' feedback preference?

RQ 4: To what extent are the learners ready to incorporate Brisk AI feedback in their EFL writing?

Literature Review

Feedback is one of the influencers on student accomplishment since it helps learners understand their strengths and possible actions for improvement (Hattie & Timperley, 2007). Although, despite its advantages, feedback on EFL learners' writing is challenging, especially when it has to compete with the newest trends in teaching and assessment, including the latest technological advancements such as Artificial Intelligence (AI). The latter has quickly gained popularity in English as a Foreign Language class, notably in writing. Recently, there has been a major increase in interest in the educational features of Automated Writing Evaluation (AWE) feedback in EFL (Ranalli et al., 2017). Automated Writing Evaluation (AWE) is a computerized feedback system that analyses and provides comments on learners' writing in terms of grammar, style, and content using Natural Language Processing (NLP) (Aldosemani, 2022). AWE systems have been developed to save teachers time and effort when providing individual feedback on students' writing (Chen & Pan, 2022). As AI technologies advance, their application in education is proving to be transformative, providing learners with dynamic, tailored, and instant feedback (Han & Sari, 2024).

There have been numerous studies reporting the positive effect of utilizing AI-driven feedback on enhancing EFL learners' writing skills. They suggest it offers students opportunities for deliberate practice and holistic feedback on their writing. It can provide feedback on various types of writing tasks, including essays, reports, various types of business correspondence, research papers, etc. It is reported to increase both writing fluency and accuracy. Besides, it saves teachers time and allows more opportunities for writing practice. AI feedback tools are also very interactive in which they are allowed to revise their writing based on the feedback that they receive from the source of the AWE tools (Wei et al., 2023; Saricaoglu & Bilki, 2021; Hibert, 2019; Huang & Renandya, 2020; Zhu et al., 2019).

Brisk AI, Grammarly, Quillbot, and ProWritingAid are examples of AI-driven feedback tools that use sophisticated algorithms to provide corrective feedback on grammar, syntax, style, and even higher-order concerns like coherence and argumentation (Aldosemani et al., 2022). These automated feedback tools have become increasingly common in teaching writing, supplementing traditional teacher-led feedback (Wang & Han, 2022; Fan, 2023; Fitria, 2021).

There are various studies examining the effectiveness of automated feedback on writing and the learners' attitudes toward them. The study carried out in China in March 2021 aimed to examine EFL learners' writing performance using another AIdriven feedback tool Grammarly. The researchers investigated the student participants' acceptance of automated feedback tools and Grammarly in particular. The participants in the experimental group used Grammarly

to revise and edit their essays, while the control group followed traditional instructions without Grammarly. A total of 65 sophomore students, enrolled in a Chinese-English Translation program, were recruited from two English classes at a four-year university located in Fujian, China. The intervention period lasted for 16 weeks and both groups completed five essays. At the end of the intervention, researchers gathered students' feedback on Grammarly through a survey. An independent ttest revealed that the experimental group significantly outperformed the control group in post-test writing performance. Additionally, open-ended survey responses indicated that students valued Grammarly's AI-driven grammar corrections (Chang et al., 2021).

Another study conducted by Chae-Young Mun in May 2024 aimed to investigate the application of AIdriven feedback in EFL writing. ChatGPT was used as an automated feedback tool. One of the objectives of the study was to explore to what extent ChatGPT improves learners' writing. It also aimed to understand the learners' perception regarding the utilization of AI-driven feedback tools. The study revealed that students using ChatGPT had fewer grammar and lexical errors. Similarly, the holistic analysis of their writing showed that they had improved the content and organization of their essay writing. The study also revealed that the research participants (43 Korean college freshmen) reported a positive attitude toward the use of AI-driven feedback tools although they expressed, they would not like to be over-reliant on it and suggested using the combination of both teacher and automated feedback (Mun, 2024).

Method

To gain a deeper understanding of the learners' readiness for Brisk Teaching automated feedback on essay writing, mixed methods research methodology was applied integrating quantitative and qualitative research approaches. Quantitative data was collected through questionnaires. To complement this, qualitative data was gathered using semi-structured interviews to gain a more in-depth exploration of participants' experience, practices, and readiness for using automated feedback on their essay writing. Before conducting the survey and applying the interview, structured questionnaires and interview questions were examined by three experts for content validity. Expert panel recommendations help the researchers improve study instruments and make them reliable which was the reason for content validity (Zamanzadeh et al., 2015; Roebianto et al., 2023).

Procedures

The present research was carried out at International Black Sea University, Tbilisi, Georgia in the Spring semester of the 2023-24 academic year. The duration of the research was fourteen weeks. To gain initial insights from the research sample, at the beginning of the course, researchers administered a pre-research questionnaire to investigate the participants' practices and attitudes toward essay writing and their readiness for AI-driven feedback on their essays. It focused on various aspects of feedback, including the types, quality, readiness, and motivational impact of both teacher and AI feedback. The survey allowed respondents to reflect on their experiences with feedback and express their preferences and perceptions.

The pre-research questionnaire was designed to investigate students' writing practices, the types of feedback they receive, and their perception of the effectiveness of both teacher and AI-generated feedback. The survey explored the

use of AI tools and the quality of feedback from both their teachers and automated tools. The questionnaire identified the participants' writing backgrounds, perceptions, and attitudes toward automated feedback tools. The questionnaire was created via Google Forms and was sent to 67 students. 54 of them filled out the survey. By providing valuable insight into learners' context, the pre-research questionnaire helped researchers refine the focus of the research.

After analysing the pre-research questionnaire, the teacher researchers explained and taught research participants how to use Brisk Teaching to evaluate their essays. During fourteen weeks, the research participants wrote two opinions, two argumentative essays, and two compare/contrast types of essays. They were asked to upload their first drafts, written in Google Docs on Google Drive, created by the teacher. Research participants were asked to proofread and revise their first drafts individually using the Brisk Teaching automated feedback tool. The student participants were uploading their revised drafts to Google Docs after applying feedback provided by the Brisk Teaching automated feedback. The primary reason for choosing the three aforementioned essay types was that they were reported to be most frequently practised and also highly challenging for students. Each essay was practised for two weeks (One week - explanation and writing process; the second week - giving automated feedback through Brisk Teaching on learners' writing performance). A total of six essays were implemented during the 14 weeks.

Participants

The participants of the study were fifty-six C1 level (Advanced) freshmen and sophomore students from International Black Sea University from all the faculties and departments. General English is an obligatory course in the aforementioned university and the study participants were assigned to the C1 level by the standardised exam organised and administered by the university. These participants were selected through convenience sampling from the classes taught by the researchers.

Results and Analysis
Study 1: Pre-Research Questionnaire Results

The questionnaire aimed to gain information about the respondents' writing practices. The first question asked referred to the writing practice. Respondents were asked about the frequency of writing as part of their study. The obtained results showed that the majority of them (47.3%) had it daily, followed by 41.8% who experienced it weekly and 5.5% had writing tasks monthly and 5.5% had it rarely. Respondents were asked about the type of writing (academic, creative, professional, and informal) they were most frequently engaged in as part of their course. Majority of them (61.1%) responded that they were engaged in academic (essay and report) writing followed by informal writing (46.3%), 24.1% were engaged in email and application letter writing and 22.2% in creative writing. The next question dealt with feedback from experience students had. The equal number of respondents (34.5%) reported that they always received feedback from the teacher and the same number reported that they sometimes received it. 21.8% of the respondents often got it and 5.5% rarely and 3.6% never received teacher feedback. The next question dealt with the type of feedback students received. The respondents reported that the feedback teachers provided covered the following aspects: grammar (61.8%), writing style and coherence (54.5%), structure and organisation (50.9%), content (40%), and vocabulary use (27.3%). The researchers were interested if the teachers used any AI tools in the teaching

process. Majority of the respondents (37.3%) were not sure about it, while 35.7% had a negative answer. 27.4% responded positively to the question asked. To further investigate what kind of AI tools were used in the class, the responses were as follows. 42.9% of the participants responded that none of the mentioned AI tools were employed in the class. 37.5% of the respondents mentioned that Grammarly was employed in their class. The second AI tool was Brisk AI (25%) followed by other tools, though it was not mentioned by the respondents which other tools were used. ProWritingAid was mentioned by 5.4% and Quillbot by only 1.8%.

What kind of feedback do you get from AI tools? 75% of the respondents mentioned grammar correction, 32.1% punctuation and spelling correction and the same number of students named sentence structure improvement, 28.6% style and tone suggestions, and 21.4% mentioned plagiarism check.

The next part of the questionnaire investigated the quality of feedback provided by the teacher and AI tool. If we compare the results exactly the same number of respondents (44.6%) think that feedback provided by the teacher and AI is good. For less than half of the respondents (41.1%) teacher feedback is excellent and only 19.6% of the students think that AI feedback is excellent. More respondents (28.6%) think that AI feedback is far compared with teacher feedback (12.5%). More respondents (5.4%) assess AI feedback as poor compared with teacher feedback (1.8%). None of the respondents assessed teacher feedback as poor, though 1.8% of the students assessed feedback provided by AI tools as being poor.

Table 1. Teacher Feedback vs AI Feedback

	Excellent	Good	Fair	Poor	Very poor
Teacher Feedback	41.1 %	44.6%	12.5%	1.8%	0%
AI feedback	19.6%	44.6%	28.6%	5.4%	1.8%

The researchers were interested to investigate to what extent helped them the feedback provided by the teacher and AI tools to understand their mistakes. The figures in the table stand for the following: 1 – strongly disagree, 2 – disagree, 3- neither agree nor disagree, 4 – agree, 5 – strongly agree. The results are displayed in Table 2.

Table 2. Teacher Feedback and AI Feedback Help to Understand the Mistakes

	1	2	3	4	5
Teacher Feedback	0%	0%	17.9%	32.1%	50%
AI feedback	1.8%	7.1%	30.4%	32.1%	28.6%

The responses to the statement "I feel that the feedback from my teacher helps me understand my writing mistakes" and "I feel that the feedback from AI tools helps me understand my writing mistakes" are as follows. The same number of respondents (32.1%) agree with the statement. Half of the respondents (50%) strongly agree that teacher feedback helped them to understand their mistakes while only 28.6% think that AI tools helped them. More respondents (30.4%)

neither agree nor disagree that AI tools helped them while fewer students (17.9%) are not sure about the teacher's help in understanding their mistakes.

Following the question dealing with the teacher and AI help, it was logical to ask how often students refined their papers based on the received feedback from both a teacher and AI tool. Data comparison is displayed in Table 3.

Table 3. Paper revision based on teacher feedback and AI feedback

	Always	Often	Sometimes	Rarely	Never
Teacher Feedback	23.2%	30.4%	37.5%	7.1%	1.8%
AI feedback	16.1%	23.2%	44.6%	12.5%	3.6%

The results show that the students relied more on teacher feedback for revising their papers, though there is a tendency to revise based on AI feedback. The researchers were interested in how effective teacher feedback was in improving writing skills from the students' perspectives. The same question was asked for AI feedback. The results are displayed in Table 4, where 6 stands for extremely effective, 5 - very effective, 4 - moderately effective, 3 - effective, 2 - slightly effective and 1 - not effective at all.

Table 4. Students' Views on the Effectiveness of Teacher Feedback and AI Feedback in Improving Writing Skills

	6	5	4	3	2	1
Teacher Feedback	10.7 %	28.6 %	50%	10. 7%	10. 7%	0%
AI feedback	3.7 %	14.3%	41.1 %	28. 6%	10. 7%	1.8%

The results show that for 10.7% of respondents, teacher feedback was very effective, while only 3.7% considered AI feedback very effective in improving writing skills. A lot more respondents (28.65%) named teacher feedback as very effective, and 14.3% AI feedback. Half of the respondents (50%) named teacher feedback as moderately effective, and 41.1% feedback was received from AI. The same number of respondents (10.7%) named teacher feedback as effective and slightly effective, while more students considered AI feedback as effective (28.6%). Feedback received from AI was slightly effective for 10.7% of the respondents, which equals the results for teacher feedback. None of the respondents thought that the teacher feedback was effective at all, while 1.8% of the respondents considered AI feedback as not effective at all in improving their writing skills. The researchers investigate the role of teacher feedback and AI feedback to motivate students. A Likert scale question was asked where 5 stands for strongly agree, 4 - agree, 3 - neither agree nor disagree, 2 - disagree, and 1 - strongly disagree.

Table 5. Teacher Feedback and AI Feedback Motivation to Improve Writing Skills

	1	2	3	4	5
Teacher Feedback	1.8%	0%	16.1%	39.3%	42.9%
AI feedback	10.7 %	17.9%	35.7%	19.6%	16.1%

Less than half of the respondents (42.9%) strongly agree with the statement that teacher feedback motivated them to improve their writing skills, while quite a few (16.1%) considered AI feedback as motivation. More respondents (39.3%) indicated teacher feedback as motivation compared with AI feedback (19.6%). 16.1% of the respondents are not sure about teacher feedback, while more respondents, 35.7% , indicated it in the case of AI feedback. None of the students disagreed with the statement concerning teacher feedback, but 17.9% of the respondents indicated it in the case of AI feedback. Very few students (1.8%) strongly disagree with the idea that teacher feedback motivated them to improve their writing skills compared with AI feedback where more students (10.7%) stated it as strongly disagree. The researchers were interested in what type of feedback students preferred when revising their writing. The majority of the respondents (55.4%) indicated the combination of teacher feedback and AI, while 30.4% preferred teacher feedback, 10.7% of the respondents showed no preference and only 3.6% indicated AI feedback for revision.

The results of the question in what areas students believed AI feedback would be more useful compared to teacher feedback and vice versa, teacher feedback is more useful than AI feedback, the results are as follows in Table 6.

Table 6. Student's Perspective on the Usefulness of AI Feedback over Teacher Feedback and Teacher Feedback over AI

	AI feedback vs teacher feedback	Teacher feedback vs AI feedback
Content and ideas	44.6%	39.3%
Coherence and structure	17.9%	42.9%
Critical thinking and argumentation	12.5%	58.9%
Creativity	28.6%	44.6%
Grammar	41.1%	41.1%
Punctuation	21.4%	32.1%
Spelling	26.8%	28.6%
Vocabulary	21.4%	28.6%
Writing Style	12.5%	66.1%

Judging from the results obtained, respondents prefer teacher feedback vs AI feedback in almost all components except content and ideas, where it is 44.6% compared with 39.3%. The results are the same (41.1%) when it comes to grammar.

It was interesting how accurate feedback was provided by the teacher and the AI tools from the students' perspective. The obtained responses are displayed in Table 7.   The results obtained from the statement "I believe the feedback from AI tools is fair and unbiased" and "I believe the feedback from teachers is fair and unbiased" is as follows: 46.4% of the participants neither agree nor disagree with the statement that feedback from AI is fair and unbiased, while 25% agrees with the aforementioned idea followed by 23.2% of the participants strongly agreeing with it. 37.5% of the research sample agrees, and 39.3% strongly agree that the feedback from their teacher is fair and unbiased.

Table 7. Students' Views on the Accuracy of Teacher Feedback and AI Feedback

	Teacher feedback	AI feedback
Not accurate at all	1.8%	1.8%
Slightly accurate	0%	5.4%
Moderately Accurate	10.7%	30.4%
Accurate	46.4%	37.5%
Very accurate	32.1%	19.6%
Extremely accurate	8.9%	5.4%

Table 8. Fair and Unbiased Feedback from Teachers and AI

	1	2	3	4	5
Teacher Feedback	3.6%	5.4%	14.3%	37.5%	39.3%
AI feedback	1.8%	3.6%	46.4%	25%	23.2%

The last question was an open-ended question: "What would make feedback more effective for your writing improvement? "The obtained results are varied but mainly provide the learners' preference for detailed feedback that highlights "every aspect of mistakes, including areas that need improvement, such as unclear arguments, weak transitions, or grammatical errors", as mentioned by one of the participants in the open-ended question. According to another participant, "vague feedback like 'this part is unclear" is less helpful than "the argument in the second paragraph is hard to follow because the connection between two points isn't clear". Another participant commented on the importance of giving specific suggestions for their improvement. "For example, if the teacher tells me that I should sound more professional, it would be better if he/she told me how it could be made more professional". Other participants emphasised the importance of timely feedback, providing the following suggestion:" feedback that would be more effective is pointing both, good and bad parts to improve them. Quick feedback also works for me, because I easily remember my mistakes and this helps me to fix them".

Post-Research Questionnaire Results

The post-research survey aimed to obtain information about the students' overall experience and attitudes toward automated feedback after incorporating Brisk feedback in their essays. It also aimed to gain insights into the advantages and limitations, and the learners' readiness to utilize Brisk's automated feedback on their writing in the future. The data showed that for almost half of the respondents (48%), Brisk was easy and convenient to use. The majority of the participants (64%) reported that Brisk helped them revise faster, allowing them to make improvements relatively fast. According to the data obtained, the vast majority of the participants (72%) consider teacher and Brisk AI feedback equally helpful. Almost half of the participants (44%) were also positive and very positive (32%) about using Brisk's automated feedback on their writing. The respondents were asked about their readiness to utilize AI-driven feedback tools such as Brisk in their future writing. The data revealed that the majority (48%) of the participants

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are somewhat ready and 32% are mostly ready to use automated feedback tools like Brisk in their writing, and 20% of respondents are completely ready for this.

The data also showed that the benefit of incorporating Brisk AI feedback in their essay writing process, apart from timely feedback, is giving respondents numerous possibilities to improve their writing as well as thinking (44%). The results also showed that 28% of the respondents feel that Brisk AI feedback helped them understand their strengths and weaknesses in EFL writing. Results also showed that for 12% of the respondents, the biggest benefit of utilising Brisk automated feedback was the improvement of their revision skills, and for the 12%, the best feature of Brisk was immediate and timely feedback.

Table 9. Advantages of Brisk Automated Feedback

Gives numerous possibilities to improve.	44%
Helps understand their strengths and weaknesses.	32%
Develops their revision, and correction skills.	12%
Timely and detailed.	12%

The post-research survey showed that the limitation of incorporating Brisk in EFL essay writing is the lack of human interactions (16%). For 44% of the respondents, AI feedback was somewhat general and lacked personalization (28%).

Table 10. Limitations of Brisk Automated Feedback

Too general	44%
Lacks personalization	28%
Reduces critical thinking	12%
Lack of human interaction	16%

Post-Research Interview Results

To provide evidence-based implications and reliable data obtained from the interviews, the current research applied the most current popular qualitative data management program, NVivo, since it has in-built facilities that allow the researchers to work well with a wide range of qualitative research designs and data analysis methods. Table 11 below shows the content analysis of the interview results reflecting on the respondents' overall experience and perception of incorporating Brisk automated feedback on their essays. They described Brisk AI feedback as personalised (1.47%), quick (0.86%), detailed (0.58%), constructive (0.17%), relevant (0.17%), timely (0.12%), beneficial (0.06%) and accurate (0.03%). They also reported that Brisk feedback was easy to use and efficient (0.23%).

Table 11. Overall Perception of Brisk Google Extension Automated Feedback on EFL Essay

Word	Length	Count.	Weighted percentages
Personalized	12	51	1.47%

Quick	5	30	0.86%
Detailed	8	20	0.58%
Easy	4	14	0.40%
Immediate	9	12	0.35%
Instant	7	9	0.26%
Efficient	9	8	0.23%
Constructive	12	6	0.17%
Relevant	8	6	0.17%
Individual	10	5	0.14%
Timely	6	4	0.12%
Beneficial	10	2	0.06%
Accurate	8	1	0.03%

The data in Table 12 below illustrates the respondents' opinions about the advantages and limitations of Brisk's automated feedback on their EFL essays. According to the data analysed through the NVivo Framework Matrix, the respondents consider that the most effective features of Brisk feedback are constructive and timely grammar and style suggestions, structure recommendations, and specific immediate advice. They reported that instant feedback helped them stay motivated and encouraged them to experiment with different styles and techniques. Brisk feedback helped them understand their weakness better, and it allowed them to develop a more critical eye for their work and fostered their growth as writers. The respondents also mentioned that using Brisk feedback on essays allows them to get real-time opinions about their essays, which saves their time.

According to the analyzed interviews, the limitations of Brisk's automated feedback was the lack of personalized or detailed advice that made it overly generic and could occasionally miss the content or intention behind their writing. Some of the respondents also mentioned that Brisk or any other automated feedback may not always match the user's specific needs or content, leading to potential misunderstanding or misuse.

Table 12. Advantages and Limitations of Brisk Feedback

Advantages	Limitations
● highlights areas for improvement and suggests specific changes;	● overly generic;
● the suggestions kept my creative flow going;	● may not always match the user's specific needs or context, leading to potential misunderstandings or misuse;
● made it easier to incorporate changes right away;	● feedback sometimes seemed too simple, especially for more complicated writing;
● opportunity to understand my writing weaknesses better;	
● immediately provides all thin formation that will help you to improve your writing skills;	● it can sometimes miss the deeper meaning or context of my

● convenient and fast platform enhances my writing skills; ● grammar and style suggestions; ● structure recommendations; ● encouraged me to experiment with different styles and techniques; ● convenient.	writing and give suggestions that aren't always relevant.

Representation of the participants' feedback preferences is displayed in Table 13. The majority of the respondents (5 out of 9) mentioned that they prefer the combination of both. 2 out of 9 respondents prefer using Brisk feedback over teacher feedback, while 2 (out of 9) expressed preference for teacher feedback.

Table 13. Respondents' Preference

Participants	Preference
P1	Combination of both
P2	Combination of both
P3	Teacher feedback
P4	Combination of both
P5	Teacher feedback
P6	A mix of both
P7	Using both
P8	Brisk AI
P9	Brisk AI

Table 14 illustrates the Framework Matrix (NVivo) of the respondents' suggestions for future considerations regarding incorporating automatic feedback tools. The respondents suggest utilizing the combination of both teacher and automated feedback, since the majority of the respondents talked about the less personalized and more general feedback that Brisk provided, they suggested that such balanced feedback practices will provide them with more personalized feedback from both teacher and automated tools.

Table 14. Suggestions for Future Consideration

Participants	Suggestions regarding incorporating Brisk
P1	It would be beneficial if Brisk could incorporate more contextual learning based on individual writing styles and preferences.
P2	Not to completely switch to the use of AI, because this can make us lose our ability to be creative.

P3	- Integrating AI-driven feedback tools with traditional teacher feedback; - More balanced approach to writing improvement.
P4	Incorporating more personalised feedback.
P5	x
P6	It would be better if they offered more personalised options and explanations to help with different writing styles and goals.
P7	More personalised feedback would be helpful.
P8	x
P9	x

Discussion

The current research paper focused on obtaining valuable data about the HEI learners' attitudes, perceptions, and readiness for incorporating automated feedback like Brisk Teaching Google extensions in EFL essay writing. The study showed that the participants had very positive attitudes and were ready to use automated feedback. They found it timely and convenient. It was free and easy to use, allowing learners to receive feedback instantly and make immediate changes. Similarly, the study carried out in Korea aimed to obtain information about the EFL college students' perceptions regarding the use of ChatGPT in editing EFL writing. The results coincide with the findings of the present paper, claiming that using automated feedback is convenient, easy to use, and helpful. Overall, AI driven feedback was perceived as user-friendly (Mun, 2024). The results of the current paper are also in line with the research findings of Rasoul, Aboelwafa, and Seddeek (2023), who aimed to explore learners' attitudes toward Automated Writing Evaluation (AWE). The study incorporated Grammarly. The results showed that the majority of the participants found Grammarly helpful in supporting them in identifying and correcting mistakes. According to the results, students found AWE effective and user-friendly (Rasoul, Aboelwafa, & Seddeek, 2023). The evidence in the research by Huang & Renandya (2018) and Sinha (2021) shows almost similar results and reveals a positive attitude and readiness for applying automated feedback tools in EFL writing.

Another focus of the present research paper was to highlight the advantages and limitations of utilizing Brisk AI-driven feedback in essay writing. The research findings revealed that the advantage of Brisk automated feedback was the function to highlight areas for improvement and suggest specific changes. It allowed learners to understand their strengths and weaknesses in a fast, convenient way that saved their time, allowing them to make instant corrections and develop revision skills as well as writing itself. These results can be supported by the research by Benali (2021), which revealed that the integration of automated feedback tools in writing affects learners' composition skills very positively. Furthermore, the study offered that the best way to incorporate automated feedback is to combine both teacher and automated feedback (Benali, 2021). It is in complete alliance with the results of the current study. Regardless of the advantages that automated feedback tools bring to EFL learners, there are some limitations that the

present research revealed. The findings showed that the challenge of the Brisk Teaching Google extension automated feedback tool was the lack of human communication. This largely coincides with the findings of the study by Yi-hsiu Lai in 2010 which also revealed that one of the limitations of automated feedback was the lack of human interaction, providing the term "dehumanizing instruction" to better illustrate the problem since automated feedback involves social learning (Lai, 2010). Some students also reported that sometimes, if they did not understand the feedback, it could lead to a misunderstanding of the action plan for the future development of their writing. However, this was noticed among the weaker students. In case of low proficiency learners, they reported having difficulty comprehending the messages about errors from automated writing evaluation tools (Woodworth & Barkaoui, 2020).

The findings of the current study revealed that the majority of the research sample expressed a preference for incorporating both teacher and automated feedback in their writings. This is supported by the study by Wong and Han, which revealed that the participants in the AI-driven feedback classroom had higher scores in writing proficiency. The reported advantage of automated feedback was the ability to identify all errors in no time, allowing them to quickly revise their writing, although the teacher feedback was clearer and easier for them to understand. Another benefit of AI-driven feedback was the ability to suggest multiple synonyms, detailed explanations of errors and more specific suggestions for future consideration, whereas the automated feedback could provide all aforementioned, similarly the current research paper also revealed the same attitude towards Brisk Teaching Google extension automated feedback tool. However, since one of the most frequently reported limitations of Brisk AI-driven feedback was the lack of personalization and human interaction, the majority of the current research sample preferred the combination of both teacher and automated writing evaluation tools. These results coincide with research by Wang and Han (2022).

Conclusion

The current research discusses the students' writing experiences, their attitude toward teacher feedback compared with AI feedback, and the effectiveness and accuracy of the mentioned feedback types in improving their writing competence. Students described Brisk as a quick, easy-to-use and convenient automated feedback tool. They believe the feedback they received was relevant, constructive, and convenient. The results revealed that Brisk automated feedback made it easier for the students to incorporate changes into their essays right away and fostered faster improvement in various aspects of their writing in their perception.

As the respondents perceived, Brisk helped them understand their weaknesses better and allowed them to make changes and improvements instantly by providing them with specific suggestions and recommendations. However, there were some limitations of Brisk's automated feedback that students revealed. In the post-research surveys and interviews, they talked about he lack of personalized feedback that sometimes felt too general, or did not necessarily meet the learners' specific essay content and needs. As students reported, it could lead to some potential misunderstandings and misuse. Besides, for some of the students, lack of human interaction was also the limitation of automated feedback. In this regard, some of the participants still preferred teacher feedback over automated feedback on their essays, since they believed teachers could provide them with more personalized feedback, although in the longer time and it would not be as instant as it could be by incorporating Brisk feedback.

Regardless of some limitations as mentioned earlier, some students still opted for automated feedback tools mainly for their ability to provide timely feedback and allow them to make changes on very specific aspects of their writing. Overall, the learners showed very positive attitudes toward the incorporation of Brisk AI-driven feedback and showed complete readiness to use it more frequently in the future. The most optimal feedback approach they showed to believe in is the utilization of both automated feedback and teacher feedback that will accompany the AI feedback.

Research Limitations and Future Considerations

The current study highlights the students' attitudes and readiness for incorporating automated feedback tools like the Brisk Teaching Google extension in HE EFL essay writing. Shortly, the researchers plan to expand the research scope and carry out more long-term studies focusing on obtaining data about the effectiveness and influence of Brisk automated feedback on HEI learners' writing fluency, structure, coherence, or accuracy. The experiment is planned to be conducted with a larger sample size. The future research will use broader methods for obtaining data, for example, triangulation for gathering information to generalise research findings and will also incorporate more types of essays for a longer period, for example, one academic year. Overall, future research will have more validation on a larger scale, with the application of various qualitative and quantitative methods within the experimental study.

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Exploring the Role of Artificial Intelligence in Shaping Students' Social Skills

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Abstract: Technological development and the emergence of artificial intelligence have rapidly reshaped the education sphere by transforming the ways students learn and master new knowledge. The learning process has become more adaptive since learners can effectively leverage artificial intelligence (AI) tools to complete multiple academic tasks without human assistance. However, researchers scrutinize the impact of artificial intelligence on learners' social skills since over-reliance on artificial intelligence assistance can potentially reduce the communication level with students and lecturers, resulting in deteriorated interaction skills. The study investigates the influence of artificial intelligence on students' social and interpersonal development in Georgian higher education institutions. By applying the mixed methodology, the extensive body of literature was analyzed, and the survey was conducted among 133 students from various academic programs and levels in 3 Georgian higher education institutions. The research findings revealed that even though AI-powered tools are valuable for academic processes, students demonstrate awareness of potential risks affecting their social and interpersonal skill development. Therefore, they try to maintain the balance between technological assistance and social interactions in their academic environment. The study concludes that the balanced application of AI in education can enhance students' academic performance without hindering the development of their social skills.

Keywords: Artificial Intelligence (AI), Higher Education, Social Interactions, Social Development, Peer Collaboration

Introduction

The progression of technology has fundamentally reshaped the world by transforming the way students seek information, acquire new knowledge, and master skills. The artificial intelligence (AI) can identify the interrelationship between information and generate clearly articulated texts due to its pre-training with a large-scale dataset. ChatGPT, which OpenAI develops, is one of the AI tools that, due to its complex language processing ability, can fulfill multiple tasks such as responding to questions, translating and summarizing information, writing full texts including relevant punctuation and vocabulary (Miao & Holmes, 2023). Therefore, students harness AI tools for a range of purposes, such as researching information and receiving real-time feedback as a part of a personalized

learning experience (Lin & Chen, 2024). Consequently, the learning environment has become more adaptive and responsive to individual students' needs.

AI garners the interest of researchers due to its multifunctional nature and the ability to engage in human-like conversations. However, over-reliance on technology may entail decreased interactions with peers and lecturers while solving and discussing academic tasks. Therefore, the increased integration of AI tools in education may adversely influence the development of students' social skills due to the lack of social presence, which involves peer interaction and collaboration. Meanwhile, decreased peer communication may gradually turn computer-supported interactions more convenient than in-person exchanges, ultimately impeding interpersonal skill development.

While previous research studies (Banihashem et al., 2024; McGuire et al., 2024) have investigated the positive and negative impacts of AI in education-such as personalized instruction, real-time feedback, and the unethical use of AI-limited research has examined the effects of students' social skill development. Therefore, the study aims to explore the relationship between the regular application of AI-driven tools in Georgian educational settings on students' communication skills. Additionally, the research seeks to evaluate the effects of AI-driven tools on Georgian students' social skills, such as peer interaction and collaboration with lecturers, to identify whether the time students spend interacting offline while completing assignments has changed since AI implementation has grown. By addressing this gap, the research will contribute to the field of education in Georgian higher education institutions and address students' needs with relevant activities which will enhance their social skills development and promote a more human-centered approach to education. Based on the research goals, the researcher has developed the following research questions:

1. What benefits do students identify from using AI tools as systematic learning assistants?
2. How often do students engage in collaborative activities?
3. Do students identify any benefits from using AI tools as systematic learning assistants regarding their communication and social skills?
4. What aspects of AI do students identify as negatively impacting their social skills?
5. Which approaches do students consider effective to keep the balance between AI tools usage and social skills development in education?

Artificial Intelligence in Education

Education is the spheres that is currently experiencing changes encouraged by Artificial Intelligence (AI) development. The AI's impact on the educational system has grown significantly by enabling access to multiple resources and regular student assistance. Students can get learning support at any point, without teacher or lecturer intervention. According to Shireesha and Jeevan (2024)

> Personalized learning, which tailors educational experiences to individual strengths, needs, and learning paces, is increasingly seen as a pathway to more inclusive education. This approach aligns well with the global push for educational equity, ensuring that all learners, regardless of background, ability, or socioeconomic status, have access to effective learning opportunities. (p. 21747)

AI-powered tools address one of the core needs in education, namely, educational adaptability and independent learning. By enabling learners to access information and adapt it according to individual needs, these tools support the key objective of modern, digitized education. For instance, Malik et al. (2023) demonstrate that students actively use AI tools in writing essays. Their findings show that students utilize AI-powered tools to assist them with tasks such as grammar and spelling correction. Moreover, the data indicate that these tools positively influence students' writing skills. Functions such as translation, organization, writing clarity, and structure enhancement are among the features that are identified and effectively leveraged by the research participants. McGuire et al. (2024) present ChatGPT as an AI-powered tool effective in providing individualized feedback and enhancing student learning. However, they express concerns about the ethical implications of integrating AI in pedagogy. Also, despite acknowledging the strengths of AI in improving student learning experiences, they also stress the importance of human knowledge and skills. Another study revealed that students gradually improve their writing skills through AI-driven tools; however, Ozfidan et al. (2024) underline that over-reliance on AI can diminish students' critical thinking skills and creativity. The multifaceted AI system attracts users since it is highly accessible and enables self-directed and self-paced learning. AI integration into the learning practices functions in compliance with a basic principle that learners need, interests, and knowledge level must be adequately addressed, including the tool selection that will enable students to maximize their learning potential. "Artificial Intelligence (AI) has emerged as a transformative force in education, with particular promise in enhancing personalized learning approaches that cater to diverse student needs" (Shireesha & Jeevan, 2024, p. 21748).

AI offers a wide range of tools that support personalized learning, real-time feedback, and consistent access to resources. As a result, the educational settings have become more flexible and learner-oriented. Students can now integrate AI into their individual learning experience, build on prior knowledge, and address their unique learning needs. However, Miao et al. (2024) highlight a range of aspects related to AI, such as the collection and use of personal information, its effect on society, and the role it will take in decision-making processes compared ot that of humans. As a result, it is essential to equip educators and students with both practical and theoretical knowledge concerning the use of AI, including its benefits and potential threats.

The Impact of Social Interactions on Children's Cognitive Growth

The development of social skills is an integral part of education, which has a remarkable impact on the quality of learning and knowledge exchange among students and teachers. Merrell and Gimpel (2014) explain that multiple psychological concepts, such as behaviour, perception, and language, influence the formation of the social skills definition. Furthermore, the authors highlight that diverse disciplines such as psychology, psychiatry, special education, education, and psychiatric nursing also affect the definition, as every discipline has its distinct perspective on social skills, and each sphere suggests its unique definition. However, considering the common attribute of social skills as viewed from different perspectives, they can be defined as the skills individuals use to communicate (Hargie et al., 1994). Thus, social skills refer to a human's ability to interact and communicate with other individuals to build a positive connection. Lev Vygotsky, in his sociocultural theory, concludes that social interaction is an integral part of education, which enables students to shape their knowledge of the world around them. According to Vygotsky (1999)

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In order to express the essence of the forms of the child's behavior characteristic for the earliest stage of development, we must say that the child enters into relations with the situation not directly, but through another person. Thus, we come to the conclusion that the role of speech, which we identified as the basic point in the organization of the practical behavior of the child, is crucial for understanding not only the structure of behavior, but also its genesis: speech stands at the very beginning of development and is its most important and decisive factor. (p. 20)

The behavioural growth of a child is conditional on the integration of speech, the utilization of tools, and the incorporation of a social factor into the learning process (Vygotsky, 1999). Interaction with more experienced and knowledgeable adults or peers is another crucial factor that is a prerequisite to a child's consistent cognitive growth. Social interactions significantly influence students' cognitive development within their Zone of Proximal Development (ZPD). Based on sociocultural theory, Vygotsky (1978) explains ZPD as "the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (p. 33).

Social interactions foster multiple inner processes that result in a child's development and permit teachers to define students' potential areas of development to guide them through the process of learning. As described by Vygotsky (1978), two ten-year-old children took a standardized test to identify their mental development before entering school, and the results showed that their mental development corresponded to that of an eight-year-old child. However, while fulfilling certain tasks under the teacher's assistance, one of the children demonstrated an ability to solve problems that corresponded to a twelve-year-old child's degree of expertise, while the second, a nine-year-old's. This example leads towards a conclusion that, under adult assistance, these children revealed their developmental potential, permitting teachers to nurture their cognitive growth. Therefore, ZPD allows educators to comprehend children's developmental cycles and address their needs.

Social interaction is a key component that is indicative of learners' cognitive development. Through communication, teachers guide students through their ZPD and assist them in achieving their developmental stages. Students form their knowledge and behaviour through multiple interactions, which include social skills enhancement, identification of verbal and non-verbal cues, and knowledge formation. Therefore, the social aspect of education is an inseparable component of learning and development.

AI and Its Potential to Replace Peer Interactions

AI has become an integral part of modern education, with educators and students implementing it in diverse aspects of teaching and learning. The development of social skills is one of the focal aspects of education that delineates students' cognitive development and enhances learning experiences. However, a question arises as to whether AI-supported tools fully encompass the ability to provide relevant educational support, compared to the support students offer one another. Furthermore, it is also questioned whether AI can suggest tools that effectively enhance student interactions and communication throughout the learning process.

Building on this concern, Francesc et al. (2019) investigate how AI can promote student collaboration and suggest that AI can provide collaborative learning practices, particularly when students are not physically present and prefer to choose the time to engage in asynchronous discussions and other group activities. In such cases, AI tools enable continuous student monitoring and inform teachers on student participation and engagement levels revealed during collaborative tasks. However, Lai et al. (2023) highlight the importance of nonverbal communication such as eye contact, smiling, voice tone, and body posture, emphasizing that the absence of nonverbal cues may decrease social interactions. Therefore, in an era where students increasingly rely on AI-powered tools, it is especially important to enhance collaborative learning to support the development of communication skills, which depend greatly on an understanding of non-verbal cues that AI cannot fully provide.

The study conducted by Song et al. (2025) presents experimental results of students' participation in a research proposal writing task. One group collaborated with generative artificial intelligence chatbots (GAI), while the control group engaged in a peer interaction process to complete the same research activity. The implications of the study conducted by the researchers highlight the discrepancy between the dialogues students had with a chatbot and their peers. The dialogue with a chatbot has been found to provide more informative and objective responses, initiating a significantly more consequential communication than that shown with peers. An AI chatbot provided students with the information, considering their prior expertise and comprehension of the issue. Therefore, the interaction with the chatbot was observed to be more efficient in the role of a student assistant due to the scope of information it could provide and the accuracy in identifying the knowledge level and further needs to complete a particular assignment. As a result, Song et al. (2025) argue that AI-generated chatbots are a useful tool for obtaining information and acquiring knowledge; however, peer communication is considered more effective for collecting subjective responses and generating creative ideas-tasks that cannot be fully replaced by AI chatbots. Concurrently, Banihashem et al. (2024) present research findings that highlight a discrepancy between feedback offered by ChatGPT and that of peers, particularly in terms of quality in the context of essay writing. ChatGPT's feedback is primarily characterized as generating broad descriptions, often including a summary of the topic, while peer feedback tends to be more specific, carefully identifying major issues. Therefore, the authors conclude that ChatGPT outperforms students in such tasks as analysing texts and providing extensive feedback, however, students exhibit a better performance in identifying areas needing enhancement and refinement. These results support the conclusion that humans' cognitive skills and the ability to think critically are key to high academic performance.

Considering the evidence base supporting the cooperative functions of AI-powered tools, it can be assumed that these technologies possess multiple features that enable human-like interactions and effective cooperation with learners. While some studies have indicated that AI applications can be detrimental to individual development, particularly by impairing adolescents' social skills, other research highlights that AI has a positive impact on students' academic performance and social integration. Therefore, although over-reliance on AI technology may hinder key aspects of learning, such as communication and positive interpersonal relationships, which are essential for personal growth, the reasonable application of AI tools in the education process holds significant potential. It can foster interactive, self-directed, adaptive learning that can assist students in the learning process without compromising students' social development. Furthermore, it is essential to consider the functions of AI that, in certain circumstances, can enhance learning outcomes. However, there are documented cases in which students outperform AI in providing feedback and

offering one another directions on areas for improvement. As a result, peer interaction remains an indispensable component of both learning and social development.

Method

Research Methodology and Design

The current study employs a mixed-method approach to explore the influence of artificial intelligence on students' social and interpersonal development in Georgian Higher educational Institutions. This methodology was selected to gain a deep understanding of the issue through qualitative and quantitative data.

The research was conducted in two phases:

1. Literature review phase as a qualitative approach comprising a comprehensive analysis of the existing scholarly perspectives on AI implications in education and its effects on social skills development.
2. Empirical research phase as a quantitative approach, applying a survey-based data collection.

Research Tools

The primary research instrument was a structured questionnaire with the application of Google Forms. The survey was applied to provide a comprehensive picture of BA students' experiences and perceptions about the effects of AI usage on their social skills development in Georgian Higher Educational Institutions.

The questionnaire was developed considering the essential topics of literature review and was piloted for validation with a small sample of PhD students and Professors in education, Humanities, and Social Sciences. The pilot feedback was considered to adjust question wording and some options. The survey was administered in English among the students of different faculties providing academic courses in the English language.

The questionnaire consists of 13 questions designed to address the five research questions, including demographic and multiple-choice questions with single and multiple-choice response options, Likert scale items to measure agreement, effectiveness, and frequency levels. One open-ended question was provided to capture the qualitative insight of students' perceptions of AI tools and social interactions.

Sampling

Participants of the study were recruited from 3 different private universities in Georgia. The study utilized a random sampling technique to guarantee the participation of students of various academic programs and study levels. Totally 133 students participated in the survey, and their valid responses were used for analysis.

Ethical Consideration

To adhere to the ethical principles, the research protocol was approved by the Ethics Committee of the International Black Sea University. The participants were informed about the purpose of the study. Participation was voluntary,

and respondents were guaranteed confidentiality and data protection in compliance with Georgian data protection regulations.

Results

A total of 133 individuals participated in the survey, representing all levels of the BA programs. The survey identified participants' year of study to demonstrate the representativeness of the sample and enhance the study's transparency. The sample consisted of 37.6% freshmen, 22.6% sophomores, 20.3% juniors, and 19.5% seniors. Among them, 97.7% of respondents reported being familiar with AI-powered tools, while 2.3% were not. A significant portion of respondents (43.6%) reported using AI tools weekly for educational purposes, while 40.6% reported daily use. A smaller percentage of participants (15%) indicated monthly use, and 0.8% stated that they never use AI in their studies.

How frequently do you use AI-powered tools in your studies?
133 responses

- Daily
- Weekly
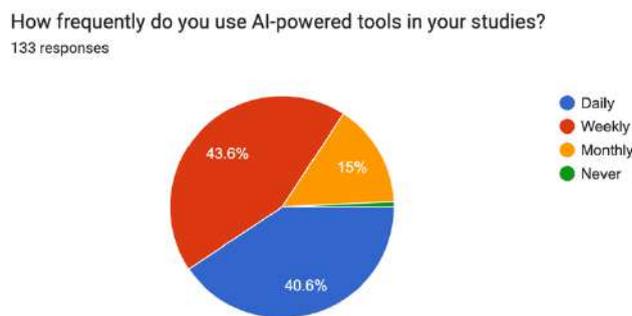- Monthly
- Never

43.6% 15% 40.6%

Figure 1. The frequency of using AI-powered tools for educational purposes

Among the AI functions used for academic purposes, the most reported tool was research assistance (65.4%), followed by personalized learning support (47.4%), writing assistance (42.1%), and content creation (42.1%). 'Other' responses included AI functions such as providing word definitions and fact checking (0.8%), while 0.8% selected "other" without specifying further. The survey data also revealed that the most commonly recognized benefit of using AI educational tools was immediate feedback, as indicated by 69.9% of respondents. This was followed by AI availability (63.9%) and personalized learning (62.4%). A small proportion of respondents (2.3%) selected "other" without specifying any further details, while 0.8% highlighted the AI time-saving nature, flexibility, and free access to it. These findings suggest that Georgian students are increasingly aware of the various ways AI tools can enhance their learning experience.

The study aimed to explore students' engagement in collaborative activities and their preference for communicating with peers and lecturers versus relying on AI chatbots when completing assignments. The study revealed that while 52.6% of students reported weekly engagement in collaborative work, only 12% reported daily engagement. Additionally, 32.3% of participants reported engaging in collaborative learning monthly, while 3% of respondents noted that they never engage in such activities, including group projects or peer discussions. It is important to highlight the fact that even though AI is actively used in the study process, students still engage in collaborative work and interact with their peers while fulfilling academic assignments.
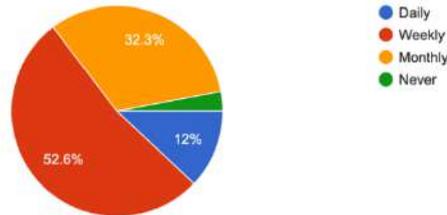
Figure 2. The frequency of student engagement in collaborative activities while completing academic assignments

The research aimed to explore the tendency of students using AI instead of collaborating with peers, and the study has shown that while 21.8% of respondents reported using AI chatbots daily instead of interacting with peers to complete assignments, 20.3% indicated doing so on a monthly basis. A notable difference was observed in weekly usage, with 41.4% of students reporting that they rely on AI chatbots more often compared to peer collaboration. A significantly smaller percentage (16.5%) reported that they never use AI-powered tools as a substitute for peer interaction.
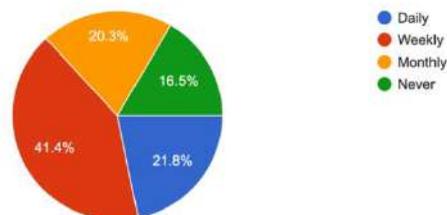

Figure 3. The extent to which AI is used as a substitute for peer interaction during assignment completion

The study also sought to investigate student collaboration with lecturers and the research has revealed a notable proportion of students (35.6%) reporting that they sometimes use AI chatbots instead of seeking support from lecturers, with a slightly lower percentage (34.1%) indicating frequent use of AI chatbots as a substitute for lecturer interaction. Only a small number of participants (12.9%) reported consistently using AI chatbots in place of lecturer communication, while 14.4% noted they rarely rely on AI tools to clarify assignments. Additionally, 3% stated they never use AI for these purposes. The data suggests that students regularly complete tasks that require peer collaboration. However, there is a tendency that shows that students opt for AI-supported guidance instead of interacting with lecturers.

The current study aimed to collect data on the frequency of face-to-face interactions compared to AI usage, and the following research findings were observed: 35.3% of students reported sometimes seeking support from their peers while completing assignments, with 29.3 % indicating frequent interactions with peers. Additionally, 20.3% of respondents noted that their involvement in peer interactions is rare, and the lowest percentage-6.8%, never seeking

support from peers. Only 8.3% of respondents indicated that they regularly engage in peer interactions for assignment completion.
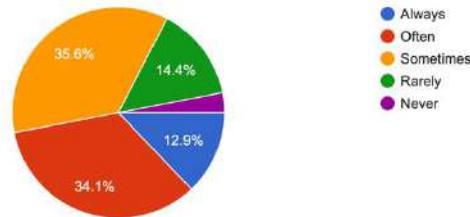

Figure 4. The extent to which AI is used as a substitute for lecturer interaction to seek support.

Considering the main goal of the research, which is to identify the impact of regular AI use on students' social skills, he pie chart illustrates that most participants (46.6%) perceived AI-powered tools as making collaborative learning more effective. A smaller percentage of students (34.6%) noted that AI tools made collaborative learning somewhat effective. Furthermore, 17.3% of students reported that collaborative learning became extremely effective with the use of AI, while only 1.5% of students reported that AI is not very effective in enhancing collaborative learning. It is noteworthy that none of the respondents believed that AI makes collaborative learning completely ineffective. Therefore, AI-assisted learning is viewed as an effective tool not only in supporting the improvement of learning outcomes but also enhancing students' social skills.

Figure 5. The degree to which AI-powered tools made collaboration more effective for students

The study also provided insights into the aspects of communication and social skills that improved through AI-assisted learning, as perceived by students. A considerable percentage of students (54.9%) reported an improved ability to express ideas clearly as one of the benefits of AI-powered tools, while 43.6% believed they had developed a better ability to give constructive feedback. A modest portion of the sample (33.8%) reported increased confidence in collaborating with peers, and 30.1% noted greater classroom engagement. Additionally, 1.5% of respondents mentioned "other" without providing further details.

Identify the aspects of communication and social skills that you believe have improved through AI-powered learning assistants You can select multiple options

133 responses

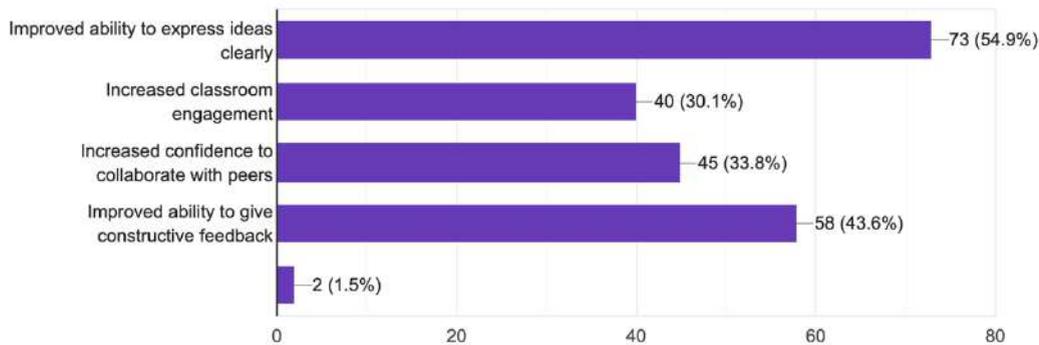Figure 6. The aspects of communication and social skills that have improved through AI-powered learning assistants.

Along with AI benefits, the study aimed to investigate potential negative impacts of AI assistants on students' social skills and the survey results revealed the following distribution: most respondents (54.9%) identified a lack of face-to-face communication as a potential consequence of AI use, while 51.9% believed that over-reliance on technology poses another threat to the development of social skills. A smaller proportion of respondents (29.3%) reported limited development of collaborative skills and decreased understanding of non-verbal communication (24.1%) as negative influences. Only 12% of respondents believed that AI has no negative impact on social skills. The data illustrates that the majority of respondents are aware of potential risks connected with regular AI usage on social skills.

Identify the aspects of AI-powered learning assistants that can negatively impact your social skills You can select multiple options

133 responses
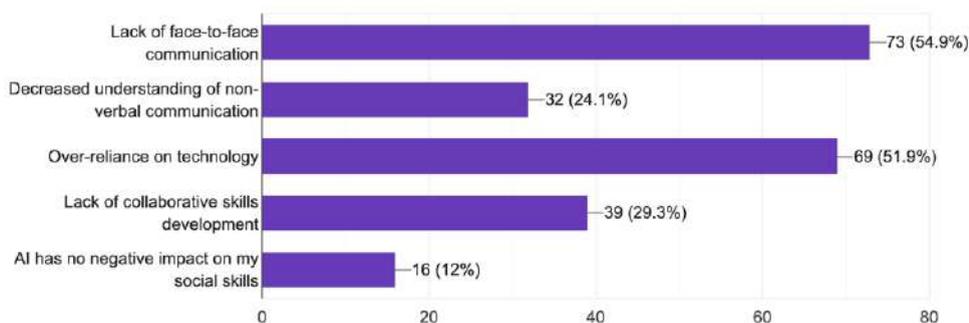
Figure 7. The aspects of AI-powered learning assistants that can negatively impact students' social skills

Finally, the study explored student perceptions regarding the approaches necessary to maintain a balance between AI usage and the development of social skills through in-person interactions. The largest portion of the sample (59.4%) viewed hybrid assignments with both AI assistance and peer collaboration as key to achieving a balance between

digital support and real-life engagement. Furthermore, 38.3% of respondents highlighted the importance of courses that teach effective AI application alongside teamwork skills. Meanwhile, 24.8% believed that limiting the time allocated for AI use in certain assignments is beneficial to preserve a healthy balance between digital tools and face-to-face interaction. The smallest percentage of respondents supported the idea of using AI in group projects as shared resources. Overall, the study offers valuable insights into key trends related to the impact of AI assistants on BA students' social skills, as well as students' perceptions of the main benefits and potential risks associated with regular AI use in the process of learning.

Discussion

The data suggests widespread awareness of and use of AI for academic purposes. The results demonstrate that students view AI as a valuable tool to support them while searching for information and provide them with personalized learning experiences, writing assistance, and content creation. Therefore, regular availability, immediate feedback provision, and personalized learning were selected by a significant portion of respondents as the core benefits of AI. The pattern observed suggests that students value the ability to receive academic support at a convenient time for them, and feedback, which builds on their specific needs and provides information that will supplement and strengthen their current knowledge.

The research aimed to study the tendency of collaborative activities in the era of AI as a source to develop social skills, which are an integral component of human development. The findings imply that most of the respondents regularly engage in collaborative activities with their peers to complete assignments. However, the findings also illustrate that AI chatbots are implemented regularly as a substitute for peer and lecturer interactions. Thus, this trend reflects a growing reliance on AI-supported instruction and knowledge provision. Another possible explanation of systematic AI utilization can be the convenience of AI as a digital instructor due to lowered stress and pressure levels as compared to face-to-face, classroom interactions.

Another topic that the study aimed to explore was whether AI tools have a positive impact on students' social skills. The findings indicate that AI made learning more effective according to most participants, and the effectiveness is reflected in such communication skills as increased ability to express ideas clearly, give constructive feedback, higher confidence to collaborate with peers, and increased classroom engagement. It is plausible to assume that students' improved communication skills are the result of AI providing objective, coherent, and unambiguous data, while regular exposure to it helps students to formulate their knowledge and assumptions coherently, as well as provide constructive feedback. Therefore, there is a high probability that increased communication ability results in refined overall social skills.

However, the research also aimed to investigate the adverse impacts of AI on students' social skills, and the most frequently reported factors as negatively influencing interactions were a lack of face-to-face communication and over-reliance on AI. Among other negative impacts, a smaller percentage of participants consider the lack of non-verbal cues and limited development of social skills. Therefore, it was essential for the researchers to explore which approaches can support students in keeping a balance between AI tool usage and social skills development. As

reported by the majority of respondents, a hybrid approach with AI assistance and peer collaboration is viewed as the most effective. Meanwhile, other students considered a training course that aims to master learners' skills in using AI and effectively participate in teamwork activities.

Conclusion

The outcomes of this research confirm Georgian BA students' awareness of AI-powered chatbots and their perceived value in supporting the learning process. The study contributes to a deeper understanding of how students engage with AI and identifies in which aspects of learning they consider AI support most relevant. It has become evident that students regard AI as a multifaceted tool that is effective in information retrieval, providing a personalized learning experience, and offering immediate feedback. These features are viewed to make the education process more adaptive than what is typically possible within traditional classroom environments, contributing to a more learner-oriented and flexible educational experience. The research data also indicates that students regularly engage in collaborative activities, such as group projects and peer discussions, to complete assignments. Taken together, the results imply that students participate in face-to-face activities, complementing their learning with personalized support. However, the data also reflects that a large number of students prefer using AI tools over interacting with peers when completing assignments. This may be attributed to a perception that AI offers more objective responses and enables quicker access to information compared to peer interaction. Currently, Georgia is undergoing significant AI-driven transformations in the field of education. AI-supported tools are gradually shifting modes of interaction, and hence, lecturers must be prepared to guide students using appropriate teaching techniques, ensuring that AI integration promotes collaboration and communication among learners. AI literacy training for educators can provide a valuable experience for lecturers to learn how to integrate AI strategies effectively and promote students' social skill development. This will enable a balanced approach to virtual activities without undermining peer interactions. Therefore, there is a greater need for refined pedagogical strategies to enhance students' social engagement and equip lecturers with practical skills and knowledge to effectively integrate collaborative AI tools that can promote social interactions.

Recommendations

To address these findings, it is advisable to implement hybrid models of education that not only regulate the time allocated to peer collaboration and AI-assisted task completion but also integrate AI tools designed to foster the enhancement of students' social skills through digital platforms. Accordingly, efforts should be made to enhance lecturers' and students' awareness of such tools and how they can be effectively utilized within academic frameworks. This approach may mitigate potential risks related to the deterioration of students' social skills resulting from excessive implementation of technologies.

While the data suggests that AI can improve communication skills-such as the ability to express ideas, provide feedback, increase engagement and confidence in peer collaboration, and enhance the overall collaborative learning experience-further studies are recommended to validate students' experiences and to identify specific factors that contribute to social skills enhancement through AI-assisted learning, as well as the particular benefits of AI in collaborative learning contexts. This will enable educators to professionally integrate AI tools to address students'

academic and social needs.

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Artificial Intelligence in German Robo-Advisory: A Qualitative Examination of Adoption and Future Prospects

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Abstract: This qualitative study explores the current and prospective use of artificial intelligence (AI) by robo-advisory (RA) services in Germany, a market that is expected to reach EUR 20 billion in assets under management by 2025. Based on a sample of 45 RA providers invited to participate, the research collected responses from 10 of these organizations. Data collection also included in-depth interviews with the chief executive officers of two selected providers, allowing for the exploration of rich, qualitative insights into the drivers, challenges and expected developments in AI adoption in this field. All data collected was subjected to a thorough qualitative content analysis to identify common themes and significant patterns. A SWOT analysis was then conducted to highlight the strengths, weaknesses, opportunities and threats associated with AI-driven RA services. The findings show that a small number of the RA services in the sample currently use AI, with a few considering its future implementation. However, issues such as regulatory compliance, data privacy concerns and the cost of implementing AI may hinder wider adoption. In addition, the shortage of skilled AI professionals is an additional barrier for some providers. Based on these findings, the study offers practical recommendations, including investing in employee training to mitigate the talent gap, adopting robust governance frameworks to ensure regulatory compliance, and fostering collaboration with technology partners to streamline implementation processes. The paper concludes by outlining avenues for future research, such as investigating the long-term impact of AI-driven services on investor outcomes and exploring the ethical implications of AI-mediated financial advice. The study explores the potential of AI in digital wealth management, providing insights to help stakeholders harness its benefits while addressing challenges to ensure strategic adoption in an evolving RA landscape.

Keywords: Robo-Advisory, Robo-Advice, Artificial Intelligence, Wealth Management, FinTech

Introduction

Robo-advisors (RAs) have grown rapidly in popularity over the past decade, becoming a disruptive force in wealth management. By providing accessible, easy-to-use digital platforms that automate portfolio construction and ongoing management, RAs have arguably lowered the barriers to entry for a wide range of investors, particularly those with smaller capital bases or limited financial literacy (Iannarone, 2018; Jung et al., 2018, 2019; Sironi, 2016). Robo-advisors automate the investment advice and portfolio management of client funds, where investors undergo an assessment, known as the investor profiling process, by completing a questionnaire and creating an investor profile

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with characteristics of risk preference, investment horizon and other needs to then receive portfolio recommendations – usually consisting of allocations of exchange-traded funds (ETFs) – which are then dynamically managed by the RA on an ongoing basis (Jung et al., 2019; Tahvildari, 2025b). The rise of robo- advisory (RA) has been catalysed by several factors: widespread internet penetration, a pronounced shift towards digital solutions, cost-consciousness in the wake of the 2008 financial crisis, and the growing comfort of younger generations with technology-enabled financial tools (D'Acunto et al., 2019; Ferri, 2014; Phoon & Koh, 2018; Renaux et al., 2019; Wang & Nguyen, 2015). As a result, the global RA market has seen significant expansion, driving innovation in the way investment advice is delivered and how portfolios are constructed, monitored and rebalanced. The global RA market is expected to reach approximately USD 2 trillion in terms of assets under management (AuM) by 2025 (Statista, 2025). Despite the operational efficiencies and convenience offered by RAs, competition within the segment has intensified. Numerous providers are now competing on fee structures, ease of use and brand differentiation - all while striving to maintain appropriate regulatory compliance and risk management protocols. In Germany, the RA scene is particularly fragmented, with a variety of different investor profile profiling processes and increasingly complex algorithms and portfolio customisation (Tahvildari, 2025b). In addition to the different methodologies used by RAs, there are also significant performance differences between them, with RAs underperforming on average but also having significant potential for improvement (Tahvildari, 2025a). The adoption of artificial intelligence (AI) may offer a potential solution to this challenge.

Amid technical and regulatory challenges, AI is increasingly seen as a potential game-changer in the wealth management and financial advisory sectors (Tahvildari, 2025c). While many RAs rely on basic algorithms - often simple rule-based systems or questionnaire-driven risk profiles (Blaschke & Kriebel, 2021; Faloon & Scherer, 2017; Oehler & Horn, 2024; Scherer & Lehner, 2022; So, 2021; Tertilt & Scholz, 2018) - AI offers a more sophisticated toolkit (Tahvildari, 2025c). Techniques such as machine learning, neural networks and advanced data analytics can scan vast amounts of information to refine portfolio decisions, forecast market trends and even personalise investor interactions. The promise of AI-driven investment solutions is multifaceted: more accurate risk management, more timely portfolio adjustments, and deeper personalisation. In addition, advanced natural language processing capabilities could revolutionise client interactions by providing personalised, on-demand customer service and educational support (Mirete-Ferrer et al., 2022; Shen et al., 2025; Tahvildari, 2025c). Given this potential, actual adoption rates appear to lag behind the hype. Many RAs in Germany are still in the early stages of integrating or even exploring AI, citing regulatory hurdles, cultural preferences and the perceived high cost of research and development.

One stimulus for this investigation stems from (Tahvildari, 2025c), who provides a systematic literature review of generative AI in financial advice. This work highlights how large language models (e.g., ChatGPT) can both exploit structured data and interpret unstructured market sentiment, thereby refining portfolio recommendations. However, Tahvildari also describes ethical, regulatory and psychological barriers, including algorithmic bias and user distrust. Furthermore, the necessity of explainable AI (XAI) and hybrid supervisory models is highlighted to mitigate black box risks. By integrating these findings, the present study examines whether and how German robo-advisors have taken steps to incorporate advanced AI systems, thus addressing the research gap on sustainable and user-centric AI deployment. In doing so, it builds on Tahvildari's call for AI governance that promotes transparent solutions and informed trust. In this evolving context, the present study aims to explore the extent and nature of AI use among

German RA providers. Specifically, the research aims to answer key questions about the extent of actual AI implementation - beyond simple chatbots - and the drivers or barriers that shape these decisions. To this end, the research adopts a mixed approach, firstly drawing on a quantitative examination of 45 identified RAs to assess which are using AI in any meaningful way. This screening provides an empirical foundation that clarifies whether advanced AI systems (e.g., automated portfolio rebalancing, predictive market analytics, sophisticated ESG screening) are actually present in the day-to-day operations of these firms. The research then delves deeper using qualitative methods, including semi-structured interviews with chief executive officers (CEOs) of selected providers. These conversations provide rich, contextualised insights into the attitudes, expectations and reservations surrounding the adoption of AI.

Several overlapping motivations underpin this research. The first is the apparent gap between the pervasive media discourse - often touting AI as the next revolution in finance - and the relatively modest actual usage patterns uncovered in preliminary research. While a handful of providers appear to be using true machine learning techniques, many are using simpler forms of automation that still rely heavily on manual oversight. Second, the academic literature on robo-advice has grown, but the specific dimension of AI adoption remains underexplored (Tahvildari, 2025c). Studies often analyse the pros and cons of robo-advice or focus on consumer uptake, but few look at how providers themselves integrate complex algorithms. Thirdly, policymakers, market participants, and prospective investors all stand to benefit from a clearer understanding of what "AI in robo-advisory" truly means. If automated solutions are to evolve beyond basic digital tools, it is crucial to explore the conditions for such progress. Against this backdrop, the research contributes to the body of knowledge by presenting fresh empirical data on AI adoption levels and the strategic thinking of industry leaders. By combining broad market analysis with in-depth qualitative insights, the study sheds light on the drivers and constraints that characterise AI adoption. It also situates these findings within the broader literature on fintech innovation, highlighting how cultural, regulatory and technological variables can significantly shape strategic decisions. In closing, the paper argues that while AI has the potential to further democratise finance and improve the overall investor experience, its real- world impact will depend on aligning cutting-edge technology with the specific requirements of a unique and often conservative marketplace.

In the following sections, the paper first presents the methodology used for both the quantitative and qualitative components. The subsequent findings and discussion shed light on the extent of AI adoption, the reasons behind cautious approaches, and the lessons gleaned from providers who have taken pioneering steps. Finally, the study concludes with practical recommendations, areas for future research and reflections on how AI might shape the next generation of robo-advisory.

Method

Sample

Tahvildari (2025b) showed in an analysis that the fragmented German market consisted of 45 active robo-advisors in July 2024. All 45 RAs are included in the sample to obtain the largest possible sample for the analysis. The RAs are: Mintos, Fidelity, ONVEST, Dr. Lux & Präuner Vermögensverwaltung, BW-Bank ON, growney, Minveo, Estably, peningar, easyInvesto, Triodos Impact Portfolio Manager, my-si, Solidvest, quirion, Zeedin, Gerd Kommer Invest, Liqid, LAIC ADVISOR, digiVestor, INNO INVEST, bevestor, cominvest, Oskar, easyfolio, VisualVest, Smavesto,

inyova, Raisin Invest, Whitebox, ROBIN, investify, Warburg Navigator, Revolut, MONVISO, fintego, GLS onlineInvest, truevest, vividam, ginmon, Scalable Capital, Digital Invest Assets, Evergreen, Financery, Openbank, Peaks.

Data Collection Methods

Qualitative Interview Guide

The first data collection method for this analysis is the qualitative guided interview. For this purpose, an interview guide is designed (DiCicco-Bloom & Crabtree, 2006; Kallio et al., 2016). On 18 August 2024, the interview questions were emailed to all 45 RAs in the sample. The interview guide is designed to facilitate an exploratory qualitative analysis of the role of AI in the German robo-advisory market. The 15 open-ended questions aim to capture a wide range of insights from RA executives, ensuring that the responses provide a comprehensive understanding of both the current and future use of AI in the sector. The questions are divided into thematic sections, beginning with an introduction to the respondents' roles and the positioning of their robo-advisory services. Subsequent questions explore the market environment, competitive landscape and key trends shaping the industry. A key focus is on the application of AI, with specific questions addressing existing and potential AI- driven innovations, including generative AI, personalisation and sustainability advances. Regulatory and technical challenges are also addressed to ensure a holistic view of the barriers to AI adoption. In addition, the questionnaire explores the impact of AI on customer satisfaction, data protection and the long-term outlook for the industry. The final question invites respondents to highlight any overlooked aspects, allowing for further in-depth analysis. By structuring the interview guide in this way, the study aims to extract as much valuable qualitative data as possible from RAs, allowing for a differentiated examination of the role of AI in their business models.

The interview questions are

Introduction and background: Can you please describe your position and area of responsibility within your company? What is the focus of the robo-advisor you work for, and how does it differ from other providers on the market?

Market overview: How would you describe the current state and development of the robo-advisory market in Germany? What specific trends do you see in this area?

Competitive landscape: What factors do you consider crucial to successfully positioning yourself in the German robo-advisory market? What challenges do you see in terms of competition?

Opportunities and risks: What opportunities and risks do you see for the future of robo-advisory, especially in the context of changing customer requirements and technological developments?

Technological developments: How do you see the impact of digitalisation on asset management in general and on robo-advisory in particular? Which technological developments do you consider particularly promising?

Use of artificial intelligence: To what extent does AI already play a role in your robo-advisory offering? Which specific AI technologies do you use or plan to use?

Generative AI in robo-advisory: What opportunities do you see for the use of generative AI in robo- advisory? In which areas do you think this technology could offer the greatest added value?

Personalisation and AI: How important is the personalisation of investment recommendations in robo- advisory, and how can AI help to improve this personalisation?

Sustainability and ESG criteria: How do you take sustainability and ESG criteria into account in your robo-advisory? Do you see potential for AI to play a supporting role in this area?

Regulatory challenges: What regulatory hurdles do you currently see for the use of AI in robo-advisory? How do you deal with these challenges, and what adjustments do you think are necessary?

Data protection and security: How do you address data protection and security challenges in connection with the use of AI in your robo-advisory? What measures do you consider essential?

Technical hurdles: What technical challenges do you face when using AI in robo-advisory, and how do you deal with them? Are there certain areas where the technology is not yet mature enough?

Customer satisfaction and loyalty: What role does AI play in increasing customer satisfaction and loyalty? Do you have specific strategies for making AI-based services more attractive to your customers?

Future vision: Where do you see the future of the robo-advisory market in the next five to ten years? What role do you think AI will play in this development?

Final question: Are there any aspects of the use of AI in robo-advisory that we have not yet addressed but that you consider particularly important? What future prospects do you see that we may not have considered sufficiently?

Website Research

The second data collection method used in this study is an analysis of the websites of all 45 RA providers as of February 2025 to gather information on the application of AI. Each publicly accessible website is manually investigated in detail to identify any evidence of the use of AI. In particular, the research focuses on assessing the methods used and screening for explicit references to the implementation of AI. If AI is employed, this information is systematically recorded in a binary format (AI use: yes/no) in a structured list. In addition, where available, qualitative details of the specific ways in which AI is integrated into RA services are documented. Website analysis has already been carried out by Tahvildari (2025b) in a similar approach for the investigation of the profiling processes and portfolio recommendations of RAs in Germany. This approach ensures a comprehensive assessment of the use of AI based on publicly available information from RA providers' websites.

Descriptive Analysis Method

Descriptive Analysis Method

In this approach, each RA website is examined to determine whether AI is used. This method uses a descriptive analysis that focuses on identifying and easily assessing the details of AI implementation. Each provider is then presented and described in terms of how AI is integrated into areas such as portfolio management or client communication. Observations are recorded in a structured list that captures both binary indicators of AI usage and qualitative notes. This process highlights the different approaches to AI among the RAs, providing insights into their individual strategies and how they are using technology to improve their services and performance.

Qualitative Content Analysis Method

In the systematic analysis of the two interviews, Mayring's qualitative content analysis method is employed to ensure a systematic and reproducible approach to textual data (Mayring, 2015). The transcripts are examined thoroughly to gain familiarity with recurring statements and themes associated with AI usage in robo-advisory. Initial thematic categories are defined in alignment with the research questions and refined through iterative reading. By means of constant comparison, each statement is assigned to a relevant category to allow a transparent condensation of the data. Coded segments are then interpreted for broader patterns and potential inconsistencies. This rigorous procedure preserves contextual detail as well as focusing on emergent insights, thereby enhancing both validity and credibility of the findings. Finally, results are synthesised to highlight key themes relevant to the study's aims.

Results

Adoption of AI in Robo-Advisory

Of the 45 RAs contacted, 11 (24.4%) responded, but only 6 (13.3%) of these provided an answer regarding the use of AI. Only one RA said they used AI, which was also confirmed by the website analysis. Interviews were conducted with two RAs using the interview guide with the respective CEOs, although they do not yet use AI. The results of the content analysis of the interviews are presented in the next subsection. The remaining RAs did not agree to be interviewed. In addition to the initial feedback with some information, the in-depth website analysis of the respective RA service providers for the use of AI in the robo-advisory process revealed that only 5 out of 45 (11.1%) of the RAs use AI. The results of the analysis of the use of AI technologies by these five RAs are presented below.

Quirion uses a chatbot called "Q.Ai", and calls it an AI investment advisor. It is a chatbot that is available 24/7 for customers and prospects and answers all questions related to their investments, with a focus on defining financial goals and showing how to achieve them efficiently. It is not an AI that is used in the profiling, portfolio recommendation or portfolio management process. Rather, it is a knowledge chatbot for investment.

Since 2017, Minveo has relied on a multidimensional system of specialised artificial intelligences that monitor each other and capture complex relationships in order to improve the quality of forecasts. Each of the over 900 positions is controlled with a specially trained evaluation metric that is continuously adjusted. Around 2 terabytes of market data are analysed every day using big data in order to efficiently extract relevant information. In addition, a neural network uses adaptive algorithms that continuously optimise and adjust their decision heuristics, emotionlessly and purely data-driven.

The LAIC ADVISOR uses AI to analyse big data very quickly and to optimise portfolios continuously. It keeps downside risks and volatility within defined limits and suggests targeted shifts to the asset manager to ensure stable performance. In contrast to traditional RAs, LAIC uses an adaptive system based on big data that filters around 10,000 actively managed funds and 400 ETFs. A scoring process and active risk management are used to continuously adjust the portfolio to market conditions. Rebalancing is carried out automatically, though a team of experts, including financial mathematicians, monitors the whole portfolio management process.

Since its launch in 2019, Smavesto has been innovating the investment landscape by leveraging AI to monitor markets and automatically respond to opportunities and risks. This AI-driven approach enables a cost-effective and professional wealth management solution through ETF-based investments. In August 2024, Smavesto enhanced its AI algorithms, improving their ability to process large amounts of data and respond quickly to market changes, resulting in more accurate investment decisions. The AI system integrates several advanced models to optimise portfolio management. The Hidden Markov Model (HMM) analyses historical market data to determine whether the market is in a bullish or bearish phase, helping to time buy and sell decisions effectively. The Long Short-Term Memory (LSTM) model processes time series data, trading volumes and even news articles to predict future market performance by identifying patterns and filtering out irrelevant information. In addition, eXtreme Gradient Boosting (XGBoost), a powerful machine learning algorithm, refines these predictions by classifying trends and analysing key market indicators. By combining these advanced AI techniques, Smavesto provides investors with deep market insights and forecasts.

The RA VisualVest uses AI in the form of "Malina" (Machine Learning for Investment Applications), which was developed by parent company Union Investment. Malina analyses investment-related data in the global ETF portfolios, known as VestFolios, and makes market forecasts. Among other things, she calculates the probability of equity funds outperforming commodity funds over the next six months. To do this, the AI processes a wide range of relevant data, including exchange rate movements, inflation expectations, the yield curve and commodity prices, and combines these intelligently with historical developments. Malina's forecasts help the portfolio management team to dynamically adjust portfolio weightings in response to market developments. However, the final decision is always made by a human investment committee, which supplements the AI signals with fundamental analysis. This combination of AI-supported models and human expertise enables an optimised, data- driven investment strategy that can react flexibly to market changes.

Interview Analyses

Interview 1

This analysis focuses on the core findings from an extended interview with a CEO (hereafter referred to as the "interviewee") of a leading German RA. Drawing on a structured approach derived from qualitative content analysis, the following sections are organised into thematic categories that represent prominent areas of discourse:
(I) the current state of robo-advisory in Germany, (II) sustainability (ESG/impact), (III) artificial intelligence (AI) and technological innovations, (IV) costs and investor behaviour, (V) regulations and policy, and (VI) future outlook. These categories have been derived from repeated engagement with the text, paying particular attention to recurring motifs, explicit statements, and deeper contextual cues.

Current state of robo-advisory in Germany: One of the interview's central revelations is the interviewee's perception that the German RA market, which initially enjoyed significant publicity and a rapid influx of venture capital, has now entered a more muted period. In its early stages, RA was regarded as a technologically advanced means of automating certain aspects of wealth management, enabling prospective investors—particularly those with smaller initial capital—to access portfolio allocation services that had previously been reserved for high-net- worth individuals.

However, the interviewee reports that the explosive growth projected several years ago has not materialised to the degree anticipated. A number of providers have either reduced marketing budgets or refocused their business models towards more profitable areas. Additionally, while some early adopters of digital wealth management remain loyal, many potential clients either lack the inclination to invest regularly in capital markets or remain unconvinced by automated tools. This perceived scepticism is exacerbated by market volatility and broader global uncertainties, which appear to leave some customers questioning the stability of automated strategies. According to the interviewee, the real value of RA lies in democratising finance, granting smaller portfolios access to professional-level management and processes. In their view, even though many Germans retain a conservative attitude to money, systems that allow minimal starting amounts (e.g., €500 or monthly contributions of €50–€100) can be a game-changer in terms of fostering consistent saving habits. Nonetheless, the combination of lukewarm brand visibility, intense competition from low-cost solutions, and the German public's tendency to panic when markets fall has stalled widespread adoption. At the same time, the interviewee emphasises that "robo" is, in many cases, a misnomer. Rather than an all-powerful algorithm choosing stocks in real time, many services merely automate front-end processes—such as digital onboarding, risk profiling, and client support—while following fairly standard (and at times manually managed) asset allocation models. This fundamental mismatch between the initial hype around RA ("robots are picking your portfolio!") and the more modest reality has further contributed to a sense of stagnation.

Sustainability (ESG/Impact): An especially distinctive feature of the interviewee's firm is its exclusive focus on sustainable investing. Instead of offering a conventional or passive approach, they prioritise actively managed funds that align with themes like renewable energy, education, healthcare, and water. Their reasoning is that robust sustainability criteria demand both thorough screening and proactive engagement with investee companies, rather than simply excluding overtly harmful sectors. Despite the widespread popularity of "ESG" terminology, the interviewee contends that truly impactful sustainable funds remain limited. Even though a large number of market participants claim to implement environmental, social, and governance considerations, the interviewee regards many of these offers as inadequate for serious impact. Merely labelling an exchange-traded fund (ETF) "ESG" does not necessarily guarantee meaningful change if the underlying index is heavily weighted towards tech giants or other firms whose credentials may be questionable. The interviewee acknowledges that client interest in sustainability has, paradoxically, waned amid global geopolitical and economic shifts. For example, some individuals have become drawn to sudden trading trends in cryptocurrencies or "meme stocks," overshadowing the more gradual returns of sustainable portfolios. Nonetheless, the speaker views long-term investment in solutions that actively address climate, social injustice, and resource scarcity as not only beneficial for society but also prudent for an investor's future. Yet, persuading customers to abandon short-term speculation in favour of consistent, impact-driven investments remains a persistent challenge. Ultimately, the interviewee's firm elects to concentrate on fewer, carefully vetted impact funds rather than chase the widest possible range of ESG-labelled products. They emphasise that if sustainable investing is to be undertaken seriously, it requires a combination of detailed research, active voting policies, and ongoing dialogue with companies. In their eyes, the tension between genuine impact and mainstream "greenwashing" remains one of the most salient issues in the current market.

Artificial intelligence (AI) and technological innovations: Although RA is technologically enabled, the interviewee expresses doubt regarding the efficacy of artificial intelligence—particularly "generative AI"—in standard investment

processes. While acknowledging that technology has enormous potential for certain analytical tasks (e.g., scanning thousands of documents or satellite imagery to detect environmental violations), the interviewee is wary of marketing hype. They underscore that many organisations apply the term "AI" to basic data queries or automated systems that do not truly qualify as self-learning or predictive algorithms. In areas such as on-the-ground sustainability analysis, AI could help gather real-time data on a company's carbon footprint or spot methane leaks from orbit. This sort of intelligence might feed into the deeper evaluation of which equities or bonds to include in a fund. However, for the portfolio construction itself, the interviewee insists that fundamental uncertainties—especially unforeseen geopolitical or macroeconomic events—are not readily "predictable" by any machine. Furthermore, they caution against delegating risk-control decisions to opaque AI systems. If a large- scale algorithm triggered a mass sell-off in a niche ETF or bond instrument, the subsequent market movements might be magnified in ways neither the AI nor human supervisors fully understand. From a regulatory perspective, such scenarios could invite scrutiny regarding potential market manipulation or systemic risk. Despite these reservations, the interviewee believes that ongoing research and targeted AI-driven tools will likely gain traction in peripheral services, such as personalised customer service interfaces or advanced data aggregation. What the interviewee dismisses is the notion that general-purpose AI, as currently advertised, can consistently outperform simpler heuristic or human-in-the-loop strategies over the long term.

Costs and investor behaviour: A recurring theme throughout the interview concerns the cost sensitivity of German investors. According to the interviewee, many clients exhibit a "Geiz ist geil" (roughly, "cheapskates' rule!") mentality, preferring investment solutions with the lowest possible fees. Consequently, exchange-traded funds have experienced considerable growth. The interviewee concedes that ETFs can be extremely useful for broad diversification; however, they argue that excessive fee fixation may lead investors to overlook crucial elements such as engagement policies, active stewardship, or the precise composition of an index. In parallel, the interviewee describes a curious paradox. While some investors maintain a seemingly conservative stance— preferring savings accounts or risk-averse mutual funds—others leap into high-risk opportunities such as speculative cryptocurrencies, meme-driven equities, or highly leveraged contracts. This behaviour suggests that the dividing line is not strictly a matter of age or investment knowledge but rather the power of hype and psychological influence in driving decisions. Moreover, the interviewee believes that many clients do not thoroughly understand the difference between a genuinely active fund and one that tracks a narrow ESG benchmark. If individuals purchase a popular sustainability-branded ETF, they may assume that this product exerts pressure on companies to behave more responsibly, without realising that such passive vehicles rarely engage in direct shareholder activism. In the interviewee's experience, German investors often need more education about the underlying processes of capital markets, which could help them weigh the true costs and benefits of different strategies. The cost-versus-quality debate also emerges in the interplay between robo- providers and human advisers. Digital platforms, by automating repetitive tasks, can certainly lower overheads and pass the savings on to clients. Yet, the interviewee emphasises that for truly personal guidance or complex queries—especially in the realm of sustainable and impact investing—an individual adviser's expertise still proves valuable. Whether investors are willing to pay extra for hands-on advice, however, remains an open question.

Regulations and policy: Another important focus of the interview pertains to regulatory inconsistencies in financial services. The interviewee asserts that their RA firm adheres to comprehensive rules set by financial authorities, including transparent fee structures and accountability for investment performance. In contrast, unlicensed

"Finfluencers" on social media platforms can freely recommend risky financial products or questionable schemes without facing the same rigorous oversight or potential liability. From the interviewee's perspective, customers deserve protection from misleading endorsements and unsubstantiated advice. The expansion of RAs has made investing more accessible, but it has also created new forms of vulnerability. Those who lack financial literacy may be influenced by viral trends or social-media-driven hype, only to discover that they have invested in unsound products. Additionally, the interviewee notes that large-scale algorithmic trading, which might occur if certain RAs were to manage very substantial assets via AI, could prompt regulatory intervention. If the automatic rebalancing of a prominent RA happened to coincide with a broader market event, the feedback loops might amplify volatility. The overarching lesson is that straightforward digitalisation or algorithmic sophistication does not eliminate systemic risks. Rather, it creates new areas where policy-makers and regulators must remain vigilant.

Future outlook: Looking ahead, the interviewee anticipates that RA in Germany will likely evolve in tandem with shifts in demographics, technological advancements, and global economic developments. One plausible scenario is that younger generations, accustomed to digital interfaces, will become more comfortable with automated wealth management services. Over the next five to ten years, these younger clients will also inherit larger sums of capital, possibly increasing the demand for user-friendly, transparent platforms. Yet, the interviewee does not predict an entirely AI-driven or fully automated future. They maintain that genuine human insight remains indispensable, particularly when making judgement calls about which investments are authentically sustainable. Active stewardship—exercising shareholder voting rights, engaging with company management, and pressing for environmental improvements—is difficult to replicate via formulaic   algorithms.

Nor is it readily replaced by "generative AI" that lacks domain-specific ethical or impact-conscious objectives. Another critical determinant of progress is investor education. Although digital solutions can increase access to financial products, they do not inherently teach individuals how to handle market downturns or how to consider non-monetary dimensions like climate change. The interviewee thus envisages a multifaceted landscape, where RA might handle routine tasks effectively (e.g., rebalancing, reporting, and basic risk profiling), but advisers, educators, and policy initiatives could play an equally crucial part in guiding investors towards stable, long-term outcomes. Finally, the interviewee hints at the possibility that favourable regulatory frameworks—especially those promoting retirement savings through flexible, digital solutions—could elevate RA to a mainstream pillar of personal finance. If, for instance, government-sponsored schemes granted tax advantages or matched contributions through automated platforms, the entire market might witness renewed momentum. Overall, the future of RA, as articulated in the interview, stands at a complex crossroad: it holds considerable promise for making sustainable wealth building more inclusive, yet it requires concerted efforts in regulation, technology design, and financial literacy to fulfil its potential.

Interview 2

As with the analysis of the first interview, this analysis focuses on key insights from a second interview with a CEO responsible for both portfolio management and marketing in the German RA sector. Using qualitative content analysis, the discussion is organised around core themes such as the current market environment, the future role of artificial intelligence, client-centric personalisation and ESG considerations. These categories were distilled through

repeated readings of the transcript, highlighting explicit statements, recurring ideas and underlying contextual elements.

Robo-advisory environment and differentiation: The interviewee, a CEO handling both portfolio management and marketing, describes a robo-advisory environment in Germany that has reached a plateau, with customers increasingly gravitating towards do-it-yourself (DIY) solutions. Despite initial enthusiasm around automation and digital wealth management, many individuals now favour low-cost broker platforms or self-directed investing. In such a crowded landscape, a mere digital interface is no longer enough to distinguish one RA from another. Consequently, providers must emphasise service quality, user engagement, and the ability to meet clients where they are—especially those with limited financial expertise. From the interviewee's perspective, the real differentiator lies in delivering a compelling client experience. This can involve personalised communication and a high degree of transparency around how investment decisions are made. The firm represented by the interviewee carves out a distinct niche by concentrating on pensions and long-term, sustainable value creation. Adhering to strict ESG criteria, it positions itself not merely as a low-cost alternative but as a trustworthy partner for clients who care about ethical and responsible investing. In short, the interviewee believes that RA must move beyond pure automation and incorporate human-centric services if it is to flourish in a maturing, increasingly competitive market.

Technological innovations and the role of AI: Although digitisation has left an indelible mark on wealth management, the interviewee points out that many RA services still rely on relatively basic tools, such as rudimentary questionnaires for risk assessment. Far from being truly "intelligent", these solutions simply automate traditional processes. Nevertheless, the interviewee regards more advanced forms of technology—particularly AI—as a promising route to deeper client engagement. At present, the firm does not employ AI in its RA offering. However, the CEO states that plans are underway to incorporate AI-driven tools in domains like automated customer communication and personalisation. Generative AI is viewed as having substantial potential for crafting interactive educational materials, delivering customised guidance, and analysing large sets of client data. Such capabilities could strengthen both the user experience and internal decision-making processes. That said, the interviewee emphasises that complexity and transparency remain key hurdles: AI solutions must integrate seamlessly into existing systems, scale effectively, and offer clear explanations to regulators and clients alike.

Personalisation and client experience: A critical theme in the interview is the importance of tailoring services to individual client profiles. The interviewee acknowledges that, in practice, the investment side of RA often ends up converging on a relatively small set of model portfolios. This limitation partly stems from the reality that well-diversified strategies for clients with similar goals can look quite alike. Consequently, the firm sees higher value in leveraging technology to enhance personal interactions and address unique client queries, rather than creating endless portfolio variants. Personalised communication—fuelled by data insights and potentially augmented by AI—is seen as a principal driver of customer satisfaction and loyalty. By providing accurate, tailored explanations of market movements, risk levels, or sustainability metrics, the service can surpass mere automation and offer genuine client support. Moreover, the interviewee envisions a RA experience that not only updates users on performance but also proactively addresses their educational needs. Such an approach could include simplified language, scenario analyses,

or contextual tips. In doing so, the Robo-Advisor becomes a long-term companion, guiding clients through life changes and evolving financial goals.

ESG and sustainability: Given that the firm operates as a certified wealth manager, sustainability is woven deeply into its operating model. The interviewee calls ESG factors "part of our DNA", emphasising that their RA platform applies rigorous screening processes to filter out investments that fail to meet defined standards. As interest in green investments grows, so does the necessity to provide comprehensive evidence of positive social and environmental impacts—a process that can be both data-intensive and dynamic. Here, AI may play a future role in rapidly scanning vast datasets, such as corporate reports and real-time environmental indicators, to identify suitable investments more efficiently. However, the interviewee cautions that AI-driven ESG tools must produce transparent outputs to avoid "greenwashing". Clear communication around why certain firms or funds have been selected is just as crucial as the initial screening itself. Ultimately, the interviewee believes that a balanced mix of ethical conviction, robust technology, and active engagement with portfolio companies can help distinguish a genuinely sustainable RA from those that merely wear an ESG label.

Challenges, Risks, and the Road Ahead: In looking to the future, the interviewee sees significant opportunities to combine digital innovation with cost-effective, personalised strategies that appeal to a broad segment of the population. Yet, inherent risks persist. Clients may be wary of black-box algorithms if they cannot understand how decisions are being made, yet frequent market volatility can undermine confidence in automated approaches. Moreover, stiff competition and the rise of self-directed trading apps place continued pressure on RAs to demonstrate real added value. Nonetheless, the interviewee is optimistic about the market's long-term prospects. With younger, digitally savvy generations increasingly seeking convenient investing solutions, there is ample scope for a well-structured, AI-enabled RA platform to thrive. The key is to remain agile: providers must adapt to regulatory shifts, maintain high standards of data security, and invest in R&D. Over the next five to ten years, the interviewee anticipates a notable expansion of AI usage, not merely for rebalancing portfolios but also for improving the client's overall journey, offering advanced analytics, and helping new entrants to navigate intricate financial decisions. Once regulatory concerns and technology gaps are addressed, these could become stepping stones for providers that diligently balance innovation with accountability.

Key Findings

Both interviews focus on the current state of the German RA market, its future development and the scope for innovation in areas such as sustainability and artificial intelligence (AI). The first interview features a senior portfolio manager who oversees a long-established RA service with a strong focus on active fund management and rigorous sustainability criteria. In contrast, the second interview presents the perspective of a CEO responsible for both portfolio management and marketing, whose firm also embraces ESG principles but has a more forward- looking attitude towards the use of AI in client communication and personalisation. In the first interview, the senior portfolio manager emphasises what he sees as the subdued nature of the market. Although RA was once expected to expand rapidly, the interviewee believes that growth has fallen short of expectations. They point to conservative investor attitudes and a general desire for low-cost options, leading to increased competition. Despite the reliance on digital platforms, the

interviewee argues that true use of AI remains rare. They acknowledge the potential benefits of advanced tools - particularly in sifting through large sustainability datasets - but stress that capital markets are inherently unpredictable, making fully automated AI-driven strategies questionable. Their approach to sustainability is all-encompassing: they invest strictly in actively managed funds aligned with robust ESG and impact criteria, believing that such engagement is essential for meaningful change. However, this comes at a cost, which the interviewee finds difficult to reconcile with the fee-conscious tendencies of many German investors. The second interview reinforces the notion that the German RA market is facing stagnation.

In the CEO's view, this slowdown is partly due to do-it-yourself trading platforms, which are syphoning off potential clients. However, the CEO sees a greater role for AI - particularly generative AI - in creating personalised customer experiences and educational content. While the first interviewee was sceptical about applying AI to market forecasting or algorithmic trading, the second focuses on the utility of AI for tailoring communications and interactive tools, believing that personalised support can help RAs stand out. Sustainability is also central to the second firm's strategy, underlined by its B Corp certification. Again, the interviewee highlights the opportunity to use AI to sift through extensive ESG data or identify emerging trends more quickly, provided that transparency and data integrity are maintained.

Comparing the two interviews, both participants recognise the importance of sustainability and the potential for technology to transform RA offerings. However, they differ in how confident they are in approaching AI, with the first interviewee emphasising caution, citing the limitations and risks of opaque algorithms, whereas the second foresees a future where AI-driven customer engagement is not just an enhancement but a key differentiator. They also differ slightly in their assessment of whether current investor sentiment really supports higher costs for advanced, active ESG approaches; the first sees cost aversion as a major barrier, while the second remains hopeful that enhanced personalisation and better user journeys will justify premium pricing. Despite both share a vision of robo-advice as a means of widening access to professional investment services, they propose different paths to get there, one rooted in scepticism about AI "hype", the other in an optimistic embrace of the technology's evolving capabilities.

SWOT Analysis

Strengths

A major strength emerging from both the interview findings and the broader market data is the ability of a select group of RAs to differentiate themselves through innovative use of AI. Providers such as Minveo, LAIC, Smavesto, and VisualVest go beyond simple chatbots by integrating sophisticated machine-learning techniques, neural networks, and big data analytics for portfolio management. This allows them to deliver faster responses to market changes, potentially boosting returns and lowering risk exposure for their clients. In parallel, the interviews highlight a commitment to sustainability, particularly in the first interview, suggesting that those who effectively combine AI-driven analysis with credible ESG frameworks could carve out a distinctive brand identity. Together, robust technological capabilities and principled investing strategies create a compelling value proposition for clients who desire both performance and responsible asset allocation.

Weaknesses

Despite these pockets of advanced AI usage, the overall adoption rate remains low. The figures show that only 5 out of 45 (11.1%) RAs use AI in any capacity, and the two interviewed providers do not yet deploy AI in their processes. Such limited uptake points to an industry that, though digitised, still depends heavily on basic questionnaires or traditional investment models. The interviews further underscore a certain scepticism around fully automated decisions, with concerns about the unpredictability of capital markets and the high costs required to implement genuine AI solutions. Additionally, the German market's strong cost sensitivity can undermine attempts to charge premiums for AI-driven services, especially if prospective clients are not convinced of tangible benefits over simpler, cheaper alternatives.

Opportunities

Nevertheless, both interviewees see long-term potential in better-personalised services and high-quality customer engagement. RAs that successfully integrate generative AI and other machine-learning techniques—whether for real-time market forecasting, multi-factor portfolio management, or enhanced sustainability screening—could stand out in a maturing market. Providers such as Quirion demonstrate how AI-powered chatbots can support client onboarding and education, potentially drawing in inexperienced investors. Meanwhile, platforms like Smavesto and VisualVest show how neural networks, time-series models, and fundamental data can be combined to offer robust risk management and nuanced rebalancing. As the younger, digitally fluent generation accumulates wealth, there is growing demand for accessible yet sophisticated tools that make investing simpler and more transparent.

Threats

Key threats revolve around over-regulation and market volatility. The interviews revealed awareness that excessive regulatory scrutiny could restrict AI experimentation, particularly if authorities perceive AI-driven trading as opaque or potentially manipulative. In addition, the German public's historic reliance on guaranteed returns and aversion to risk might limit uptake of advanced AI strategies, especially during periods of market downturn. Another threat is posed by do-it-yourself investing platforms and neobrokers; these lower the barrier to entry for self-directed trading, pulling customers away from RAs that cannot clearly articulate or deliver superior value. Lastly, a persistent concern—mentioned in the first interview—is that the AI "hype" might not translate into consistent performance gains, undermining consumer trust in both the technology and the providers who promote it.

TOWS Strategies

SO, Strategies (Strengths-Opportunities)

RAs that combine advanced AI capabilities with a principled ESG framework can build on their existing strengths to capture unmet market needs. By highlighting the tangible benefits of real-time market monitoring, automated rebalancing, and sustainability-focused screening, they can appeal to younger, tech-savvy investors seeking both innovation and responsible financial solutions. In particular, those firms already adept at handling large datasets and

neural networks can position their services as offering far more than generic, low-fee platforms. This approach strengthens brand differentiation through cutting-edge AI methods, a transparent ESG mission, and a personalised user experience. Firms with effective AI-based forecasts and proven responsible-investment track records can also seize the opportunity to educate consumers who are considering do-it-yourself platforms or purely passive funds. By showcasing superior levels of market insight, risk management, and ethical considerations, these RAs can carve out a niche where prospective clients see genuine value—both financially and in alignment with broader social or environmental goals.

WO Strategies (Weaknesses-Opportunities)

As the overall adoption of AI in the sector remains low, providers with limited technological capabilities can partner with fintech specialists or initiate targeted R&D programmes to accelerate their AI development. This addresses the inherent weakness of a lack of in-house expertise, whilst capitalising on the market opportunity for more advanced customer engagement tools. Providers lagging behind can capitalise on the growing appetite for personalised advice by adapting relatively simple platforms into more sophisticated solutions that respond flexibly to user profiles, market trends and ESG criteria. Such an evolution also opens the door to new monetisation models. Rather than competing solely on fees, RAs can offer tiered services, enabling basic functionality at low cost and charging a premium for AI-enhanced insights and planning. In doing so, they seize the opportunity to attract budget-conscious users and still recoup their investment in new technology. This approach is particularly relevant if these firms can demonstrate how AI-driven insights tangibly improve investment outcomes or risk mitigation.

ST Strategies (Strengths-Threats)

In the face of regulatory scrutiny and market volatility, RAs with existing strengths in AI and ESG can mitigate potential threats by emphasising transparency and thorough human oversight. For example, demonstrating how AI algorithms are continuously monitored by qualified experts can allay concerns about black-box decision- making. Similarly, highlighting robust ESG due diligence can reassure risk-averse investors who fear extreme market turbulence or corporate scandals. By taking a proactive approach to compliance, where teams engage with regulators early on and articulate how AI will be used responsibly, such providers can turn potential regulatory burdens into a competitive advantage. Furthermore, by highlighting advanced real-time analytics, firms can respond quickly to market fluctuations, reducing the risk associated with sudden downturns. By presenting their AI-driven, risk-adjusted solutions as a buffer against volatility, these RAs are fostering investor confidence, even in environments where many clients are typically wary of complex or unproven technology.

WT Strategies (Weaknesses-Threats)

RAs, lacking sophisticated AI systems and facing increased market competition from low-cost, self-directed platforms, risk falling further behind if they fail to overcome their technical shortcomings or address clients' concerns about risk. One way to reduce this vulnerability is to partner with established AI-driven FinTech companies, consultancies or academic institutions. Through such partnerships, they can rapidly develop or integrate advanced AI

modules while still meeting regulatory requirements and building public trust. In addition, a deliberate focus on improving user education and transparency can counter both the threat of AI scepticism and the weakness of limited in-house expertise. By offering intuitive dashboards, simplified explanations of how decisions are made, and open communication about the limitations of algorithmic predictions, these RAs can maintain credibility. In doing so, they minimise the reputational risks associated with over-promising the benefits of AI and create a stable foundation from which they can gradually introduce more advanced features as their technological capabilities mature.

Discussion

The aggregated results of all analyses, including survey data, website research, interviews, and subsequent SWOT/TOWS assessments, paint a varied picture of how (and why) artificial intelligence (AI) is being used in the German RA market. On the one hand, there is evidence of real AI use among a handful of providers such as Minveo, LAIC, Smavesto and VisualVest, all of which use machine learning models, big data or neural networks to improve investment decision-making. On the other hand, of 45 RAs initially contacted, only 5 (11.1%) were found to be integrating AI in any meaningful way, and only one explicitly confirmed active use of AI in direct response to queries, suggesting that the sector as a whole remains slow to embrace these technologies. A closer look reveals a gulf between the hype surrounding AI, often promoted as a game-changer for personalising investments or outsmarting market volatility, and the practical realities of implementing machine learning models. The majority of RAs not using AI appear to be relying on simpler tools, such as questionnaires or rule-based systems, to build portfolios. Cost sensitivity among German investors, coupled with a historical preference for simple products, may be dampening interest in more advanced, but potentially more expensive, AI-driven solutions. The interviews confirm this conservative sentiment. In the first interview, a senior portfolio manager expresses scepticism about predictive AI, emphasising instead a reliance on active fund managers, experience- based risk control and robust sustainability criteria. The second interview also acknowledges the stagnation in the market, which he attributes in part to do-it-yourself platforms and mainstream discount brokers attracting cost- conscious clients with streamlined digital interfaces. Nevertheless, both interviewees agree that AI has the potential to add value in areas such as client engagement, personalised communications and, to some extent, ESG- driven research. Where the first interviewee emphasises that capital markets are inherently unpredictable, tempering expectations that AI can reliably predict or time the market, the second sees an opportunity to differentiate by providing an exceptional user experience through generative AI tools that enhance support and improve clarity of investment processes. This difference in perspective highlights that even though AI can be used for pure asset management functions, it may hold more immediate promise for building trust, demystifying finance for newcomers and ensuring that client interactions remain engaging and informative. From a TOWS perspective, it is clear that RAs that are strong in the use of AI (strengths) can capitalise on market opportunities (opportunities) by marketing advanced technologies as a means of providing more sophisticated investment options and risk management. Those that excel in ESG or have a robust brand reputation (strengths) can further mitigate threats (threats) by emphasising the regulated, transparent nature of AI systems to gain the trust of wary clients and regulators alike. Conversely, firms lacking in-house technical expertise (weaknesses) urgently need to collaborate or invest in AI (opportunities) if they hope to differentiate themselves in a field where discounters and new entrants are intensifying competition. Above all, the consolidated analyses show that AI alone is no guarantee of success. To reap the benefits of the technology, RAs must integrate it in a way that truly serves customer needs, whether through

portfolio management, market analysis or a more intuitive user experience. In addition, any AI-based system requires rigorous oversight to ensure that decisions are explainable, data handling is secure, and ethical considerations are addressed, especially if ESG claims are central to the marketing proposition. In summary, the market data, interviews and SWOT/TOWS findings collectively confirm that while the German RA segment has been digitised, its maturity in terms of AI varies widely. A small cadre of pioneering firms are already using complex machine learning capabilities to gain an edge, but the majority continue to operate with minimal or no AI involvement. Whether more players invest in these technologies may depend on two key factors: customers' acceptance of the associated costs and providers' ability to align AI with transparent, trustworthy and value-driven services in an evolving competitive landscape.

Conclusion

This paper explored the current landscape of AI adoption in RA services in Germany, shedding light on both technical implementations and the broader perceptions that drive or inhibit their development. An initial screening of 45 RAs revealed that only 5 (11.1%) use AI technologies beyond simple chatbots, mostly in portfolio management, risk analysis and data-driven investment decisions. Of these, some, such as Minveo and LAIC, rely on big data and machine learning models that facilitate continuous, real-time portfolio monitoring and adjustment. Others, such as VisualVest and Smavesto, use more advanced predictive models (e.g., neural networks, time series analysis) to identify market trends. In parallel, two in-depth interviews with CEOs of RAs not yet using AI revealed a cautious approach to predictive algorithms. Although these providers recognise the potential for AI to enhance client engagement, personalisation and ESG-focused research, they are mindful of the conservative investor sentiment in Germany and the high costs associated with developing or integrating new technologies. The findings from both the quantitative overview and the qualitative interviews thus converge on the point that cost sensitivity and regulatory challenges may hinder wider adoption of AI, particularly if clients do not yet perceive a clear added value. Despite these constraints, the market shows scope for growth. Firms deploying advanced data analytics, neural networks and robust ESG integration have set a precedent that underscores AI's ability to deliver refined risk management and personalised user journeys. The findings point to an early adoption phase, with AI being used by only a pioneering segment of the industry. A key limitation of this research is the relatively small sample size: less than half of the RAs contacted responded, and even fewer provided detailed insights into their use of AI. In addition, only two interviews were secured, limiting the scope of qualitative perspectives. Future research should expand the pool of RA participants, investigate measurable impacts on performance, and explore how transparency and consumer trust can be improved. A longitudinal approach would also clarify whether AI-driven benefits persist through different market cycles, thereby deepening our understanding of how AI can sustainably enhance RA services.

Recommendations

From a practical perspective, RAs looking to incorporate AI should start by identifying specific pain points or opportunities where automated solutions can truly add value. For many, this may involve improving client communication through interactive chatbots and personalised dashboards, rather than attempting full-scale algorithmic trading from the outset. Small pilots can help test the viability of different machine learning models,

allowing firms to assess both cost effectiveness and client receptivity before a wider rollout. As the handful of providers using AI have highlighted, transparent oversight is essential. AI systems should be paired with human expertise, ensuring that explanations for asset allocation or rebalancing decisions are understandable. This approach not only fosters trust, but also helps firms meet regulatory requirements and manage any reputational risks. In parallel, a focus on ESG integration can serve as a meaningful differentiator, particularly if robust sustainability metrics are systematically embedded in AI-driven assessments. Collaboration with specialised fintech partners and academic institutions can accelerate learning curves and reduce development costs. Such collaborations also foster an environment in which best practices around data privacy, algorithmic bias reduction and model validation are widely shared. Finally, organisations that embrace an iterative improvement cycle that includes consistent user feedback and rigorous performance tracking are more likely to achieve tangible benefits. By setting clear goals, ensuring transparency and remaining adaptable, RAs can use AI technologies to deliver sustainable value in a competitive market.

Acknowledgements

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Follow Up of a Woman with Antiphospholipid Syndrome: A Case Report

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Abstract: Antiphospholipid syndrome (APS) is an autoimmune disorder defined by thrombotic or obstetrical events that occurs in patients with antiphospholipid antibodies. The revised Sapporo criteria or Sydney criteria, require at least one clinical and one laboratory criterion to classify as APS. A 36 years old woman with two pregnancies with unexplained intrauterine growth restriction, after giving birth to the second child on the 36th week of pregnancy, suffered a stroke. Being suspected for antiphospholipid syndrome, she was tested for antiphospholipid antibodies like lupus anticoagulant, anti-β2glucoprotein, anti-cardiolipin, phosphatidylserine, phosphatidyl choline, ANA, ENA profiles and resulted positive for anti-β2glicoprotein, anti-cardiolipin, phosphatidylserine, phosphatidyl choline IgM and for Ro-52 antibodies. After 12 weeks this woman was tested again for antiphospholipid antibodies and the positivity for anti-cardiolipin and β2glicoprotein antibodies confirmed antiphospholipid syndrome diagnosis. This patient suffers also from another autoimmune disease, Hashimoto's thyroiditis. This patient is tested for antiphospholipid antibodies, ANA and ENA profiles every year from the time of initial diagnosis ensuring continuous monitoring of all parameters.

Introduction

Antiphospholipid Syndrome (APS) is an autoimmune disorder characterized by thrombotic or obstetrical events and the persistent presence of antiphospholipid antibodies, known as lupus anticoagulant, anticardiolipin antibody and anti-β2glucoprotein (anti-β2GPI), in the patient's plasma (Toska et al.,2024).

The Sapporo criteria for Antiphospholipid syndrome classification, first published in 1998, then revised in 2006 as Sydney criteria, require at least the presence of one clinical and one laboratory criterion to classify as APS. Clinical

criteria include vascular thrombosis or pregnancy morbidity and the laboratory ones include the presence of medium or high titers of IgG and/or IgM of anticardiolipin (aCL), the IgG/IgM anti-beta 2 glycoprotein I (anti-β2GPI) and/or lupus anticoagulant (LAC) positive on two or more occasions at least 12 weeks apart (Dabit et al., 2021).

Figure 1. *Classification Criteria for APS*

	Sapporo criteria	Sydney criteria
LACs	Screening, mixing, and confirmation tests (ISTH guidelines)	Screening, mixing, and confirmation tests (ISTH guidelines)
	Two or more occasions at least 6 weeks apart	Two or more occasions at least 12 weeks apart
aCL antibodies	Detected by standardized β2GPI-dependent ELISA	Detected by standardized ELISA
	IgG and/or IgM	IgG and/or IgM
	Medium or high titer	Medium or high titer (>40 units IgG or IgM phospholipid antibody titer or >99th percentile)
	Two or more occasions at least 6 weeks apart	Two or more occasions at least 12 weeks apart
Anti-β2GPI antibodies		IgG and/or IgM
		Titer >99th percentile
		Two or more occasions at least 12 weeks apart

Source: Devreese, K., & Hoylaerts, M. F. (2010). Challenges in the diagnosis of the antiphospholipid syndrome. *Clinical Chemistry*, *56*(6), 930–940. https://doi.org/10.1373/clinchem.2009.133678

Antiphospholipid syndrome may occur as a primary disorder or in association with other autoimmune diseases, especially with Systemic Lupus Erythematosus (SLE), (Keleşoğlu & Erkan 2023; Branch 2019), Rheumatoid arthritis (RA), (Jeleniewicz et al. 2012).

Antiphospholipid Syndrome is an autoimmune condition, which may potentially cause adverse pregnancy outcomes such as recurrent miscarriage, stillbirth, severe pre-eclampsia and severe placental insufficiency. One of the features of placental insufficiency is fetal growth restriction (FGR), defined as a fetus that has not achieved his or her growth potential (Xu et al.,2022). This paper reports for a woman with two unexplained intrauterine growth restriction, who suffered a stroke shortly giving birth to the second child, on the first day of the 36th week of pregnancy.

Case

A 36 years old woman, who experienced two unexplained intrauterine growth restriction in both pregnancies, suffered a stroke postpartum, after giving birth to the second child, on the first day of the 36th week of pregnancy. A series of examinations were started to discover the cause of this situation. Initially was noticed that transaminases were elevated in this woman's serum respectively AST 125 U/L and ALT 172.8 U/L. An abdominal computed tomography is immediately realized, which resulted normal, suggesting for an autoimmune condition. Antiphospholipid syndrome was suspected as a potential cause and this patient underwent several examinations. She was tested for antiphospholipid antibodies like lupus anticoagulant, three isotypes IgM, IgA, IgG of anti-cardiolipin, anti-β2-glucoprotein, phosphatidylserine, phosphatidyl choline. Homocysteine, ANA and ENA profiles were also part of the

laboratory control. The results of examinations showed positivity for anti-β2glicoprotein, anti-cardiolipin, phosphatidylserine, phosphatidyl choline IgM. ENA profiles resulted also positive for SSA/Ro-52 antibodies. Homocysteine level resulted within normal range and ANA was negative. According the clinical criteria and laboratory results the diagnosis for this woman is antiphospholipid syndrome with anti-cardiolipin IgM positive, anti-β2glucoprotein IgM positive, phosphatidylserine IgM positive, phosphatidyl choline IgM positive, with normal homocysteine and negative thrombophilia. This patient was tested also after 12 weeks according the recommendation of antiphospholipid classification criteria and continuous positivity for anti-cardiolipin and anti-β2GPI IgM reconfirmed antiphospholipid syndrome diagnosis. In this case antiphospholipid syndrome is associated with another autoimmune condition, because this patient suffers from Hashimoto thyroiditis. Thyroid hormone levels are 1.47 uIU/ml for TSH (0.27- 4.2 uIU/ml > 21 year) and 122.7 IU/ml for A-TPO (< 34 Iu/ml).

The medical treatment began immediately after the initial diagnosis and includes:

Plaquenil 200mg   1 tablet per day

Medrol 4 mg   1 tablet by mouth following breakfast

Omeprazole   1 tablet by mouth on an empty stomach, before breakfast

Aspirin protect 100mg   1 tablet by mouth following lunch

Vitamin D 2000 IU   1 tablet per day in the morning.

Clinical situation appears to be stabilized and under control upon the receipt of medical protocol for six months.

The continuous follow-up is very important to ensure monitoring of all clinical and laboratory parameters.

Table 1. *Summary of Laboratory Examination*

Examination	I	II	III	IV
LAC	Negative	Negative	Negative	Negative
aCL IgA	Negative <2	Negative < 2	Negative < 2	Negative <2
aCL IgG	Negative < 2	Negative < 2	Negative < 2	Negative 2.98
aCL IgM	Positive 25.4	Positive 23.4	Positive 30.8	Positive 21.5
aβ2GPI IgA		Negative 3.3	Negative < 2	Negative 2.94
aβ2GPI IgG	Negative 2.8	Negative < 2	Negative 2.43	Negative 2.09
aβ2GPI IgM	Positive 95.2	Positive 135.1	Positive 131.4	Positive 157.8
Serina IgA		Negative < 2		Negative <2
Serina IgG	Negative < 2	Negative < 2		Negative <2
Serina IgM	Positive 12.1	Negative 8.9		Positive 21.5
Choline IgG	Negative 0.5	Negative 0.1		Positive 4.8
Choline IgM	Positive 1.6	Negative 0.7		Positive 28.3
ANA	Negative 1:80	Negative 1:80	Negative 1:80	Negative 1:80
ENA profiles	SSA/Ro52 positive	SSA/Ro52 positive	SSA/Ro52 positive	SSA/Ro52 positive
Homocysteine		12.1	11.6	

In table 1 are presented all laboratory examination realized for this patient from the initial diagnosis until today. Presented laboratory data, shows a persistent positivity of IgM anti-cardiolipin and anti-β2GPI through all tests performed. Lupus anticoagulant remains negative in all test, as well as homocysteine levels. As for the ANA, it resulted negative and in ENA profiles, it is represented positivity for SSA/ Ro52 antibodies, that highly suggest for Sjogren syndrome (SS). Ultrasound of submandibular and parotids glands was compatible for Sjogren syndrome. Currently she is taking first plan of treatment, but without Medrol. Last laboratory results showed more positivity in realized tests and this suggest to consider performing testing every 6 months to ensure complete monitoring and a safe health.

Discussion and Conclusion

As we mentioned before, antiphospholipid syndrome is an autoimmune condition that can cause adverse pregnancy outcomes like recurrent miscarriages, eclampsia, pre-eclampsia and placental insufficiency. Intra uterine growth restriction is a form of placental insufficiency, described as a condition that fetus has not achieved his growth potential. The association with antiphospholipid antibodies remains controversial, but also is reported in several studies. One of the causes of (IUGR) may be APS and in those patients has an incidence between 6.7% and 16.0%. In a systematic review and meta-analysis realized to show the link between IUGR and antiphospholipid antibodies was found that presence of antiphospholipid antibodies (aPL) elevates the odds of IUGR 1.26 times (Xu et al., 2022). This case report is an example that shows not only the linkage of IUGR and aPL, but at the same time is another evidence for IUGR caused by antiphospholipid syndrome. In another study realized in China, the aim of which was to identify the risk factors for pregnancy outcomes in women with antiphospholipid antibodies positivity was found that incidence of IUGR was significantly higher in aPL carriers than in normal pregnancies and among risk factors like age, IVF, pregnancy loses related with treatments, anticardiolipin positivity was the only variable strongly associated with IUGR (Xi et al., 2020). Our laboratory findings for this patient with anticardiolipin IgM positivity, antiβ2-GPI IgM positive correlate with studies that we mentioned above. According another study realized by Saccone et al, anti-β2GPI is the one associated with the lowest live birth rate and highest incidence of preeclampsia, intrauterine growth restriction, and stillbirth, compared with the presence of anticardiolipin antibodies or lupus anticoagulant alone (Saccone et al.,2017). This case report is important because it provides another evidence among controversial studies between association of APS and IUGR. Referring to different studies that we discussed, an early testing for antiphospholipid antibodies in patients who are experiencing IUGR, may be beneficial, in order to be excluded APS as a probable diagnosis or be early treated without causing further damages. Continuous follow- up in patients diagnosed with antiphospholipid syndrome is very important (referring similar situations with our patient), to ensure monitoring of laboratory parameters in order to reduce the risk for another thrombotic event.

Antiphospholipid syndrome in an autoimmune disorder that can cause adverse outcomes in pregnancy and one of them is intrauterine growth restriction. With the evidence of several studies and cases like the one we described, we can recommend early antiphospholipid antibodies testing, in women with an unexplained pregnancy loss after the 12th week and in women that have mothers or sisters with miscarriages or thrombotic events at an early age. Correct diagnosis is very important for the management of pregnancy and health of mother and baby.

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Boosting English Language Listening Skills Through Copilot AI (A Case of Georgian Higher Education Institutions)

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Abstract: This study explores the impact of Copilot AI on enhancing English language listening skills among B1-level students through an experimental research design. The research involved two groups: an experimental group that used Copilot AI for listening practice and a control group that followed traditional listening activities. Over a set period, students in the experimental group engaged with AI-generated listening exercises, interactive transcripts, and real-time feedback, while the control group relied on conventional audio materials and teacher-led discussions. Pre- and post-tests were administered to measure improvements in listening comprehension. The results indicate that students showing to Copilot AI demonstrated greater progress in their ability to understand spoken English, recognize key details, and respond accurately. The study highlights the potential of AI-assisted learning in improving listening proficiency and suggests practical applications for integrating AI tools into English language instruction.

Keywords: Copilot AI, AI-Assisted Learning, Language Acquisition, Listening Comprehension

Introduction of Copilot AI

The rapid advancement of artificial intelligence (AI) has transformed educational practices, offering innovative tools to enhance language learning. Among these, AI-driven applications have shown significant potential in developing listening skills, a crucial component of language acquisition (Yang, 2022). Copilot AI, a sophisticated language model, offers personalized learning experiences that simulate real-life conversations, thereby fostering active listening and comprehension (Zawacki-Richter et al., 2019). Such technology provides learners with authentic, interactive dialogues that promote engagement and facilitate the improvement of listening skills (Chen & Lin, 2023). Research suggests that AI-powered tools like Copilot AI can support language learners by offering immediate feedback and adaptive content personalized to individual proficiency levels (Tegos et al., 2021). This adaptability is particularly beneficial for students preparing for high-stakes assessments, where listening comprehension plays a pivotal role (Graham, 2017). Furthermore, the ability of AI to provide repeated exposure to varied accents, speech rates, and contexts enhances learners' auditory processing and increases their overall language competence (Shao & Purpur, 2020).

Despite the growing integration of AI in education, there remains a gap in empirical research examining the specific impact of Copilot AI on English language listening skills. This study aims to address this gap by exploring how the

use of Copilot AI influences the listening proficiency of B1-level students. By investigating learners' experiences and outcomes, the research seeks to provide insights into the efficacy of AI-driven tools in language acquisition.

Leveraging Copilot AI for Listening Skill Development

Artificial intelligence (AI) use in education creates fresh opportunities for customizing learning experiences to become more effective. Improving listening comprehension represents one of the most effective uses of AI technology in language acquisition. The ability to listen effectively plays a fundamental role in acquiring language skills because it helps learners recognize spoken language in various contexts (Yang, 2022). Through its sophisticated language processing abilities, Copilot AI delivers an inventive solution for listening skill enhancement by providing learners with interactive real-world scenarios designed to match their personal needs (Zawacki-Richter et al., 2019).

Copilot AI and Its Role in Listening Comprehension

Copilot AI enables learners to access genuine listening content through its individual approach. Traditional listening exercises rely on scripted dialogues but Copilot AI creates spontaneous and dynamic conversations. The tool teaches students about different accents which helps them better understand English spoken in real situations (Chen & Lin, 2023).

Copilot AI stands out because it creates natural and unexpected speech sequences that reflect everyday language learners' experiences. Language learning audio recordings usually adhere to a standardized format which often prevents students from fully comprehending spontaneous speech patterns. Copilot AI employs adaptive algorithms to produce dialogues that mimic authentic communication patterns. This variation features regional accents and informal language with speech disfluencies like pauses and hesitations which create difficulties for language learners yet play a crucial role in building advanced listening abilities (Yang, 2022).

Copilot AI provides learners with the capability to tailor their auditory learning experiences. Users can modify parameters including speech speed along with their preferred accent and desired complexity level. Students often face challenges understanding speech delivered at a fast speed. Students develop their listening abilities by using Copilot AI which allows them to hear different speakers at the speed settings they choose. The system's flexibility enables learners to incrementally develop both their listening endurance and precision in comprehension. Copilot AI offers focused exercises on complex sentence structures as well as idiomatic expressions and technical vocabulary to address specific student weaknesses (Tegos et al., 2021).

Copilot AI offers its users instant feedback that is customized to their needs. The system flags any phrase misinterpretations or overlooked critical details and then supplies the learner with an accurate transcription. The process of immediate correction lets students reinforce their learning through direct comparison between their attempts and the correct answers. Copilot AI assists students during simulated job interviews by marking misunderstood questions and offering a clarified version or explanation of the question. Through its real-time assistance learners can engage in an iterative and self-paced learning process which enhances comprehension abilities progressively (Graham, 2017).

The platform maintains records of learner progress while detecting patterns of repeated difficulties. Copilot AI uses error pattern analysis to create specific exercises that address student weaknesses that appear frequently. Whenever a student demonstrates persistent difficulty with contractions or connected speech patterns such as "gonna" instead of "going to," the system responds by giving extra exercises that target these specific features. Teachers can find Copilot AI extremely useful in educational settings. Educators have the option to assign listening exercises through the platform that match the language requirements of official evaluations. The technology serves as an essential tool for training students to take standardized tests that heavily depend on listening comprehension skills. The curriculum integration of Copilot AI enables educators to offer personalized support while effectively tracking student development (Zawacki-Richter et al., 2019).

Simulating Real-Life Situations and Bridging the Gap to Real-World Listening

The Copilot AI program excels at recreating real-life situations to create a link between simulated scenarios and actual real-world listening situations. Copilot AI surpasses through its function to recreate real-life scenarios. Learners can participate in typical communication contexts including interviews and customer service dialogues through scenario-based interactions. The exercise enables students to develop their ability to understand complex questions while practicing proper responses. These simulations enable students to understand formal language patterns and vocabulary while teaching them to process spoken information promptly when facing pressure (Shao & Purpur, 2020).

One major obstacle in learning languages involves applying classroom material to practical real-life situations. Copilot AI assists students in connecting their classroom learning to real-world language use through exposure to diverse language inputs and spontaneous speech patterns. Students participate in role-play activities where they must understand and execute intricate verbal directions through tasks like city navigation or restaurant ordering. The student's capacity to manage genuine communication situations improves through this contextualized practice (Yang, 2022). Using Copilot AI students practice simulated exchanges with host families while simultaneously honing their ability to understand cultural explanations and answer daily questions. Through this preparation, students develop greater confidence for real-world interactions while their anxiety levels decrease (Yang, 2022). These simulations enable students to explore cultural nuances along with unfamiliar expressions which leads to an enhanced understanding of language application across different contexts.

Regular interaction with real-life scenarios enables learners to build their language skills and boosts their confidence. The extensive training provided by Copilot AI enables students to transfer their language abilities beyond classroom settings and apply them in practical real-world contexts. The flexibility of Copilot AI allows teachers to create custom listening exercises that match curriculum objectives and establishes an all-encompassing language learning approach which equips students for subsequent academic and career hurdles (Zawacki-Richter et al., 2019).

Adaptive Learning and Personalized Feedback

The adaptive learning system of Copilot AI adjusts listening tasks to match the proficiency levels of individual learners. Beginner students engage with slow and clear dialogues while advanced learners practice with fast natural

speech patterns. The modified educational method promotes gradual improvements in skills and enables students to monitor their learning progress throughout their studies (Tegos et al., 2021). Teachers can use Copilot AI listening exercises in classrooms where students engage with virtual tour guides describing historical sites. The AI delivers feedback to students about their level of understanding and identifies areas where they need to improve once they finish the task. Teachers and learners benefit from this immediate feedback based on data as it reveals both strong points and areas requiring additional practice (Graham, 2017). Copilot AI provides advanced analytics tools that enable users to track their long-term development. The system tracks metrics including listening accuracy along with response time and comprehension rate which assists learners and teachers in evaluating educational progress over time. When a student encounters difficulties processing fast speech, the system will progressively elevate the speed of spoken content as their understanding advances (Tegos et al., 2021).

Copilot AI delivers custom support that addresses the unique educational requirements of each learner. The platform offers extra exercises on common idioms and their meanings when a student finds idiomatic language challenging to understand. Targeted assistance helps learners address specific listening difficulties while strengthening their overall language abilities (Chen & Lin, 2023). The personalized feedback from Copilot AI empowers students to develop their learning autonomy. Students obtain full control over their educational path through ongoing adaptive learning experiences that allow them to tackle difficult content at their speed. Students' autonomous learning practice leads to better listening abilities and improved language confidence and motivation (Shao & Purpur, 2020).

Challenges and Limitations

While Copilot AI has several benefits, it also creates many challenges and limitations. One such problem arises from the reliance on technology and reliable internet connections. AI-based platforms can also be a challenge for students who live in places with unstable internet connections (Chen & Lin, 2023). The quality and scope of the data the Copilot AI is trained on determines its effectiveness. Data collection is either incomplete or biased and when faced with unique accents and dialects, speech recognition systems make errors (Yang, 2022). The absence of any human interaction is a considerable hurdle. Copilot AI responds with much more dynamic and adaptive forms than a human, but cannot reproduce the intricacies of face-to-face interaction like body language and emotional signals (Shao & Purpur, 2020). This restriction hinders learners from understanding implicit meanings as well as cultural contexts. Compared to human teachers, AI systems can hardly offer detailed explanations and motivation to personalize feedback. Reliance on this technology limits the scope of collaboration in learning and peer relationships which are crucial for holistic language learning processes (Tegos et al., 2021).

Methodology and Methods

This is a mixed-methods research design study that explored the effect of Copilot AI on English listening comprehension through both quantitative and qualitative methods. We adopted a mixed-methods approach (Creswell & Plano Clark, 2018) so that we could have a comprehensive analysis, which integrates statistical findings with detailed insights from participants' experiences. Listening proficiency will be measured through the use of pre-tests and post-tests, providing quantitative data. These assessments will test on major listening skills, such as understanding

of the main points made, recognition of detail, and understanding of implied meanings. From the statistical perspective, trends and patterns in students' performance will be measured with accuracy (Dörnyei, 2007). The study will perform interviews with students and classroom observations to obtain qualitative data that explores additional research questions about students' views and experiences with Copilot AI. The qualitative findings will provide context for quantitative results and expand the understanding of AI's impact on listening skill development (Merriam & Tisdell, 2015). This research investigates the root causes behind the proficiency gap while evaluating how interventions such as Copilot AI contribute to developing students' listening abilities. The research employs a mixed-methods approach, utilizing both quantitative (experimental) and qualitative (reflective) techniques to address the following research questions (RQs):

1. How does the use of Copilot AI influence students' listening comprehension skills, and what are their perceptions of its effectiveness in enhancing their understanding of authentic spoken English?
2. How does personalized feedback from Copilot AI impact learners' ability to identify and correct listening comprehension errors over time?
3. What challenges do students encounter when using Copilot AI for listening practice, and how do these challenges affect their learning outcomes?

This study employs a mixed-methods research design, combining both quantitative and qualitative approaches to investigate the impact of Copilot AI on English listening comprehension. The rationale for using a mixed-methods approach lies in its ability to provide a comprehensive analysis by integrating statistical data with in-depth insights from participants' experiences (Creswell & Plano Clark, 2018).

Findings and discussions

Participants

The experiment which was conducted to identify the effectiveness of Copilot AI includes control group and experimental group. In the experimental group were 21 students and in the control group-20 students. All participants complete three stages of assessment with the B1 Preliminary (PET) Listening Test: a pre-test, a mid-test and a post-test. This design enables a comparative analysis of the impact of Copilot AI on the development of students' listening skills against traditional teaching methods.

Sample and Procedure

The experiment was implemented at university. Both experimental and control group used the same a Pearson English guidebook- Roadmap B1 level, however experimental group utilized the Copilot AI application for listening exercise, whilst the Control group applied only traditional method of teaching using guidebook. Both groups attended English lectures for four hours a week, with the experimental group spending an hour working with Copilot AI. The app is free, and all the students in the experimental group used the app on their personal mobile phones, during which they participated in all different activities in active listening and rational dialogues with the AI. With this setup, the researcher could measure the efficacy of AI-assisted learning against traditional teaching methods.

Results

The identity of the students remained anonymous so the researcher used codes to identify each student. The listening test's maximum score is 25 points. The obtained results were studied and processed in the SPSS software.

Experimental Group

Table 1. Pre- Middle and Post-Test Results.

Students	Pre-Test	Middle-Test	Improvement	Post-test	Improvement	Final results
EXP_S_1	12	15	+3	20	+5	+8
EXP_S_2	7	9	+2	13	+4	+5
EXP_S_3	7	8	+1	11	+3	+4
EXP_S_4	15	18	+3	21	+3	+6
EXP_S_5	17	21	+4	24	+3	+8
EXP_S_6	6	10	+4	12	+2	+6
EXP_S_7	3	4	+1	7	+3	+4
EXP_S_8	11	14	+3	15	+1	+4
EXP_S_9	6	11	+5	15	+5	+9
EXP_S_10	8	10	+2	13	+3	+4
EXP_S_11	7	10	+3	14	+4	+7
EXP_S_12	10	15	+5	18	+3	+8
EXP_S_13	10	14	+4	16	+2	+6
EXP_S_14	3	6	+3	10	+4	+7
EXP_S_15	6	9	+3	11	+2	+5
EXP_S_16	8	12	+4	15	+3	+7
EXP_S_17	5	9	+4	10	+1	+5
EXP_S_18	8	10	+2	13	+3	+5
EXP_S_19	4	5	+1	8	+3	+4
EXP_S_20	6	7	+2	9	+2	+3
EXP_S_21	6	8	+2	10	+2	+4
Mean	7.8571	10.7143		13.5714		
Median	7.0000	10.0000		13.0000		
Mode	6.00	10.00		10.00		
Standard Deviation	3.60951	4.23253		4.39968		
Skewness	1.066	.731		.774		
Kurtosis	1.062	.501		.501		

The mean represents the average score of the participants. The average increased from 7.86 to 13.57 across the three stages. This shows that the students' listening skills improved over time. Since the mean gets higher at each stage, it suggests that the participants made steady progress as they continued practicing.

The median is the middle value when all the scores are arranged in order. It also increased over time, but it is slightly lower than the mean. This means that more than half of the students scored below the average, but there were a few students with higher scores that raised the mean. This suggests that most participants improved, but a small number showed even greater progress.

The mode is the most common score among the participants. The most frequent scores were 6, 10, and 10. Since the mode is close to the median, it indicates that many students had similar levels of improvement. However, the presence of multiple modes means that while most students improved steadily, a few groups of students shared the same scores at different stages.

The standard deviation shows how much the scores vary from the average. In your research, these values increased slightly at each stage (3.61, 4.23, and 4.40), meaning that while many students' scores were close to the mean, there were also some who improved much faster or slower. This suggests that although most students made regular progress, a few advanced more quickly than others.

The skewness describes whether the scores are balanced or uneven. Positive skewness in your results means most students scored below the average, but a few scored much higher, which raised the overall mean. This shows that while many participants made moderate improvements, some showed significant progress, pushing the average score upward.

The kurtosis refers to the shape of the score distribution. A positive kurtosis means the scores are clustered closely together, with fewer extreme results. This suggests that most students performed similarly, with only a few scorings much higher than the rest. It also indicates that the majority of participants improved steadily, without many extreme highs or lows.

The research shows that students improved their listening skills. Most participants made steady progress, while a few showed exceptional gains. The results suggest that regular practice with Copilot helps students improve, and those who engage with the AI more frequently show faster and more noticeable progress.

Table 2. Pre- Middle and Post-Test Results. Listening Experimental Group. Correlations

Correlations		VAR00001	VAR00002	VAR00003
VAR00001	Pearson Correlation	1	.989**	.981**
	Sig. (2-tailed)		<.001	<.001
	N	21	21	21
VAR00002	Pearson Correlation	.989**	1	.981**
	Sig. (2-tailed)	<.001		<.001
	N	21	21	21
VAR00003	Pearson Correlation	.981**	.981**	1
	Sig. (2-tailed)	<.001	<.001	
	N	21	21	21
**. Correlation is significant at the 0.01 level (2-tailed).				

This correlation table shows the relationships between the three sets of scores (VAR00001, VAR00002 and VAR00003). Put another way, it quantifies how much a given score tends to rise or fall in relation to the others.
All the values in this table are very close to each other as well (the Pearson correlation values) as 0.989 and 0.981.
That is to say, that these three score sets have a strong positive correlation between them. That means when one score goes up, so do the others.

The significance value (Sig. The probability value (2-tailed) associated with all three comparisons is less than 0.001. Correspondingly, the correlation is statistically significant, and the probability of these results occurring by chance are exceptionally low. It verifies the ordinal improvement over the different stages is genuine and consistent.

Table 3. Pre- Middle and Post-Test Results. Listening Experimental Group. T-test analysis

			One-Sample Test			
			Test Value = 0			
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
VAR00001	9.975	20	<.001	7.85714	6.2141	9.5002
VAR00002	11.600	20	<.001	10.71429	8.7877	12.6409
VAR00003	14.136	20	<.001	13.57143	11.5687	15.5741

The one-sample t-test conducts a test to determine if the average (mean) scores of the three variables (VAR00001, VAR00002, and VAR00003) are significantly different from zero. That student score compared to zero also shows high t-values (9.975, 11.600, 14.136), meaning the difference is considerable. That means the findings are statistically significant and there's virtually no chance the improvements occurred randomly. The differences between the mean scores (7.86, 10.71, and 13.57) tell us how much the students' scores converged. And the 95% confidence intervals show that these improvements are consistent.

Control Group

Table 4. Pre- Middle and Post-Test Results. Listening Experimental Group.

Students	Pre-Test	Middle-Test	Improvement	Post-test	Improvement	Final results
EXP_S_1	20	20	+0	22	+2	+2
EXP_S_2	2	5	+3	6	+1	+4
EXP_S_3	7	10	+3	11	+1	+5
EXP_S_4	8	9	+1	9	+0	+1
EXP_S_5	6	6	+0	7	+1	+1
EXP_S_6	4	5	+1	5	+0	+1
EXP_S_7	18	20	+2	22	+2	+4
EXP_S_8	9	9	+0	11	+2	+2
EXP_S_9	5	5	+0	6	+1	+1
EXP_S_10	16	20	+4	20	+0	+4
EXP_S_11	2	2	+0	3	+1	+1
EXP_S_12	9	9	+0	10	+1	+1
EXP_S_13	14	15	+1	15	+0	+1
EXP_S_14	7	9	+2	9	+0	+2
EXP_S_15	1	1	+0	3	+2	+2
EXP_S_16	5	5	+0	5	+0	+0
EXP_S_17	6	6	+0	6	+0	+0
EXP_S_18	11	13	+2	13	+0	+2
EXP_S_19	16	18	+2	18	+0	+2
EXP_S_20	15	16	+1	17	+1	+2
Mean	9.0500	10.1500		10.9000		
Median	7.5000	9.0000		9.5000		
Mode	2.00[a]	5.00[a]		6.00		

Standard Deviation	5.67056	6.13253	6.18912
Skewness	.475	.427	.574
Kurtosis	-.894	-1.054	-.898

In this study, the average values for the three variables were 9.05, 10.15, and 10.9, indicating that the control group performed at a moderate level in absence of AI tools. Systematically analyzing a set of ordered values, 7.5, 9.0, and 9.5 become the median, meaning that half the students scored below these points and half above. These medians are lower than the means, indicating that a few high score pushed up the average. The control group mode score was 2, 5, and 6 as the most occurring values that are much lower than mean.

Standard deviation (5.67, 6.13, 6.19) specify more dispersion in student outcomes. These values indicate that students' scores were spread out, with some doing much better or worse than others. Skewness tells us whether the data is symmetric or biased toward low or high values. Positive skewness values (0.475, 0.427, and 0.574) imply a second slight right skew of the distribution, which means more students had lower scores in comparison to a few higher scores.

Kurtosis indicates whether the distribution is more or less peaked than a normal distribution. The standardized skewness values (-0.894, -1.054, and -0.898) suggest negative kurtosis of the data with visible low number of extreme numbers with more flatness compare to normal distribution.

Table 5. Pre- Middle and Post-Test Results. Listening Experimental Group. Correlations

Correlations		VAR00001	VAR00002	VAR00003
VAR00001	Pearson Correlation	1	.984**	.990**
	Sig. (2-tailed)		<.001	<.001
	N	20	20	20
VAR00002	Pearson Correlation	.984**	1	.992**
	Sig. (2-tailed)	<.001		<.001
	N	20	20	20
VAR00003	Pearson Correlation	.990**	.992**	1
	Sig. (2-tailed)	<.001	<.001	
	N	20	20	20
**. Correlation is significant at the 0.01 level (2-tailed).				

The correlation table shows how strongly the three variables (VAR00001, VAR00002, and VAR00003) are related to each other. The Pearson correlation values (.984, .990, and .992) are very close to 1, which means there is a strong positive relationship between all three variables. The Sig. (2-tailed) values are all 0.000, meaning the correlations are statistically significant.

Each variable's mean significantly differs from zero in the one-sample t-test. In this table of t-values (7.137, 7.402, and 7.886), t-values indicate a huge difference from zero. The Sig. (2-tailed) for all three variables <. 001, indicating that the results are statistically significant. That means the improvements observed are highly unlikely to have occurred by chance. The Mean Difference indicates how much each of the variables is different from zero. Thus,

VAR00001 has a mean difference of 9.05, which indicates that on average, this group scored 9.05 points higher than zero. The 95% Confidence Interval (such as VAR00001: 95%CI = 6.40 → 11.70) means that we are 95% confident that the population average lies in this interval.

Table 6. Pre- Middle and Post-Test Results. Listening Experimental Group. T-test analysis

	One-Sample Test					
	Test Value = 0					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
VAR00001	7.137	19	<.001	9.05000	6.3961	11.7039
VAR00002	7.402	19	<.001	10.15000	7.2799	13.0201
VAR00003	7.876	19	<.001	10.90000	8.0034	13.7966

Analysis of Pre-, Middle- and Post-Experimental Study Results

Comparing experimental group (AI-use) vs control group (non-AI-use) to listen skill development shows us some significant differences. Mean of scores in VAR00002 (10.71 vs 10.15) and VAR00003 (13.57 vs 10.90) were higher for the experimental than control group. The implication is that students assisted by AI proceeded much better, particularly in VAR00003 where their average score was substantially elevated. However, with VAR00001, experimental group mean (7.86) was less than control group mean (9.05), which indicates that the support that AI provides only helps with higher level listening tasks not with basic tasks. The mode is indicative of the experimental group's higher and less varied most frequent scores. To illustrate, for VAR00003 in the experimental group, the mode was 10 and in the control group the mode was 6 indicating that the performance was better when AI was used. The standard deviation tells us how dispersed the scores are. The standard deviations of the three variables (3.61, 4.23, 4.40) are also less in the experimental group compared to the control group (5.67, 6.13, 6.19). That means results were more consistent for students using AI, while the control group variance was greater, with some students doing really well and others doing really poorly.

Both groups showed positive skewness which means most of the students scored below the average, however, experimental group showed higher skewness (1.066, 0.731, 0.774) where this is especially true for VAR00001, showing that there are a few students in AI (the experimental group) scoring significantly higher than the other students. Skewness (0.475, 0.427, 0.574) for control group was much lower and implies better distribution but lower availability of high achievers. The experimental group had positive kurtosis (1.062, 0.456, 0.251), which indicates that the students in the experimental group had more of a tendency to scoring closer to the mean, while the control group had negative kurtosis and they are more likely to be located away from the mean (-0.894, -1.054, -0.898). This means that AI-supported learning resulted in more consistent outcomes while the traditional methods yielded mixed results.

Table correlation of three variables (VAR00001, VAR00002, and VAR00003) with the experimental group and the control group showed a noteworthy positive relationship between the variables, yet the correlations of the control group are marginally stronger. This meant that, among the students who did not engage in AI, performance across the

three skills was more tightly correlated – when they improved in one area, their performance in the others also improved by a similar amount.

The One-Sample Test demonstrates that there are differences between the experimental group who used the AI for enhancing the listening skills and the control group who designated not to use that. The means difference tells us how much each group's scores went up. Mean differences of the experimental group were 7.86, 10.71, and 13.57, and for the control group were 9.05, 10.15, and 10.90. Both groups showed improvement, although the experimental group improved more than the control group, particularly in the third measure (VAR00003), indicating that the use of AI resulted in more positive outcomes from advanced listening exercises.

Experimental group working with AI had higher scores, was more consistent, and performed better at advanced listening tasks. The AI-enabled group, in contrast, exhibited less variance, performing better overall, and under more difficult conditions. Moreover, AI can enhance listening skills on the personal practice level from the structural feedback gained from AI listening practice, which can create a more stable and improve the result on personal practice level (Huang and Rappa, 2023).

Discussion and Conclusion

Comparing the AI-assisted experimental group to the non-AI control group reveals significant differences in how their listening skills developed. In two out of three listening tasks the experimental group performed better than the control group with the largest difference observed in advanced task VAR00003. Students displayed improved abilities to manage complex listening tasks as shown by higher average scores on tasks VAR00002 and VAR00003 after using AI-assisted learning. The better performance of the control group in the basic task VAR00001 indicates that students need time to adapt to AI tools before they show improvement in basic listening skills.

The experimental group demonstrated better performance and more consistent results as shown by their smaller standard deviations. AI technology improves student achievement levels and simultaneously reduces differences in performance among students. Distribution patterns with positive skewness and kurtosis reveal that most students performed around the average score but some achieved outstanding results which led to a balanced performance distribution. The experimental group outperformed the control group in advanced tasks showing their stable results which demonstrate AI's ability to boost higher-level listening comprehension skills. The findings of this study support Huang & Rappa's 2023 research which demonstrates that AI facilitates structured feedback and personalized exercises resulting in more reliable and enhanced learning outcomes.

The study results demonstrate that using Copilot AI leads to significant improvement in student listening comprehension. Students who used Copilot AI demonstrated both higher average scores and more significant progress than those in the control group. The study shows better listening comprehension development when students use Copilot AI for daily conversations compared to traditional learning methods. Students expressed a generally positive view of their experience with Copilot AI. Qualitative data revealed that the students appreciated AI for making their course interactive and engaging. The authentic spoken English practice with Copilot AI helped participants achieve

higher fluency and confidence levels. The combination of personalized discussions and immediate feedback enhanced both understanding and processing of spoken language which demonstrated the AI's utility as a listening comprehension tool. This approach demonstrates that specific feedback enhances the development of listening accuracy and comprehension skills during the learning process. The students successfully adjusted to the technology but encountered challenges with complex prompts and maintaining pace during dialogues. Despite the challenges encountered these problems did not significantly affect the final learning results. The patient and adaptive features of Copilot AI enabled repeated practice with the same material which helped reduce anxiety and improved students' ability to understand spoken English. The benefits of Copilot AI in improving listening comprehension skills surpass its challenges.

Students need access to technology and technical support to prevent disruptions so they can use the tool effectively. Because students felt more comfortable practicing with Copilot AI due to its non-judgmental nature educators should establish a low-anxiety learning environment. The system builds students' confidence in communicating during listening exercises while reducing their fear of making mistakes as they practice independently. The study demonstrates that Copilot AI enhances students' listening comprehension abilities while providing useful error correction support and inspiring positive learning attitudes. The combination of immediate personalized feedback and interactive learning methods enabled students to improve their spoken English understanding while also boosting their confidence.

There are some recommendations for educators to enhance students listening skills.

Teachers should incorporate Copilot AI into listening activities.

Educators should encourage to have sufficient knowledge to integrate AI tools correctly into the teaching process and act as a facilitator.

Educational organizations must guarantee students have access to suitable technology and reliable internet, along with technical support to address potential issues with using Copilot AI.

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From Deficiency to Recovery: How the COVID-19 Pandemic Altered Bone Metabolism

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Abstract: Osteoporosis is a leading bone health disorder in Albania, especially among postmenopausal women and the elderly. Studies conducted in the Albanian population in 2015 showed that the prevalence of low bone mineral density in women was 28.4%. Bone turnover markers (BTMs) serve as critical tools in evaluating bone metabolism and managing osteoporosis and other skeletal disorders. Research on BTMs in albanian population has primarily focused on postmenopausal women, however, the clinical utilization of BTMs in routine diagnostics remains limited. The present analysis examines the trends in BTM utilization in Albania over different time periods, examining shifts in awareness, diagnostic applications, and research focus. Our work evaluates changes in BTMs and Vitamin D levels before, during, and after the pandemic, highlighting their potential implications for skeletal health. The research primarily focused on three key biomarkers: Vitamin D, osteocalcin and beta-CTX. Our findings highlight that overall Vitamin D levels were lower before the pandemic 23.3 ng/mL in 2018, whereas in 2024, levels increased to 27.41 ng/mL, trending from insufficiency toward normal values. Despite improved Vitamin D levels, beta-CTX concentrations, an indicator of bone resorption, showed a rising trend from 0.271 ng/mL in 2018 to 0.365 ng/mL in 2024, suggesting increased bone turnover. Meanwhile, osteocalcin, a bone formation marker, declined from 18.58 ng/mL in 2019 to 16.32 ng/mL in 2020 and partially recovered to18.96 ng/mL in 2024. While public awareness and supplementation efforts have successfully improved Vitamin D levels, our data indicate that bone turnover markers, particularly osteocalcin and beta-CTX, remain low in the population. By identifying trends and gaps in BTM usage, this study aims to encourage further research and enhanced clinical adoption, ultimately contributing to improved bone health management in Albania.

Keywords: Bone metabolism, Osteocalcin, Beta CTx, Vitamin D, Post COVID-19.

Introduction

When we think of COVID-19, we often focus on its respiratory impact. But beneath the surface, literally within our bones another story unfolded. The COVID-19 pandemic disrupted many aspects of daily life, including dietary habits, sun exposure, and healthcare access, all of which may have significantly impacted bone health. Current evidence and reports indicate the direct relation between SARS-CoV-2 infection and bone health and thus warrant future research in this field.

Osteoporosis is a leading bone health disorder in Albania, especially among postmenopausal women and the elderly. Studies conducted in the Albanian population in 2015 showed that the prevalence of low bone mineral density in women was 28.4% (Kollcaku, 2015). Data from Balkan regional studies suggest that 15–30% of postmenopausal women in the region have osteoporosis, with a similar trend likely in Albania with studies reporting 33.5% of postmenopausal women in 2022 (Hoxhaj, 2025). Fragility fractures are a significant burden due to untreated osteoporosis. Hip fractures are among the most common, with a notable increase in incidence among the elderly. For instance, the International Osteoporosis Foundation highlights that fragility fractures represent a significant and growing economic burden worldwide, with annual costs in Europe estimated at €37.5 billion and projected to increase by 27% by 2030 (https://www.osteoporosis.foundation/policy-makers/burden-osteoporosis). The number of osteoporotic fractures is certain to increase in both men and women as a result of the ageing population and two thirds of all incident fractures occurred in women. Various organizations, including the International Osteoporosis Foundation (IOF), the International Federation of Clinical Chemistry and Laboratory Medicine (IFCC), the National Osteoporosis Foundation, and the National Bone Health Alliance (NBHA), have acknowledged the need to advance research and standardization in the field of bone turnover markers (Bauer, 2012).

Bone metabolism is a dynamic process regulated by a balance between bone resorption and bone formation, influenced by various factors, including hormonal regulation, physical activity, and nutritional intake. Under normal physiological conditions, the process of bone resorption occurs over approximately 10 days, while bone formation requires around three months. Each year, up to 20% of the skeleton may be renewed through bone remodelling (Shetty, 2016). Bone strength is influenced by both quantitative measures like bone mineral density (BMD) typically evaluated using dual-energy X-ray absorptiometry (DXA) and qualitative aspects, including bone bone geometry, microarchitecture, and the composition of its mineral and organic matrix, with are generally not assessed in routin clinical settings (*Rossini, 2016)*. Biochemical markers used to evaluate bone turnover consist of enzymes and nonenzymatic peptides originating from both cellular and noncellular components of bone (Lorentzon, 2019). The most commonly utilized markers for bone formation include N-terminal propertied of type I collagen (PINP), osteocalcin, and bone-specific alkaline phosphatase. For bone resorption, widely used markers include C-terminal cross-linking telopeptide of type I collagen (bCTX-I), N-terminal telopeptide of type I collagen (NTX), deoxypyridinoline, hydroxyproline, and tartrate-resistant acid phosphatase isoform 5b (TRAP5b) (Lorentzon, 2019). The International Osteoporosis Foundation (IOF) and the International Federation of Clinical Chemistry and Laboratory Medicine recommend serum CTX-1 (sCTX) as a reference marker for bone resorption, serum P1NP and Osteocalcin for bone formation, particularly for assessing fracture risk and monitoring treatment in clinical practice (*Vasikaran, 2011)*. Bone formation markers are products of active osteoblasts expressed during different phases of

their development and are considered to reflect different aspects of osteoblast function and bone formation (Shetty, 2016). Bone resorption markers are formed during bone resorption phase of bone remodelling including molecules released during osteoclasts activity (Shetty, 2016). Bone turnover markers (BTMs) serve as critical tools in evaluating bone metabolism and managing osteoporosis and other skeletal disorders (Shetty, 2016). In Albania, their clinical and research applications have evolved over the years, but the research on BTMs in this population has primarily focused on postmenopausal women, highlighting increased bone resorption and decreased bone formation as significant factors contributing to osteoporosis risk (Hoxhaj, 2025 & Hysi 2013). However, the clinical utilization of BTMs in routine diagnostics remains limited. By identifying trends and gaps in BTM usage, this study aims to encourage further research and enhanced clinical adoption, ultimately contributing to improved bone health management in Albania. Bone turnover markers exhibit a positive correlation with vitamin D levels, indicating that higher vitamin D concentrations are associated with increased bone remodelling activity (Shetty, 2016 & Bikle 2012). Vitamin D, on the other hand, is a **regulator** of bone metabolism (Bikle 2012 & Suda 2004). It plays a key role in **calcium and phosphate homeostasis**, which indirectly influences bone turnover (Suda 2004). Low vitamin D levels can lead to **secondary hyperparathyroidism**, increasing bone resorption (Rumano, 2023 & Suda 2004). During the pandemic in 2020, there was an increased awareness of vitamin D importance in immune function, leading to greater supplementation practices in the post-pandemic period. Results from studies about food supplements in Albania during COVID-19 pandemic has showmen that vitamin D is one of the supplements that has best levels of evidence and reported from the pharmacists, one of the most used supplements was the combination of Vitamin C, Vitamin D direct and Zinc, a product from FORTEX ((Rumano, 2023).

The present analysis examines the trends in BTM utilization in Albania over different time periods, examining shifts in awareness, diagnostic applications, and research focus. Comparative analysis with regional and international data will provide a contextual understanding of Albania's progress in integrating BTMs into routine medical practice. Our work evaluates changes in bone turnover markers (BTMs) and Vitamin D levels before, during, and after the Covid-19 pandemic, highlighting their potential implications for skeletal health. The research primarily focused on three key biomarkers: Vitamin D, osteocalcin (a bone formation marker), and beta-C-terminal telopeptide of type I collagen (beta-CTX, a bone resorption marker). These parameters were analyzed to evaluate changes in bone metabolism before, during, and after the COVID-19 pandemic. Systemic inflammation, immobilization, corticosteroid use, and reduced healthcare access in infected individuals have contributed to altered bone remodeling, with increased bone resorption markers (e.g., C-terminal telopeptide of type I collagen, CTX-I) and decreased bone formation markers (Osteocalcin) (Salvio, 2020).

Method

This study analyzed database from a private medical laboratory, Intermedia Center, located in the capital city, Tirana, Albania. We conducted an analysis of bone turnover marker cases presented to our medical center over three distinct time periods. The data were collected over a period from January 2017 to September 2024, allowing for a comprehensive assessment of trends in Vitamin D levels and bone turnover markers before, during, and after the COVID-19 pandemic. The pre-COVID-19 period was defined as the 36 months from January 2017 to December 2019, while the COVID-19 pandemic period covered January 2020 to December 2021. The period from January 2022

to December 2024 was selected to represent the post-pandemic era, as it reflects the timeframe following the widespread easing of COVID-19 restrictions and the return to normal healthcare access, lifestyle patterns, and supplementation practices.

To eliminate duplicate samples, key identifiers such as date of birth and medical record number were extracted. The analysis focused on the frequency of these cases, the demographic characteristics of the populations involved, and the demand for consultation from specialist physicians. For a comprehensive analysis, our study population was divided into subgroups based on gender, season, age and vitamin D status. This stratification allowed for a more detailed evaluation of variations in bone turnover markers and Vitamin D levels across different demographic groups. Within this study, we analyzed osteocalcin, beta CTx, and vitamin D levels, as P1NP was not included due to its limited availability in Albania. Additionally, the usage rate of P1NP in our laboratory was extremely low, making it an impractical marker for analysis. All markers of bone turnover are measured in serum. Osteocalcin and beta-CTx were measured using the Cobas 6000 analyzer (Roche), while 25-hydroxyvitamin D (25-OHD) was analyzed with the Maglumi X8 SNIBE system.

Results

During the COVID-19 pandemic, there was a significant increase in the use of vitamin D supplements, as many people sought ways to support their immune systems. Given the growing interest in vitamin D and its potential role in immune function, we were interested in evaluating how this surge in supplementation might affect our population. Specifically, we aimed to assess whether the increased recommendation of vitamin D during this period had any notable impact on bone health outcomes. From the data collected, we note that the demand for measuring vitamin D levels has increased over the years, accompanied by a growing interest in bone metabolism markers such as osteocalcin. The analysis of test request data from 2017 to 2024 reveals a marked increase in the demand for vitamin D testing, significantly outpacing the growth observed for bone turnover markers such as osteocalcin and beta-C-terminal telopeptide of type I collagen (beta-CTx). Vitamin D testing rose dramatically from 1,198 patient requests in 2017 to 28,098 in 2024, representing an approximate 23-fold increase over the seven-year period
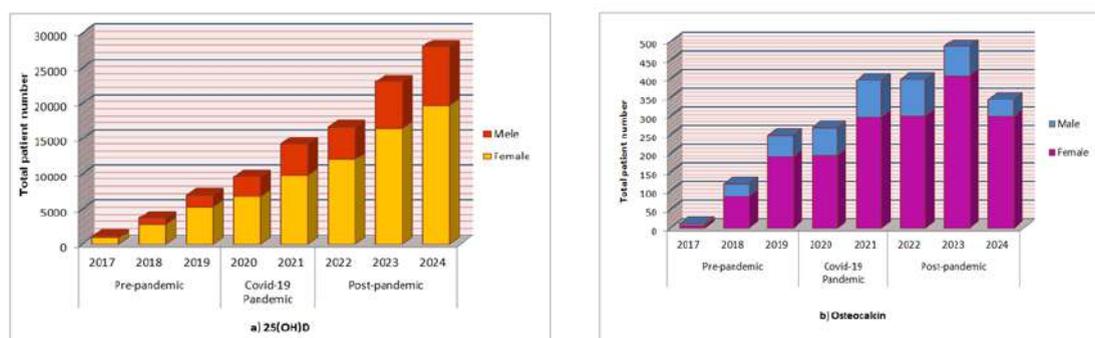

Figure 1. Annual Number of Patients Tested for a) Vitamin D and b) Osteocalcin (2017–2024).

In contrast, testing for bone turnover markers, while also increasing, demonstrated a more modest uptake. Osteocalcin testing increased from 12 patient requests in 2017 to 345 in 2024, corresponding to nearly a 29-fold rise. Similarly, beta-CTx testing rose from 10 patients in 2017 to 67 patients per year in 2023 and 2024, indicating a 6.7-fold increase.

The **average age** of the study population decreased slightly across the study period. Regarding the average age of participants tested for Vitamin D, a gradual decrease was observed during the post-pandemic period compared to both the pandemic and pre-pandemic periods, as in 2017 the average age was 44.65 years old, while in 2024 it was 35.41 years old. In contrast, for osteocalcin levels, the average age was lower during the pre-pandemic period and higher in the post-pandemic period—specifically, 43.75 years in 2017 and 53.49 years in 2024. As for beta-CTx, no significant differences were observed in the average age of the study population across the examined time periods.
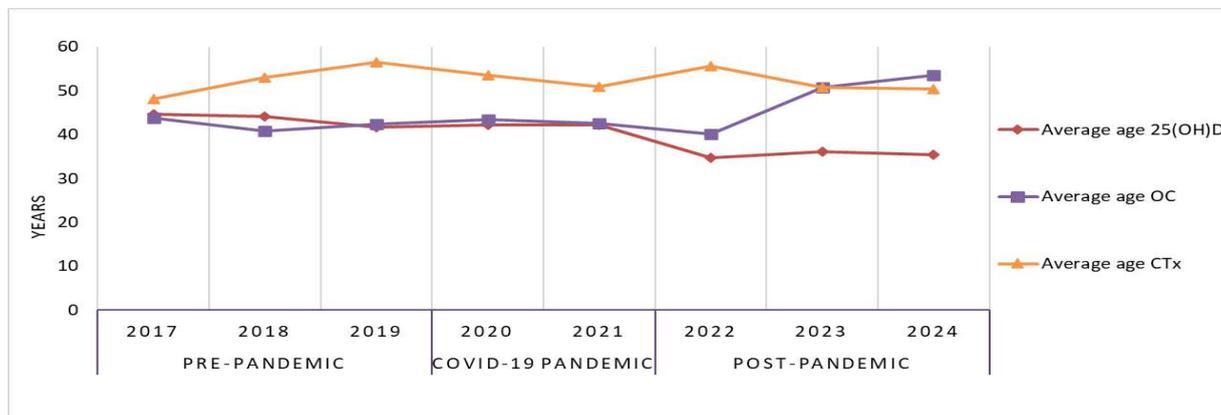

Figure 2. Average Age of The Study Population for Vitamin D, Beta-CTX, And Osteocalcin During the Pandemic.

The mean concentration of 25(OH)D for the total population reached 27.76 ng/mL in 2020, a marked rise from 22.35 ng/mL in 2019, suggesting an effect of the pandemic on Vitamin D levels. This increase was especially pronounced in the male population, where Vitamin D levels increased from 24.17 ng/mL in 2019 to 29.6 ng/mL in 2020, and further increased to 30.04 ng/mL by 2024. In contrast, females showed a smaller increase, from 21.7 ng/mL in 2019 to 26.82 ng/mL in 2024. A marked increase was observed during the first year of the COVID-19 pandemic, reaching 27 ng/mL in 2020, followed by a slight decrease to 25.53 ng/mL in 2021. In the post-pandemic years, values remained relatively stable, with 25.33 ng/mL in 2022, 25.84 ng/mL in 2023, and 26.82 ng/mL in 2024.
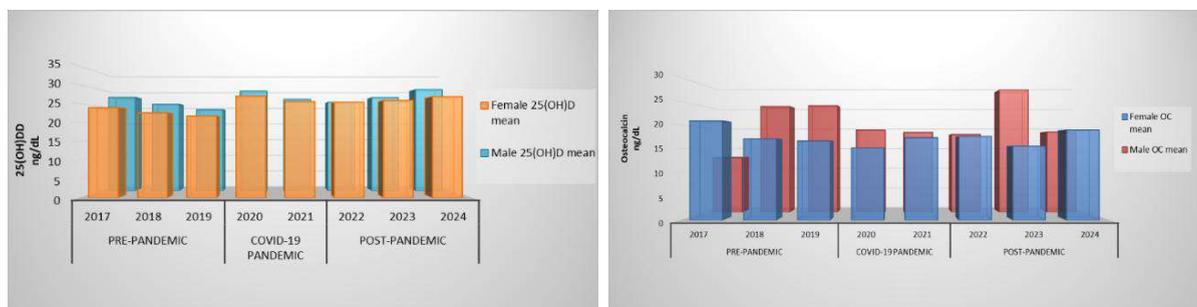

Figure 3. Annual Mean Concentration of Serum 25(OH)D And Osteocalcin In Study Participants (2017–2024).

The **mean osteocalcin levels** displayed some fluctuations over time. In the **Pre-pandemic** period (2017–2018), the mean osteocalcin concentration was 18.4 ng/mL in 2017 and 21.48 ng/mL in 2018. The **COVID pandemic** period (2019–2021) witnessed a drop in osteocalcin levels, reaching 16.32 ng/mL in 2020, before slightly increasing to 17 ng/mL in 2021. During the **post-pandemic** period (2022–2024), osteocalcin levels showed a recovery, with a mean of 18.96 ng/mL in 2024, returning to the range seen in the Pre-pandemic period. During the **COVID pandemic,** both

males and females experienced a decrease in osteocalcin levels. The mean osteocalcin for males dropped to 19.47 ng/mL in 2020 from 25 ng/mL in 2019, while females saw a decrease from 17.1 ng/mL in 2019 to 15.16 ng/mL in 2020. In the **post-pandemic** period, males' osteocalcin levels stabilized at 18.97 ng/mL in 2024, while females' levels remained slightly lower at 18.96 ng/mL, showing a recovery trend. Despite this recovery, males still exhibited significantly lower osteocalcin levels than females at all time points.

A statistical analysis was performed to assess changes in β-CTX (beta crosslaps) levels across three time periods. Although slight **variations** in mean β-CTX levels were observed across the three periods (pre-pandemic, pandemic, and post-pandemic), all values remained well within the normal reference range (<0.6 ng/mL). The observed changes, ranging from 0.271 ng/mL to 0.418 ng/mL, were not statistically or clinically significant.
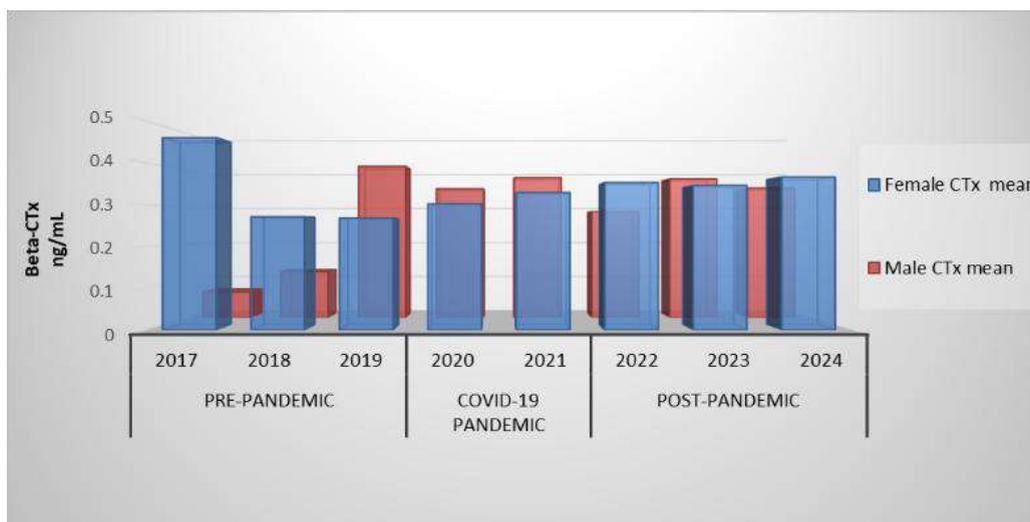

Figure 4. Mean B-CTX Concentrations Across Study Piriods with Comparison by Sex.

Considering the impact of COVID-19-related safety measures, changes in vitamin supplementation habits, and variations in outdoor physical activity, we investigated the seasonal patterns in Vitamin D and osteocalcin concentrations over the study period. The graphical analysis reveals that Vitamin D levels in both males and females are lowest during the winter and spring months, with a clear increase during the summer, likely reflecting greater sunlight exposure during this period. Following the COVID-19 pandemic, mean vitamin D concentrations were consistently higher throughout the year, with values approaching the normal reference range, particularly during the summer months. In contrast, osteocalcin levels were higher during the pre-pandemic period but declined in both males and females during the COVID-19 pandemic. These reduced levels persisted throughout the post-pandemic years, remaining consistently lower than pre-pandemic values.

Unlike Vitamin D, osteocalcin concentrations did not exhibit noticeable seasonal variation, suggesting that bone formation activity, as reflected by osteocalcin, may be less influenced by seasonal factors such as sunlight exposure and more affected by long-term physiological or lifestyle changes associated with the pandemic period. In 2017, a noticeable difference in osteocalcin levels was observed between females and males, with males showing lower concentrations. This disparity may be attributed to particularly low osteocalcin measurements among males during

that year, potentially reflecting sex-specific differences in bone turnover or sample variation. Conversely, as the number of male cases evaluated for osteocalcin increased, the mean osteocalcin levels in the male population rose markedly.
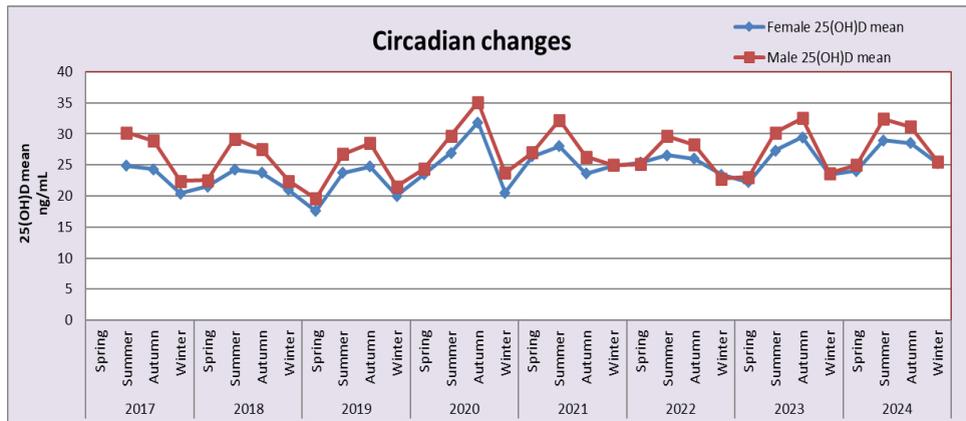

Figure 3. Circadian Changes of Serum 25(OH)D Concentrations for Bothe Male and Female Groups.
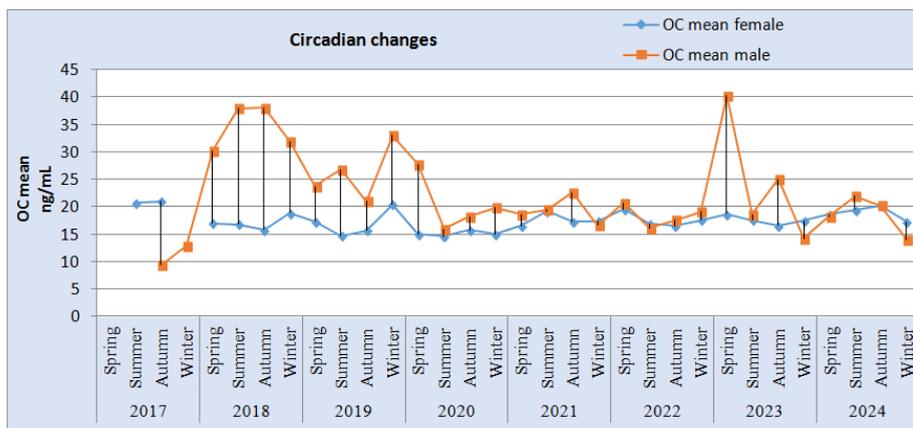

Figure 4. Circadian Changes of Serum Osteocalcin Concentrations for Bothe Male and Female Groups.

Stratification of the study population according to vitamin D status revealed significant changes in the prevalence of vitamin D deficiency over time. In the pre-pandemic period, 40.3% of individuals were classified as vitamin D deficient. This proportion decreased to 28.6% during the pandemic and continued to decline modestly to 27% in the post-pandemic period. While deficiency rates declined, a significant portion of the population remained insufficient, indicating that although vitamin D levels improved, many individuals still did not reach optimal status. Although the number of individuals tested for vitamin D increased significantly, the number of deficient individuals decreased markedly, while the percentage of people with toxic levels of vitamin D remained negligible (0.4%–0.6%), indicating that excessive supplementation or toxicity was rare and not a public health concern in this cohort.
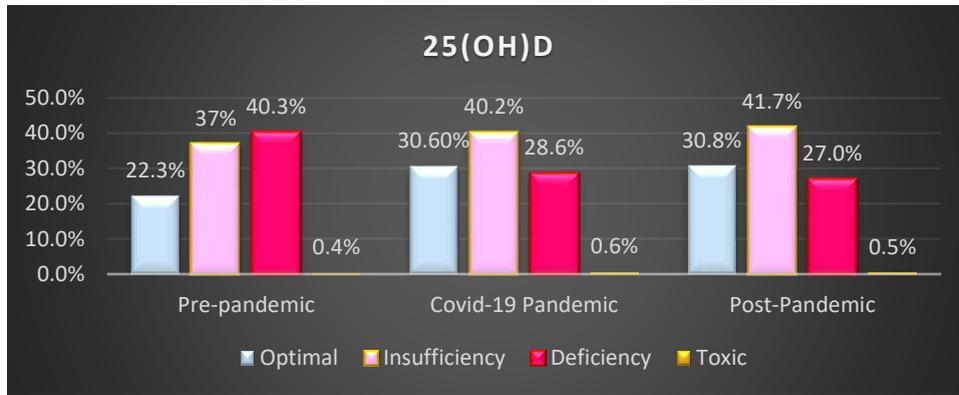
Figure 5. Comparative Assessment of Vitamin D Status Across Pandemic-Related Time Intervals.

Comparison of osteocalcin concentrations across the three time periods revealed notable shifts in the distribution of optimal, low, and high values. Osteocalcin levels demonstrated a progressive improvement in the proportion of individuals with optimal values over time. Prior to the pandemic, 71.5% of participants exhibited optimal OC levels, which increased to 81.1% during the pandemic and further to 82.3% in the post-pandemic period. Conversely, the prevalence of low OC levels declined from 23.1% pre-pandemic to 18.2% during the pandemic, reaching 16.0% post-pandemic.
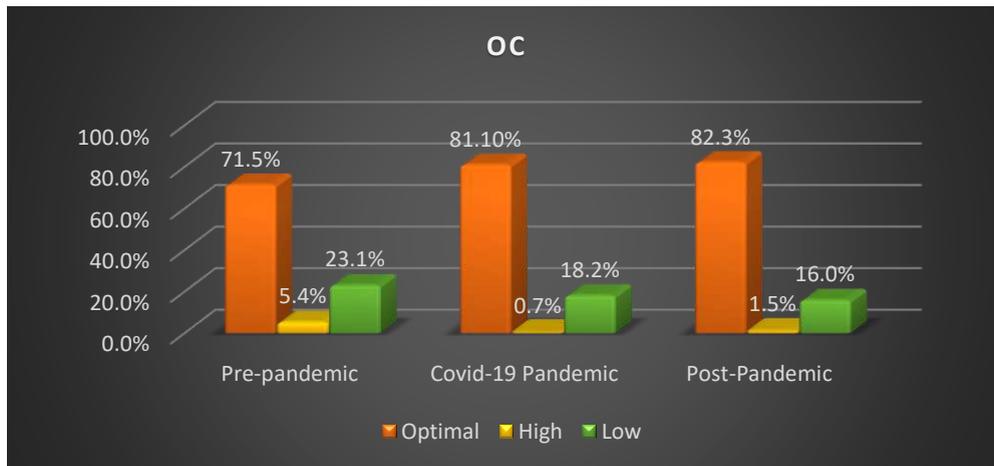
Figure 6. Overview Of Osteocalcin (OC) Status Across Pre-Pandemic, Pandemic, And Post-Pandemic Periods.

Given the role of β-CTX as a marker of bone resorption, we examined its levels over the course of the COVID-19 pandemic to identify any trends related to pandemic-related lifestyle changes. The graphical representation indicates that the percentage of individuals with elevated β-CTX levels was stable in both the pre-pandemic and post-pandemic phases. In contrast, a notable increase was observed during the pandemic, with the proportion rising to 11.6%—approximately twice the pre-pandemic value. This suggests a significant surge in bone resorption activity during the COVID-19 pandemic period.

Figure 7. Changes In B-CTX Classification Over the Pre-Pandemic, Pandemic, And Post-Pandemic Phases.

Discussion

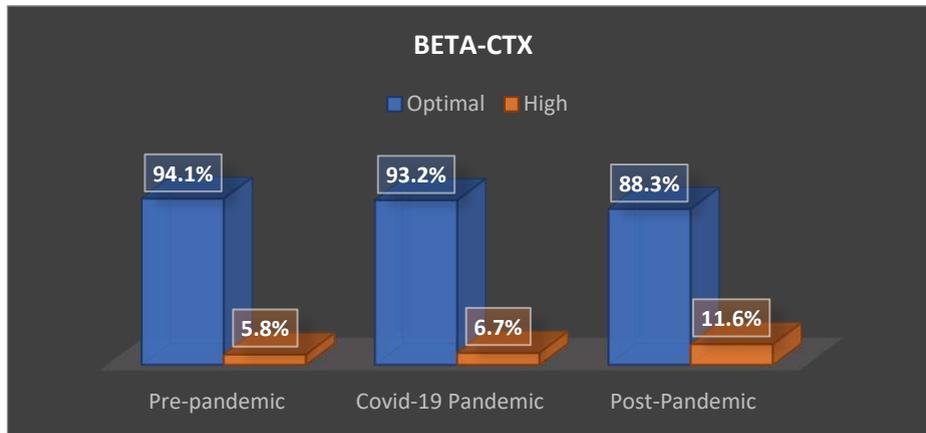Before COVID-19, bone health was a growing focus in preventive medicine. With adequate exposure to sunlight, reasonable activity levels, and dietary balance, many individuals maintained a healthy bone turnover rate. This equilibrium was critical in preventing conditions like osteoporosis. However, this stability was vulnerable to sudden changes, the pandemic disrupted nearly every one of these factors. COVID-19 has had several direct and indirect effects on bone metabolism due to the virus itself, the body's immune response, lifestyle changes during the pandemic, and treatments used for the disease.

For the purposes of this study, the years 2017–2019 were defined as the *pre-pandemic period*, as they represent the timeframe immediately preceding the emergence and global spread of COVID-19. During this interval, no confirmed cases had been reported, and normal healthcare practices and population behaviors were maintained. The period 2020–2022 was designated as the *pandemic phase*, aligning with the first confirmed COVID-19 cases in the Western Balkans, including North Macedonia (26 February 2020), Bosnia and Herzegovina (5 March 2020), Serbia (6 March 2020), Albania (9 March 2020), Kosovo (13 March 2020), and Montenegro (17 March 2020) (http://www.dep.gov.ba). In response, all countries in the region implemented nationwide lockdowns and stringent public health measures. Specifically, Albania declared a state of natural disaster on 24 March 2020 (Council of Ministers Decision No. 243), enforcing emergency restrictions to contain the outbreak (https://www.venice.coe.int/files/EmergencyPowersObservatory/ALB-E.htm). The years 2023–2024 were classified as the *post-pandemic period*, following the official announcement by the World Health Organization on 5 May 2023 that COVID-19 no longer constituted a global health emergency (http://www.dep.gov.ba). This categorization reflects a return to relative public health stability and the gradual resumption of pre-pandemic conditions.

Further analysis of the data revealed that the increase in Vitamin D levels during the pandemic was accompanied by a substantial increase in the number of participants, particularly among females. The number of female participants surged from 929 in 2017 to 19,710 in 2024, reflecting a broader trend of heightened awareness of health during the pandemic. Similarly, male participation grew, though at a slower rate, from 269 in 2017 to 8,388 in 2024. Despite the relative increases, the absolute number of tests requested for osteocalcin and β-**CTx** remains significantly lower than

for vitamin D. This disparity suggests that while there is a growing interest in assessing bone turnover markers, their use in routine clinical practice is still limited. Potential reasons may include limited clinician familiarity, cost considerations, or uncertainty regarding the clinical utility of these markers in guiding patient management outside of specific contexts, such as osteoporosis treatment monitoring or metabolic bone disease.

Vitamin D levels improved over the study period, with a marked rise during the COVID-19 pandemic. Males consistently exhibited higher levels of Vitamin D than females, and both genders showed upward trends, particularly during the pandemic. Age demographic changes also played a role in shaping the trends, with a younger population emerging in the later years of the study. These findings suggest that the pandemic period may have led to increased awareness and supplementation of Vitamin D, contributing to better overall Vitamin D status, especially in males and younger individuals.

The study results demonstrated that the prevalence of vitamin D insufficiency in Albania is notably high, similar to other Balkan countries, where lifestyle, dietary habits, and limited sun exposure during certain seasons contribute to widespread deficiency. This deficiency contributes to the dysregulation of bone turnover, especially in vulnerable groups such as postmenopausal women and the elderly. Our data show that overall Vitamin D levels were lower before the pandemic (24.5 ng/mL in 2017 and 23.3 ng/mL in 2018), whereas in 2024, levels increased to 27.41 ng/mL, trending from insufficiency toward normal values. The rise in the proportion of individuals with optimal vitamin D status highlights a positive shift in public health behaviour, likely due to increased supplementation and health awareness during and after the pandemic. These trends underscore the heightened emphasis on vitamin D status in clinical screening and preventative care, while also pointing to an emerging, though still limited, role for biochemical markers of bone turnover in broader clinical settings.

A growing proportion of individuals fell within the optimal osteocalcin range during and after the pandemic, despite the overall decrease in mean OC concentrations noted in earlier analyses. The drop in osteocalcin during the pandemic (from 21.48 ng/mL in 2018 to 16.32 ng/mL in 2020) followed by a recovery suggests potential disruptions in bone turnover during the pandemic that normalized in the post-pandemic years. This may reflect a tightening of the distribution around the normal range or a shift away from extremes (low/high values). There is a consistent decline in the prevalence of low OC levels across the study period. This trend may indicate a slight recovery or stabilization of bone formation markers, potentially due to increased vitamin D levels or changes in lifestyle, nutrition, and health care access post-pandemic. High osteocalcin values became rare during the pandemic and remained low afterward. This could reflect less bone turnover due to reduced physical activity or other metabolic changes during this period.

The rise in 25(OH)D levels over time correlates with a trend of increasing β-CTx levels in the early stages of the pandemic (2020-2021). This might seem counterintuitive because vitamin D is expected to reduce bone resorption by promoting calcium absorption and osteoblast activity. During the pandemic, stress levels were elevated, and physical activity decreased, which could have contributed to higher bone resorption, reflected in increased β-CTx levels. Additionally, inflammation, which is often seen during periods of stress or illness, can stimulate osteoclast activity, increasing β-CTx. While vitamin D helps maintain bone health, factors such as changes in diet, physical activity, and stress during the pandemic might have disrupted the usual balance between bone formation and resorption. The β-

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CTx increase during the pandemic could reflect a response to these disruptions. Although vitamin D levels rose during the pandemic due to increased supplementation, the effects of vitamin D on bone turnover markers may not be immediate. The bone resorption marker may have continued to fluctuate during the pandemic due to a lag in the full effects of supplementation or other environmental factors.

Vitamin D supplementation during the winter months may have contributed to stabilizing or mitigating declines in osteocalcin levels observed during the COVID-19 pandemic. Given that vitamin D plays a crucial role in bone metabolism by promoting calcium absorption and supporting bone formation, its increased intake during periods of limited sunlight could help maintain osteoblast activity reflected by osteocalcin concentrations. Although osteocalcin levels showed an overall decrease during the pandemic, the use of vitamin D supplements might have prevented a more pronounced reduction, especially during the winter when endogenous vitamin D synthesis is low. However, direct causality cannot be confirmed without specific supplementation data, and other factors such as reduced physical activity during lockdowns may also have influenced osteocalcin dynamics.

Despite improved Vitamin D levels, β-**CTx** concentrations, an indicator of bone resorption, showed a rising trend from 0.271 ng/mL in 2018 to 0.365 ng/mL in 2024, suggesting increased bone turnover, which may be attributed to post-pandemic lifestyle changes, and potential disruptions in osteoporosis management, and long-term inflammatory effects of COVID-19. Meanwhile, osteocalcin, a bone formation marker, declined from 18.58 ng/mL in 2019 to 16.32 ng/mL in 2020 and remained at minimal borderline levels in 2021 (17 ng/mL), indicating a temporary suppression of bone formation during the pandemic. Although osteocalcin levels partially recovered (19.37 ng/mL in 2023 and 18.96 ng/mL in 2024), the slower increase compared to Vitamin D suggests a delayed response in bone formation. While higher Vitamin D levels may provide protective benefits, the concurrent increase in bone resorption requires further investigation into skeletal health trends in post-pandemic populations. The concurrent rise in bone resorption and the unstable recovery of osteocalcin highlight the need for further investigation into long-term skeletal health risks post-pandemic. While public awareness and supplementation efforts have successfully improved Vitamin D levels, our data indicate that bone turnover markers, particularly osteocalcin and β-**CTx**, remain low in the population. This suggests that attention has been primarily focused on Vitamin D, while the importance of bone metabolism has been overlooked. In light of these findings, greater emphasis should be placed on the clinical use of bone turnover markers to improve bone health management and prevent long-term skeletal complications in Albanian population.

Conclusion

The COVID-19 pandemic initially disrupted bone metabolism through vitamin D deficiency, increased bone resorption, and reduced physical activity. However, the post-pandemic period has seen a trend toward recovery, driven by increased supplementation, awareness, and a return to normal physical activity levels. Future research should focus on long-term skeletal health implications and potential strategies to mitigate similar risks in future public health crises.

The observed increase in mean 25(OH)D concentration across the study period (from 2017 to 2024) can likely be attributed to increased awareness, lifestyle changes, and health interventions during the COVID-19 pandemic, which encouraged supplementation and improved sun exposure. The stabilization in the **Post-pandemic period s**uggests that the elevated levels achieved during the pandemic were somewhat maintained, though without a significant continued increase. Statistical analysis would be needed to confirm whether these changes were significant and to rule out other confounding factors.

The significant increase in male β-**CTx** levels from 2019 to 2020 likely reflects the combined impact of pandemic-related stress, lifestyle changes, reduced physical activity, and possible dietary deficiencies. The fluctuations observed in the **post-pandemic period** might be indicative of a period of recovery and adaptation as individuals adjusted to the post-pandemic environment, though long-term changes in health and lifestyle could still contribute to varying β-**CTx** levels.

Recommendations

Public health initiatives should National promote and possibly subsidize vitamin D supplementation, particularly during the winter and early spring months when sunlight exposure is minimal, to support bone health and reduce deficiency-related risks. Also, should emphasize the importance of safe outdoor activities to increase natural vitamin D synthesis and maintain bone metabolism, especially during periods of restrictive measures or seasonal low sunlight. Because of the low participation of male population on evaluating BTMs levels we recommend that a special attention should be given to males and other demographic groups showing altered bone metabolism profiles, tailoring interventions to address specific needs and reduce long-term skeletal risks.

National health authorities should support further research within Albania to monitor ongoing trends in bone metabolism markers post-pandemic and evaluate the effectiveness of public health interventions tailored to the Albanian context. Additional longitudinal studies are necessary to fully elucidate the long-term impact of lifestyle modifications such as reduced mobility and altered nutrition on BTMs, bone remodeling and overall skeletal integrity.

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Constructivist School Physics Labs: Integrating Inquiry, Collaboration, and Student-Driven Experimentation

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Abstract: Traditional school physics labs often emphasize procedural correctness over fostering deep conceptual understanding and scientific reasoning. This paper presents a constructivist model for physics laboratory instruction, integrating three key dimensions: Collaborative Inquiry and Problem Framing, Experimental Design and Open-Ended Investigation, and Knowledge Construction Through Peer Interaction. These dimensions align with three fundamental educational values: Epistemic Agency (student ownership of learning), Structured-Openness (balancing scaffolding and autonomy), and Distributed Cognition (learning through collaborative discourse). To bridge the gap between constructivist principles and classroom practice, we align this model with the 5E instructional framework (Engage, Explore, Explain, Elaborate, Evaluate). A structured mapping illustrates how inquiry, collaboration, and student-driven investigation can be embedded within each phase, ensuring both cognitive engagement and co-construction of knowledge. The case study, based on the results of implementing the constructivist laboratory model over the course of one year, demonstrates the clear impact of the method, with an effect size of 0.62. This result positions the developed model among instructional strategies based on collaborative learning, problem-solving, and metacognition. The model offers a pathway to transforming school physics labs into dynamic, student-centered environments where learners actively shape their learning process. We outline practical design principles for implementing constructivist labs, emphasizing effective scaffolding strategies, open-ended inquiry, and balancing guidance with learner autonomy. While assessment in constructivist settings remains challenging, we briefly discuss approaches for evaluating students' conceptual understanding and engagement in epistemic practices. This paper contributes to Physics Education Research (PER) by providing a structured yet flexible framework for redefining school laboratory instruction, fostering both conceptual depth and scientific agency. The proposed model holds implications for curriculum reform, teacher training, and future research on inquiry-based, collaborative learning in physics education.

Keywords: Constructivist Physics Lab, Inquiry-Based and Collaborative Learning, Epistemic Agency, Structured-Openness, Distributed Cognition.

Introduction

School physics laboratories are an essential component of physics education, as they provide students with the opportunity to explore and understand natural phenomena through direct or virtual experimentation. This is also reflected in the proportion of academic hours allocated to laboratory work relative to the total number of physics

course hours. For example, at the middle school level, one-ninth of the total physics hours is allocated in the Republic of Moldova (Physics, 2019), whereas in Romania, one-fourth is dedicated to laboratory activities (School Curriculum, 2017).

At the same time, research indicates that laboratory work correlates with students' academic success in physics at approximately 0.3 (Calalb & Zelenschi, 2024). In other words, 30% of "learning" is influenced by "doing." Furthermore, the way these laboratories are structured significantly impacts learning. While a well-designed and frequently used experimental environment can foster critical thinking and deep understanding (Uwamahoro et al., 2021; Walsh et al., 2022), many school laboratories remain focused on replicating fixed procedures, thereby limiting the development of both conceptual understanding (Maries, 2022) and authentic scientific competencies (Wang et al., 2021).

In this study, we will examine how, based on traditional teaching experience, we can ensure the transition to a constructivist school physics laboratory, grounded in scientifically validated teaching methods or Research-Based Instructional Strategies. We will start with the 5E model (Engage, Explore, Explain, Elaborate, Evaluate) (Bybee et al., 2006) and attempt to enhance it with three complex constructivist features:

- Collaborative Inquiry and Problem Framing
- Experimental Design and Open-Ended Investigation
- Knowledge Construction Through Peer Interaction.

Thus, the research objective is to identify the roadmap toward a constructivist school physics laboratory. We have chosen the constructivist paradigm because, according to multiple studies (Gerace, 1992; Pan & Gauvain, 2012; Calalb, 2023):

- When students construct their knowledge through their own cognitive effort, their ownership of learning increases, leading to the development of physics identity.
- The principle of recurrence is at play, where students' prior knowledge forms the foundation for new knowledge, ensuring depth and sustainability in conceptual understanding.
- Initial conceptual understanding is localized, if not even point-like, meaning it pertains to a specific situation encountered by students within the constructivist lesson.

Another important argument in favor of the constructivist school laboratory is metacognition, as our research results indicate that an improvement of one unit on the Likert scale leads to an approximate 25% increase in academic success—meaning a student with a grade of eight can become a ten (Calalb & Dabija, 2024). We emphasize that core metacognitive skills such as setting cognitive goals and selecting effective learning strategies, monitoring personal progress toward cognitive objectives, and evaluating the efficiency of one's learning (Schraw, 1998) are integrated into our physics learning model. This model incorporates elements of Inquiry-Based Science Education (IBSE), group work or collaborative learning within group projects, and Self-Directed Experimental Inquiry (SDEI).

At the same time, the model is built on a triad of values:
- Epistemic Agency, where students take an active role in the knowledge-building process (Calalb, 2020);

- Structured-Openness, which highlights the central role of the teacher in guiding students' learning efforts, emphasizing the need for Guided and Open Inquiry (Blanchard, 2010);
- Distributed Cognition, which, by facilitating the distribution of tasks among group members, equipment, digital resources, and learning environments, helps transform the school physics laboratory into a collaborative learning ecosystem that supports individual thinking through technology and social interaction (Heron, 2017; Wasserstein & Lazar, 2016).

In the same context, we emphasize that the 5E model is perfectly suited to integrating the core features of IBSE, SDEI, and Group Work into a cohesive learning unit (Ruiz-Martín & Bybee, 2022), as the school laboratory becomes a more:

- Authentic learning environment – students take control of the learning process through inquiry (Epistemic Agency);
- Flexible space – the teacher maintains a balance between guidance and autonomy (Structured-Openness);
- Collaborative setting – increased interaction in the classroom (Distributed Cognition).

Theoretical foundations of the constructivist model for physics lab

Deficiencies of traditional labs

In the traditional framework of physics laboratories, activities are often designed around detailed experimental recipes, where students follow pre-established steps to reach a specific result. These experiments are structured to ensure the reproduction of standardized procedures and the achievement of correct results, aiming to demonstrate physical laws or principles that are already known. Many of the experimental tasks in traditional laboratories are presented to students as a list of activities or a to-do list (similar to household chores), and students must complete the tasks outlined in the worksheet, leaving little room for independently directing their experiments (Wieman, 2015)). In this case, students either replicate the teacher's actions or take measurements according to the so-called "Work Procedure," such works are also referred to as "template physics labs" (La Braca & Kalman, 2021). Such laboratories neither motivate students nor contribute to the development of conceptual understanding, meaning that students do not form an accurate, coherent, and complete scientific picture of the world.

The traditional conduct of laboratory work in physics does not align with the declared character of student-centered teaching, as here the student is the object of the teaching act, in a passive role. Students simply follow the teacher's instructions without being involved in formulating questions or designing the experiment. Therefore, the student is excluded from the decision-making process, whereas it is well known that student involvement in setting learning objectives explains up to half of their success (Walsh et al., 2022).

The emphasis on procedural correctness and following detailed instructions places conceptual understanding on the back burner, although students' adherence to the steps predefined by the teacher is not necessarily a bad thing – there are a number of benefits: correct skills are developed in handling measuring instruments, and the expected result is already known. These are necessary as a foundation or starting point for inquiry-based learning. In any case, reducing the students' degree of independence in their learning significantly diminishes the outcome of that learning. Furthermore, research shows that more options in planning the experiment within the laboratory work led to an

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increase in ownership (Dounas-Frazer et al., 2017). Thus, traditional laboratories do not contribute to the development of research and experimentation skills. Therefore, in this case, we cannot expect a strong physics identity from the students.

In the traditional school laboratory, the main purpose of the experiment is to confirm, rather than demonstrate, an already known principle or law. That is, students are guided by the teacher toward obtaining an exact result, but not toward investigating open-ended questions. Thus, students come to believe that knowledge is not malleable but rigid, and it comes not from their own cognitive effort but from an authority, in this case – the teacher. As a result, conceptual understanding is weaker because, according to the research by Porter T. and Schumann K. (2018), experiments with open-ended results contribute to the formation of deep conceptual understanding. Furthermore, the lack of flexibility in experimentation limits creativity and adaptability and does not teach students to observe the effects of variables.

The traditional school laboratory minimizes discussions and collaboration at the class and group level, thus neglecting the social aspect of learning. Yet, it is known that communication is responsible for about one-third of the learning outcome (Walsh et al., 2022). Additionally, research shows that sometimes the success of the group can be greater than the success of the best member (Smith et al., 2009).

Students have a certain degree of independence when they must formulate their conclusions in their laboratory report. However, these conclusions, before being included by the students in their reports, have already been formulated several times by the teacher. That is, what is required is not so much analysis and critical thinking, but attention and memorization.

Finally, let us list a few things that make a difference in the students' reports on the conduct of the laboratory work: first, the correctness of completing the table with measurement data; second, the correctness of performing calculations according to the known formula; third, the correctness of constructing graphs of the dependencies between the investigated quantities; fourth, the conclusions and analysis of the obtained results (Calalb & Zelenschi, 2023).

Limitations in the development of critical thinking and scientific skills

Traditional physics laboratories, structured around fixed procedures and predefined results, can provide a solid technical foundation but often fail to cultivate critical thinking and authentic scientific skills, which develop when student-driven inquiry is introduced (Hofstein & Lunetta, 2004). Thus, one of the main obstacles is the absence of an authentic process of exploration and discovery. In a traditional laboratory, students are rarely faced with open-ended problematic situations, where they must formulate their own hypotheses, decide on investigation methods, or interpret ambiguous results. This reduces opportunities to practice analytical thinking and understand how scientific knowledge is constructed. However, when students do not merely follow the teacher's explanations but predict the outcome, such a laboratory becomes more effective than a traditional one (Etkina et al., 2002). It is precisely the reconciliation between students' prior assumptions or ideas and scientific explanations that fosters critical thinking and scientific competence. The starting point in such a method should be Driving Questions (Bielik et al., 2022).

Additionally, traditional laboratories offer few opportunities for reflection and metacognition. In a constructivist environment, students should be encouraged to review their ideas, identify weaknesses in their arguments, and adjust their approaches based on new information obtained. However, in a traditional setting, the focus is more on correctly executing procedures rather than explaining, interpreting results, and learning from mistakes, which form the basis of conceptual understanding (Ogundeji et al., 2019). Another problematic aspect is that students do not experience the inherent uncertainty of scientific research. In reality, scientific investigations involve contradictory data, measurement errors, and the need to adjust experimental methods. Without exposure to such challenges, students do not develop decision-making skills, the ability to manage incomplete information, or scientific reasoning, essential skills both in science and for critical thinking in daily life (Manz, 2015). Ultimately, it is about developing lifelong learning competencies in the school physics laboratory – the potential for personal and professional development long after graduation.

Moreover, the connection between the laboratory and the real world often remains superficial. Students may come to view experiments as mere exercises to verify theories from textbooks, without seeing how scientific methods are applied in research, industry, or technology. To avoid this, real-life situations are introduced at the beginning of the topic, and an attempt is made to achieve conceptual understanding without presenting the associated formulas (Calalb & Zelenschi, 2023; Kujović et al., 2022). To overcome these limitations, an inquiry-based approach is necessary, where students are actively involved in exploring phenomena, formulating questions, and constructing their own scientific explanations.

The essential dimensions of a constructivist lab

A constructivist school physics laboratory is not limited to applying predefined experimental procedures, but becomes a space for active exploration, where students take a central role in the learning process. In this context, scientific inquiry is not just an exercise in verifying known theories, but an opportunity to formulate authentic questions, design relevant experiments, and build knowledge through collaboration and reflection. Thus, according to data from the Center for Educational Evaluation and Analysis in Romania, which conducted a nationwide program for implementing physics learning through inquiry-based science education (IBSE), it was found that the specific competencies in physics reached an average of 3.69 points (on a 5-point scale) for the experimental group, compared to 3.00 for the control group (CEAE, 2023). To achieve these results, a constructivist laboratory relies on three essential dimensions: i) collaborative investigation and problem formulation, ii) experiment design and open exploration, and iii) knowledge construction through peer interaction. These dimensions create an integrated framework in which students not only reproduce existing knowledge but develop a deep understanding of scientific concepts through an active process of discovery and reasoning.

Collaborative inquiry and problem framing

To apply IBSE (Inquiry-Based Science Education) or Inquiry-Based Learning (IBL), it is necessary for the school laboratory to be an active learning environment where students can explore physical phenomena through question formulation and independent investigation. Thus, we have an educational framework that promotes critical thinking and knowledge construction through direct experience. In the school physics laboratory, this approach allows students to develop scientific competencies through an authentic research process, similar to the real practices of scientists.

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Therefore, such a laboratory, which focuses on active student participation in the discovery process, is structured into two levels of autonomy: Guided Inquiry – where the teacher provides a Driving Question or a problem to investigate, and students must decide on experimental methods and interpret the data obtained; and Open Inquiry – where students formulate the research questions, design the experiments, and critically analyze the results. To increase the degree of student autonomy, at the beginning of the semester, we have Guided Inquiry labs that gradually transition to Open Inquiry format (Kalender et al., 2021). Research shows that students prefer learning through experimentation (Camarao et al., 2024), and the use of IBL in the school laboratory enhances conceptual understanding and increases academic success with an effect size of 0.50 (Furtak et al., 2012). It should be emphasized that an IBL learning environment does not necessarily require a real laboratory; simulations and digital technologies amplify the effect size on learning (Anderson & Wall, 2016; Piyatissa et al., 2018).

Also, a central element of IBL is the stimulation of critical thinking through the analysis of experimental data, identification of errors, and revision of explanations. Unlike traditional laboratories, where the emphasis is placed on obtaining a "correct" result, inquiry-based laboratories allow students to understand the complexity of the scientific process and practice decision-making under uncertainty. It has been demonstrated that a school laboratory aimed at competency development fosters critical and analytical thinking (Walsh et al., 2022). Thus, the effect size of IBL on critical thinking skills is 1.27 (Arifin et al., 2025).

From the perspective of Science Education, learning science must reflect the authentic practices of scientific research. In this regard, the use of Collaborative Inquiry & Problem Framing provides students the opportunity to learn physics by actually practicing it. Research shows that involving students in formulating questions and structuring their own investigations improves conceptual understanding and develops scientific reasoning skills. In this sense, Duschl & Bybee (2014) recommend the 5D model of laboratory practices, which states that students are the ones who: decide what and how to measure; develop and choose measurement and data collection procedures; document and record measurement and observation results; devise representations for structuring data; and determine if the obtained data is good and reliable. The responsibility of students to decide what data to collect, how to analyse it, and how to construct their explanations actually promotes epistemic agency or ownership of cognitive goals, which, according to the Visible Teaching and Learning theory, has one of the largest effect sizes (Hattie, 2009).

It is important to emphasize that the IBL approach reflects the principles of IBSE, which emphasizes collaborative learning. Like IBSE, IBL requires both student-led research projects and work in small groups. Research shows that learning gains are higher for students who worked in groups compared to those who did not (Rodriguez & Potvin, 2021). Additionally, within group work, knowledge negotiation takes place, an essential component in developing critical thinking and metacognitive skills (Stroupe, 2014).

From the perspective of Educational Sciences, the learning process is not just an accumulation of information, but also a social construction of knowledge. Vygotsky emphasized the importance of social interaction in cognitive development, and contemporary approaches argue that learning is optimal when students are involved in reasoned discussions, where they must defend and adjust their ideas (Schwartz et al., 2021). Thus, Problem Framing, as an essential element of the constructivist laboratory, provides a framework in which students can define relevant and meaningful problems, connecting scientific concepts with their everyday experiences.

Additionally, studies in Educational Psychology show that the social context and individual differences, manifested through active, collaborative, and self-directed learning, increase intrinsic motivation and student engagement (Deci & Ryan, 2000). When students are involved in formulating scientific questions and exploring answers in teams, they have higher learning gains than in traditional settings (Morris et al., 2021).

Experimental design and open-ended investigation in constructivist school lab

The constructivist physics laboratory offers students the opportunity to actively engage in designing investigations and exploring physical phenomena in an open-ended manner. The second characteristic of such a laboratory is Experimental Design through Open-Ended Investigation, which represents an approach where students formulate questions, choose experimental methods, collect and analyze data, without having a predetermined single outcome (Duschl & Bybee, 2014). This process reflects the real way in which scientific researchers discover and validate knowledge (Hansson & Leden, 2016), stimulating both conceptual understanding and the development of critical thinking and experimental skills.

From the perspective of science education, having students design experiments and engage in open-ended investigations is fundamental to developing an authentic scientific culture. It should be emphasized that not all laboratories need to have a constructivist character. There are three types of laboratories: labs that aim to deepen previously studied material; labs focused on developing experimental skills; and labs that pursue both objectives (Walsh et al., 2022). Unlike "verification" experiments, where the goal is to confirm an established theory, open investigations allow for the generation of new questions and the exploration of phenomena beyond what is already known. Studies show that students who participate in active experimental design develop a better conceptual understanding and the ability to transfer knowledge to new contexts (Dounas-Frazer et al., 2017). By constructing their own experiments, students learn not only the laws of physics but also how these laws are discovered and tested (Furtak et al., 2012). Furthermore, this approach increases motivation for learning, as students perceive the investigations as authentic activities, akin to the real practice of scientists (Blanchard et al., 2010).

From the perspective of educational sciences, integrating Experimental Design and Open-Ended Investigation in the school laboratory allows the development of complex competencies, such as decision-making, scientific argumentation, and collaboration (Hofstein & Lunetta, 2004). This leads to the transition from learning based on experimental recipes to learning based on discovery, where students take an active role in the educational process. Additionally, designing experiments requires the integration of multiple competencies, from formulating hypotheses and choosing methods to critically analyzing results. This inter- and transdisciplinary approach is essential for developing scientific thinking and applying knowledge in real-world contexts (Bybee, 2014).

From the perspective of educational psychology, the principle of Experimental Design and Open-Ended Investigation aligns with Kolb's experiential learning theory and Bruner's theory of active knowledge construction. The measure of cognitive effort determines the level of success. In other words, students learn most effectively when they are actively involved in the discovery process, and open investigations provide an authentic context for active and self-regulated learning. Another important aspect is the cognitive management of uncertainty. Unlike traditional laboratories, where answers are predetermined, in open-ended investigations, students must analyse incomplete data, evaluate sources of error, and make decisions based on evidence. This develops metacognition and tolerance for

ambiguity, competencies that are essential not only for science but also for critical thinking in general. Thus, through Experimental Design and Open-Ended Investigation, the educational goal of metacognitive awareness and metastrategic control over learning is achieved (Kuhn, 2000).

Knowledge construction through peer interaction

A constructivist physics laboratory is not only a place for individual experimentation but also an environment for the social construction of knowledge. From this perspective, the principle of Knowledge Construction through Peer Interaction emphasizes the essential role of collaboration between students in the learning process. Through discussions, argumentation, and negotiation of ideas, students clarify their understanding, develop critical thinking, and acquire essential competencies for scientific practices and professional life. Communication skills are a core objective of laboratories (Wasserstein & Lazar, 2016), as interaction between peers stimulates the exploration of multiple perspectives on a phenomenon, facilitating the construction of a deeper understanding of physical concepts.

From the perspective of science education, learning through peer interaction reflects the real way in which scientific knowledge evolves – through debate, collaboration, and refining ideas based on experimental evidence (Hansson & Leden, 2016). Research shows that scientific discussions between students improve conceptual understanding, which forms the basis for knowledge transfer in a new situation (Banda & Nzabahimana, 2021). Furthermore, peer interaction allows for practicing scientific language in authentic contexts, which is essential for developing scientific literacy. When students explain concepts and experimental methods to each other, they do not simply reproduce information but actively process and integrate it into their own cognitive structures. Thus, the laboratory becomes a space for the active construction of knowledge, not just for the mechanical application of procedures.

From the perspective of educational sciences, peer interaction in the laboratory promotes collaborative learning, a pedagogical strategy that has been proven effective in multiple educational contexts. Unlike traditional teacher-centered models, the constructivist approach encourages students to take responsibility for their own learning and actively participate in the process of knowledge generation. Interestingly, collaborative learning also increases students' motivation and autonomy (Moron et al., 2019). Studies in the field show that students learn more effectively when they work together to solve problems, as this process forces them to confront their own conceptions and logically argue their solutions. As already mentioned, often the group's result exceeds the performance of its best member (Smith et al., 2009).

Additionally, collaboration reduces anxiety about experimental tasks and enhances motivation for learning, creating an atmosphere of mutual support and active exploration. The effects of collaboration in group work are not limited to learning; they are multidimensional: motivational, social cohesion, and individual development through cognitive elaboration. That is, when a student explains a concept to a peer, they must reorganize and restructure the information in their mind, leading to a deeper and more lasting understanding (Slavin, 2014).

From the perspective of educational psychology, peer interaction supports learning through the socio-cognitive construction of knowledge. Vygotsky's theory of the Zone of Proximal Development (ZPD) shows that students can reach a higher level of understanding through collaboration with more competent partners. Thus, in a constructivist laboratory, this principle is applied through discussions, argumentation, and co-regulation of cognitive processes.

Furthermore, studies in educational psychology highlight the role of socio-cognitive conflict – a situation in which students confront their viewpoints and are forced to adjust their conceptions to reach a consensus. This process stimulates metacognition, which is the ability of students to reflect on their own thinking and improve their learning strategies. Therefore, collaboration in the physics laboratory not only facilitates conceptual understanding but also develops essential skills for lifelong learning.

Fundamental educational values in a constructivist physics lab

In a constructivist physics laboratory, the goal is not only to acquire experimental knowledge and conceptual understanding but also to develop an authentic relationship with the scientific process. Students actively participate in building their own knowledge through direct involvement in exploration, collaboration, and critical reflection. For this experience to be authentic and sustainable, the laboratory must be grounded in essential educational values that support both cognitive engagement and student autonomy in the learning process.

These values not only define the learning environment but also directly influence motivation, the development of critical thinking, and the formation of a scientific perspective on the world. By integrating these values, the laboratory becomes a learning environment where students take an active role, experiment with ideas, collaborate to build meanings, and learn to manage the complexity of scientific investigation. The following will explore three fundamental values that form the foundation of the constructivist laboratory and give it a dynamic and formative character: Epistemic Agency, Structured-Openness, and Distributed Cognition.

Epistemic Agency in school physics lab

Epistemic Agency refers to the students' ability to take an active role in the scientific inquiry process: formulating questions, choosing exploration methods, interpreting results, and articulating conclusions based on their own reasoning. This concept contrasts with traditional approaches where students follow rigid experimental steps without the opportunity to exercise critical thinking or decision-making (Stroupe, 2014). By cultivating Epistemic Agency, the laboratory becomes an environment where students learn how to think from a scientific perspective, thus developing intellectual autonomy and investigative skills necessary for both formal education and professional and personal life.

From the perspective of science education, Epistemic Agency is fundamental to developing an authentic understanding of the scientific process. Students must be able to generate hypotheses, decide on experimental methods, and critically interpret the data obtained, rather than following fixed recipes that do not reflect the reality of scientific research (Duschl & Bybee, 2014). Studies in Science Education show that students who are involved in the decision-making process of scientific investigations develop deeper skills in scientific argumentation and evidence-based reasoning (Furtak et al., 2012). Moreover, learning based on cognitive effort fosters autonomy and gives students a sense of ownership over knowledge, which enhances their motivation and engagement in learning (Calalb, M. 2020; Dounas-Frazer et al., 2017).

From the perspective of educational sciences, Epistemic Agency is a core characteristic of student-centered learning, a fundamental principle of constructivist theories. In a constructivist environment, teachers play the role of facilitators,

offering support and guidance to students so that they gradually take control of the learning process (Blanchard, 2010). In practice, this translates into designing experimental activities that allow decision-making, reflection on the investigative process, and metacognitive discussions, where students are encouraged to analyze not only what they discovered but also how they reached those conclusions (Camarao et al., 2024). This approach promotes reflective thinking and the development of a sense of competence (Wang et al., 2021).

From the perspective of educational psychology, Epistemic Agency is closely linked to theories of self-determination and self-regulation in learning. When students are actively involved in making decisions about their own learning, they develop a sense of autonomy and control, which leads to stronger intrinsic motivation and greater commitment to learning activities (Deci & Ryan, 2000). Additionally, approaches that promote Epistemic Agency help develop metacognitive skills, essential for critical thinking and self-regulation in learning (Schraw, 1998). Students become more aware of their learning process, adjust their investigative strategies, and learn to rationally argue the decisions they make in experiments (Wang et al., 2021).

Structured-Openness in school physics lab

It must be noted that no matter how constructivist a laboratory may be, it is neither completely structured nor entirely open, without guidance or direction. Thus, Structured-Openness represents the balance between structure and freedom, offering students the opportunity to explore ideas and phenomena independently while being guided by a well-defined methodological framework (La Braca & Calvin, 2021). In this model, teachers create learning contexts that encourage authentic scientific inquiry but with an adequate level of pedagogical support. Students do not simply follow preset instructions; they are challenged to formulate questions, choose methods of investigation, and critically analyse results (Kujović et al., 2022). This combination optimizes the development of critical thinking, intrinsic motivation, and the ability to self-regulate learning (Schwartz et al., 2021).

From the perspective of science education, Structured-Openness reflects how students best learn science: through guided exploration, not fixed recipes. Studies show that extremes are not beneficial, meaning completely structured investigations reduce students' creativity and critical thinking, while entirely open investigations can be overwhelming for students, especially if inquiry-based learning is only practiced periodically (Kirschner et al., 2006). In other words, neither student independence and autonomy nor teacher guidance should be absolutized. Thus, a constructivist laboratory must maintain a balance between autonomy and guidance, allowing students to make decisions regarding experiments while also providing didactic support at key moments (Windschitl et al., 2008) through the Model-Based-Inquiry system, which includes five epistemic characteristics of scientific knowledge: ideas represented in the form of models that can be tested, revised, explained, refined, and generate new questions. This model is essential for the development of authentic scientific competencies, as it allows students to understand not only the results of an experiment but also the process by which they are obtained.

From the perspective of educational sciences, Structured-Openness supports J. S. Bruner's concept of discovery-based learning, where in a well-defined learning environment, students have the freedom to explore and make decisions. This approach correlates with the theory of learning through cognitive guidance, which argues that pedagogical support should not be completely eliminated but adapted to students' needs (Lin & Singh, 2015).

From the perspective of educational psychology, Structured-Openness is supported by theories of self-determined and self-regulated learning. Students who have some degree of control over their learning develop greater intrinsic motivation, leading to deeper engagement and more lasting results (Deci & Ryan, 2000). Moreover, providing an initial structure enhances components of axiological knowledge, such as attitude and motivation (Schwartz et al., 2021).

Distributed Cognition – learning through social interaction and idea exchange

As science learning is not an individual process but one that involves interaction, collaboration, and the exchange of ideas, Distributed Cognition emphasizes that thinking and learning are not limited to the mind of an individual but are distributed among people, artifacts, and the social and physical environment (Moron et al., 2019). In a constructivist physics laboratory, this perspective transforms learning into a collective process (Wasserstein & Lazar, 2016), where students develop their scientific concepts through discussions, confronting viewpoints, using technological tools, and reflecting on the problems being investigated.

From a science education perspective, Distributed Cognition is essential for authentic science learning because it reflects the real way science is produced: interdisciplinary teams, the use of databases, computer modelling, and global communication. Applying this principle in the school laboratory means that students not only collect data but also collaborate to interpret it, use digital tools for analysis, and share their conclusions. As previously mentioned, students working in groups, discussing ideas, and negotiating meanings, develop a deeper conceptual understanding than those who study alone (Smith et al., 2009). A concrete example is the use of interactive simulations or digital data collection systems in the laboratory, where students not only measure physical phenomena but also analyse and discuss the data collectively, relying on distributed technological and cognitive resources (Anderson & Wall, 2016; Piyatissa et al., 2018).

From the perspective of educational sciences, Distributed Cognition aligns with L. S. Vygotsky's concept of collaborative learning and the social nature of knowledge. To leverage this principle, the lesson should start with an open question or problem that encourages idea generation and negotiation among students. This process not only improves conceptual understanding but also develops the active scientific language of students. It is important to note that distributing knowledge extends beyond classroom communication and includes the use of digital educational resources. Thus, the use of online platforms and virtual simulations also aligns with the principle of Distributed Cognition and does not differ from the principles of organizing research-based learning in a traditional classroom: defining specific learning objectives; encouraging reasoning; connecting with prior knowledge; connecting with real-life situations; collaboration activities; guidance and scaffolding; presenting and discussing results (Wieman et al., 2010).

From the perspective of educational psychology, Distributed Cognition is supported by the theory of situated learning, which shows that deep understanding occurs in authentic contexts, through interaction with others and domain-specific tools (Cakmakci et al., 2020). Distributed Cognition is essential for the development of metacognitive thinking because students not only clarify their own concepts but also receive feedback from peers, which helps them adjust their reasoning and correct any misconceptions (Chi, 2009), as interactive activities are more effective than constructive activities, which are better than active learning, which in turn is better than passive learning.

Dimensions and values of the constructivist physics lab within the 5E model

Since the 5E model is quite well known among physics teachers and is an inquiry-based science education (IBSE) model, we will use it as the foundation for developing a physics laboratory model that includes the three essential dimensions of a constructivist laboratory (Collaborative Inquiry & Problem Framing; Experimental Design & Open-Ended Investigation; Knowledge Construction Through Peer Interaction) and the three fundamental educational values (Epistemic Agency; Structured-Openness; Distributed Cognition). This model is presented in Table 1.

Table 1. Correlation Of The 5E Model with The Dimensions and Values of The Constructivist Physics Lab

5E Phases	Collaborative Inquiry and Problem Framing	Experimental Design and Open-Ended Investigation	Knowledge Construction Through Peer Interaction	Epistemic Agency	Structured-Openness	Distributed Cognition
Engage	Students define the research problem	Students propose ways to explore the phenomenon	Students discuss initial hypotheses	Students formulate their own questions	Teacher facilitates discussions	Multiple student-teacher interactions
Explore	Students collectively analyse hypotheses	Students design the experiment	Students engage in dialogue and adjust the experiment	Students choose variables and measurement methods	Teacher guides without imposing a specific approach	Students select and use diverse resources
Explain	Students analyse obtained data	Students formulate explanations	Students discuss and validate conclusions	Students argue for their own conclusions	Teacher guides toward correct conceptual understanding	Students use visual tools for collaborative writing
Elaborate	Students collectively apply findings to new contexts	Students propose new research to deepen understanding	Students provide mutual feedback	Students autonomously expand their research	Teacher integrates conceptual structure with students' results	Students interact with new concepts and models
Evaluate	Students reflect on their research process	Students assess and revise the methods used	Students discuss potential improvements	Students perform metacognitive evaluation	Teacher aligns students' findings with clear evaluation criteria	Student–student and teacher–student feedback

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Phase-by-phase integration of dimensions and values

Let's now analyse the actions of the students and the teacher presented in Tab. 1 and see how they achieve the three dimensions and values of the constructivist physics laboratory. In the Engage phase, the students are the ones formulating the questions and framing the problem, refining the hypotheses through Collaborative Inquiry and Problem Framing. They also choose the experimental methods, thus supporting Experimental Design and Open-Ended Investigation. The exchange of ideas between students facilitates Knowledge Construction Through Peer Interaction, and Epistemic Agency is strengthened through student autonomy. The teacher guides the discussions without imposing rigid directions, maintaining Structured-Openness within a clear but flexible framework. Distributed Cognition is manifested through the interactions between students and the teacher, which contribute to the clarification and development of hypotheses.

In the Explore phase, students investigate the phenomenon within group work and decide how to collect data, strengthening Collaborative Inquiry and Problem Framing. They adapt experiments and test different variables, thus applying Experimental Design and Open-Ended Investigation. The exchange of observations and comparison of results contributes to Knowledge Construction Through Peer Interaction, while Epistemic Agency is supported by the students' autonomy in choosing procedures and adjusting parameters. The teacher provides guidance without imposing rigid methods, maintaining Structured-Openness, and Distributed Cognition is manifested through the use of diverse resources and active collaboration between students.

In the Explain phase, students analyse experimental data and construct explanations through collaboration, strengthening Collaborative Inquiry and Problem Framing. Interpretations may vary, stimulating the formulation of new hypotheses, which reflects Experimental Design and Open-Ended Investigation. Through discussions and reasoning, students negotiate the meaning of results, developing Knowledge Construction Through Peer Interaction. Epistemic Agency is highlighted by taking responsibility for conclusions based on experimental evidence. The teacher provides a conceptual framework that facilitates understanding without imposing a single interpretation, maintaining Structured-Openness, and Distributed Cognition is supported through the use of visual tools and digital collaboration.

In the Elaborate phase, students extend their knowledge by formulating new questions and designing additional investigations, strengthening Collaborative Inquiry and Problem Framing. They apply concepts in new contexts and test alternative hypotheses, reflecting Experimental Design and Open-Ended Investigation. Through peer-to-peer and student-teacher feedback, explanations are refined and conceptual understanding is improved, thus achieving Knowledge Construction Through Peer Interaction. Epistemic Agency is supported by students' autonomy in choosing directions for exploration, while the teacher maintains Structured-Openness by balancing guidance with research freedom. Distributed Cognition is activated through the use of diverse resources to validate conclusions.

In the Evaluation phase, students self-assess their progress, reflecting on the investigation process and adjusting their conceptions through discussions with peers. The teacher supports this reflection by providing clear evaluation criteria while allowing flexibility for various ways of expressing what has been learned. Additionally, the teacher facilitates the use of external resources to improve the learning process, encouraging collaboration and interaction among students, which contributes to a deeper conceptual understanding.

Scaffolding strategies within 5E model

Although in the constructivist physics laboratory, the teacher's actions are more aligned with the educational value of Structured-Openness, meaning maintaining the lesson within a specific framework, the teacher's role in this integrated model is determinant. Therefore, it is important to identify those scaffolding strategies that can be efficiently applied in each of the 5E phases.

In the Engage phase, we choose open-ended questions which, according to research in science education, stimulate students' curiosity and help them formulate hypotheses. As Anderson & Wall (2016) state, dialogue and collaboration lead to a deeper and more critical understanding of scientific concepts. Moreover, findings from Physics Education Research (PER) indicate that collaboration in small groups allows students to shape their research questions (Wieman et al., 2010).

In the Explore phase, research shows that the exchange of ideas between students facilitates hypothesis testing and experiment adjustments (Wasserstein & Lazar, 2016). Furthermore, interactive simulations help in exploring experimental variables and understanding abstract concepts (Piyatissa et al., 2018).

The Explain phase is associated with reasoning and reflecting on the results. In this case, the teacher's role is to guide structured discussions among students and highlight the differences between various interpretations of the students (Chi, 2009). Research shows that using visual materials and analogies helps students build deeper understandings of abstract physical concepts, promoting Distributed Cognition (Cakmakci et al., 2020).

In the Elaborate phase, students expand their understanding by applying knowledge in new contexts. Thus, in this phase, students must be guided to formulate new questions and design additional experiments, as this will help consolidate their understanding of what they have learned (Smith et al., 2009). According to research, feedback between students and the teacher helps refine students' understanding and adjust their initial research hypotheses (Anderson & Wall, 2016).

In the Evaluate phase, students' learning is consolidated, and their metacognition is enhanced. Therefore, this phase focuses on facilitating Epistemic Agency through self-assessment and mutual feedback (Chi, 2009). Additionally, research shows that evaluation and self-assessment can be improved through the use of online platforms, thus promoting Distributed Cognition (Wieman et al., 2010).

Approaches for evaluating students' conceptual understanding and engagement in epistemic practices

To assess students' level of conceptual understanding and their engagement in epistemic practices within the constructivist school laboratory, we can apply various types of assessments supported by research in Physics Education Research (PER), Science Education, and Educational Psychology. Each type of assessment should be organized in a way that reflects the outcomes of interactive and collaborative learning. Indirectly, the assessment will indicate the extent to which the principles of the constructivist school laboratory (Collaborative Inquiry and Problem Framing, Experimental Design and Open-Ended Investigation, Knowledge Construction Through Peer Interaction) and the educational values (Epistemic Agency, Structured-Openness, Distributed Cognition) have been effectively implemented.

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In order to measure students' understanding of previously learned key concepts before each topic, initial assessments in the form of open-ended questionnaires are used (Shavelson & Towne, 2002). At the beginning of the topic, formative assessment is applied to evaluate the conceptual understanding of new notions (Black & Wiliam, 2010). In this regard, following the principle of Big Scientific Ideas (Harlen, 2007), the lesson is structured into several sequences, each corresponding to a qualitative conceptual question (Smith et al., 2009).

Another tool that transforms the teacher's instructional objectives into students' cognitive goals — making teaching visible to students and learning visible to teachers — is immediate, continuous, and mutual feedback. Thus, feedback is the key instrument that keeps students engaged in the lesson, motivates them to progress, and provides metacognitive support (Hattie & Timperley, 2007).

To assess how students understand the relationships between learned physics concepts and to visualize their conceptual understanding, concept maps are used. Students are evaluated based on the clarity and accuracy of the connections between concepts (Ruiz-Primo & Shavelson, 1996; Cziprok et al., 2014).

Portfolios, as an assessment tool, benefit both students and teachers. They allow students to evaluate and reflect on their own work, motivating them by offering a choice in learning objectives, thus personalizing learning. For teachers, portfolios enable the assessment of students' progress and conceptual understanding. Additionally, they support differentiated instruction based on students' interests and levels (Whitworth & Bell, 2013).

Project-based assessment reflects the collaborative nature of learning, as students work in groups on a common project and present their results to the class, receiving feedback from peers and the teacher. The key benefits of this type of assessment include its strong impact on critical thinking skills, interpersonal skills development, and increased motivation (Mariani et al., 2024).

Regarding peer assessment, studies show that several factors explain variations in its effectiveness: students' engagement in evaluating their peers, the quality of the feedback received, and their understanding of formative assessment. Additionally, students respond differently to peer assessment—some improved their lab reports after peer evaluation and recognized its benefits, others did not improve their reports but acknowledged different advantages, while some did not perceive any benefits at all (Ketonen et al., 2020).

Research also indicates that digital assessment tools can enhance learning skills, students' understanding of physics, critical thinking, analytical abilities, engagement, and the application of theoretical knowledge (Alanazi et al., 2024). However, to achieve these effects, students need to be familiar with digital assessment, meaning it should be used frequently, and teachers should guide them in navigating the digital assessment platform.

Case study

We will now present the results of applying the concept of a constructivist laboratory during the 2023-2024 academic year in two 8th-grade classes at the public high school "Minerva" in Chișinău, Republic of Moldova. A total of 72 students aged 13-14 participated. In both classes, physics lessons are taught by the same teacher, who is familiar with and applies the constructivist method.

We emphasize that these students have been studying physics for three years, with the traditional teaching method applied in the first two years. In this pedagogical experiment, the pre-test consisted of the results of the first laboratory work in the 8th grade, when students were not yet familiar with the constructivist method of conducting experiments. The post-test was represented by the average results of the subsequent laboratory works. The descriptive statistics related to the experiment are presented in Table 2. The marking system ranges from 0 to 10 points.

Table 2. Descriptive Statistics

Valid	LAB Pre-Test	LAB Post-Test
	72	72
Median	8.000	8.500
Mode	8.000	10.000
Mean	7.750	8.375
Std. Deviation	1.590	1.542
Skewness	-0.246	-0.516
Std. Error of Skewness	0.283	0.283
Shapiro-Wilk	0.931	0.863
P-value of Shapiro-Wilk	< .001	< .001
Minimum	4.000	5.000
Maximum	10.000	10.000

Let us now analyse the data from Table 2. The median value shows that before the experiment, the student in the middle of the class (if we rank the marks in descending order) had a mark of 8.0, while after the experiment, the median increased to 8.50. The most frequently occurring grade was 8.0 and changed to 10.0. The mean also increased from 7.750 to 8.375. If we apply the formula: $Progress\ Factor = (Postest - Pretest)/Pretest$ we obtain a value for Progress Factor of 8.06%. The fact that skewness is negative and has increased in absolute value suggests a distribution that is more concentrated in the area of higher marks. The Shapiro-Wilk test confirms the slightly asymmetric distribution of marks. Thus, the statistical analysis indicates a moderate improvement in students' performance on laboratory work conducted using the constructivist model.

In order to see the effect size in the case of the constructivist laboratory, a paired-samples t-test was performed. Thus, the t-value of 5.308 indicate a significant difference between the pre-test and post-test. Furthermore, the p-value of < 0.001 shows that the result obtained is not due to chance. Since Cohen's d = 0.626, we can state that the effect size is moderate to strong. For comparison, according to the results of Hattie's (2009) measurements, in the case of traditional teaching by an experienced teacher over two years, the effect size is 0.40.

Table 3. T-test Results For Paired Samples

Measure 1	Measure 2	t	df	p	Cohen's d	SE Cohen's d
LAB Pre-Test	LAB Post-Test	5.308	71	< 0.001	0.626	0.082

In conclusion, we can affirm that the obtained effect size is closer to cooperative learning with an effect size of 0.59, problem-solving teaching at 0.61, or metacognitive strategies at 0.68. It should also be noted that this result was obtained in conditions where the pre-test marks were already high, with the most frequent mark in the class being 8.00.

Conclusions and implications for the future

Traditional physics labs tend to prioritize students correctly following predetermined procedures to achieve specific results. This approach limits opportunities for authentic exploration and understanding of the underlying scientific concepts. As a result, students may not develop a coherent and comprehensive scientific perspective.

The constructivist model proposed in this article provides a structured yet flexible framework for redefining school laboratory instruction. This constructivist framework sustains active engagement of students through inquiry and collaboration and encourages students to take ownership of their learning, thereby transforming the laboratory from a passive to an interactive learning environment.

Increased ownership of learning through student-driven inquiry contributes to the development of a strong physics identity. When students actively participate in formulating questions and conducting investigations, they develop a sense of agency and connection to the subject matter. This ownership helps students see themselves as independent thinkers and problem solvers in physics, which is the base for their lifelong learning skills development.

The constructivist model emphasizes collaborative inquiry and problem framing, where students work together to explore phenomena and define problems. This interaction fosters critical thinking as students learn to articulate their ideas, challenge each other's assumptions, and collectively derive conclusions. Such collaborative environments lead to deeper engagement and an enriched learning experience.

The model also integrates metacognitive strategies such as self-assessment and reflection on learning processes, which significantly enhance academic success. These skills enable students to become aware of their learning progress, adapt their strategies accordingly, and further improve their academic performance. Research indicates that even a slight improvement in metacognitive awareness is linked to notable increases in academic success

The concept of structured openness, which balances teacher guidance with student autonomy, emphasizes the teacher's role as a facilitator who provides essential support while allowing students the freedom to pursue their own inquiries. This balance fosters an environment where students feel empowered to explore concepts deeply, while still receiving the necessary support to navigate complex ideas.

The paper points out that learning is enhanced through the distribution of cognitive tasks among students, which encourages the use of various resources, including technology and peer collaboration. This approach helps develop individual cognitive skills while fostering a collective learning experience, reflecting how real scientific work occurs.

The 5E model effectively aligns with constructivist principles to create engaging and responsive learning environments for students. Thus, integrating the 5E instructional framework with constructivist pedagogical strategies establishes a cohesive structure that supports inquiry-based learning. Each phase of the 5E model is infused with

opportunities for collaboration and open exploration, ensuring that laboratories become effective learning environments.

The paper discusses the challenge of assessing students' learning in constructivist labs, where traditional testing methods may not effectively capture students' conceptual understanding. Innovative assessment strategies that account for students' processes, collaboration, and conceptual growth are essential for accurately evaluating their learning achievements.

The case study, based on the results of implementing the constructivist laboratory model over the course of one year, demonstrates the clear impact of the method, with an effect size of 0.62. This result positions the developed model among instructional strategies based on collaborative learning, problem-solving, and metacognition.

The findings suggest a need to shift traditional physics curricula towards more interactive, inquiry-based approaches. Incorporating constructivist principles in laboratory instruction can create a more dynamic and student-centered learning environment. Also, teacher training should emphasize strategies that balance guidance and student autonomy, promote collaboration, and integrate metacognitive practices. Educators must also learn alternative assessment methods to measure conceptual understanding beyond traditional testing.

Regarding the continuation of this research, a longitudinal study would be useful to observe how constructivist methods influence retention, conceptual understanding, and the development of problem-solving skills over time. Additionally, it would be interesting to measure the impact of metacognitive strategies on academic performance and explore ways to integrate these strategies into the school physics laboratory. It would also be valuable to develop and refine assessment methods that are suitable for constructivist approaches.

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Role of Virtual Reality in Enhancing Fluency for Job Interview within Task-Based Language Classrooms

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Abstract: Engaging in authentic, real-work tasks is a cornerstone in task-based language learning and teaching (TBLT). This study explores how virtual reality (VR) can be integrated into TBLT classrooms to replicate realistic scenario of job interview to enhance language learning. The primary focus of this study is to assess the effectiveness of a VR application called /spiːx/, specifically designed to improve language performance in job interview situations. Ninety-three undergraduate students enrolled in an English Communication course were recruited to participate in the study. The results revealed that students who completed three sessions of /spiːx/ reported to have improved fluency in terms of number of words per minute and number of syllables per minute by 16.4% and 26.37% respectively. It is also found that those who completed the VR treatments displayed a marked increase in fluency compared to their peers who did not. The findings suggest that VR holds promising potential in TBLT classrooms, enriching job interview preparations especially for students with no prior interview experience.

Keywords: Virtual Reality, Job Interview, Fluency, Task-Based Language Learning and Teaching (TBLT), /Spiːx/.

Introduction

Task-based language learning and teaching (TBLT) is one prominent approach founded in 1980s that emphasised on the importance of using tasks or "structured plans" to draw learners' natural repertoire while drawing attention to form (Ellis, Skehan, Li, Shintani & Lambert, 2020, p.7). In recent years, with the learners as digital natives, the swift evolution of technology has significantly changed the way they learn and interact, calling for a need to align pedagogical approach with contemporary technological advancement. As a result, many contemporary TBLT studies have started integrating the use of technology into language classroom (Adams, et al., 2014; Stockwell, 2010; González-Lloret & Ortega, 2014). This has sparked the interest in technology-mediated TBLT.

In recent years, many studies have utilised technology-mediated TBLT to address the challenges associated with TBLT, for instance, authentic and real-life communication (Smith & González-Lloret, 2021). In a systematic literature review paper, Chong and Reinders (2020) found several common characteristics of technology-mediated tasks which include authenticity as the most predominant characteristic amongst the reviewed papers. Engaging in real-life and authentic communication is one of the core-principals of TBLT in order to acquire the language, yet might be difficult to achieve especially in foreign language or non-native context (Chen, 2021; Albarqi , 2024). Therefore, turning to technology as a tool and medium to creating real-life and authentic communication can be seen as a feasible alternative in this situation.

Literature review

Technology-mediated TBLT

With rapid expansion on teaching and learning conducted in online mode especially after the pandemic, more research opportunities have emerged to explore its' effectiveness in language studies. One study investigated the use of online TBLT instruction during the Covid-19 pandemic and found great success which can be attributed to the student-centred and authentic tasks (Vellanki & Bandu, 2021). In another study in Turkiye, it is found that students have positive perception in technology-mediated TBLT classroom although the statistical tests could not find any meaningful difference in terms of the improvements in grammar (Görgülü, 2022). Annamalai (2019) utilised web 2.0 technologies and augmented reality in a TBLT classroom which found both positive and negative points on the implementations. More recently, a study by Le and Ziegler (2025) provided insights on learners' speaking and writing improvements through the implementation of online TBLT curriculum.

One technology that is under-research in technology-mediated TBLT literature is virtual reality. Smith and McCurrach (2021) conducted a study on the implementation of VR in TBLT instruction and the findings highlighted the overall students' experience on the instruction. The study managed to link the potential of VR as a teaching tool with several learning theories including Dewey's experiential learning. The study managed to lay great foundation to increase the significance of VR as a tool in language classroom, but lack of information in terms of language production in the language acquisition process. Studying language production is crucial as it indicates an evaluation of learners' language proficiency and development (Albarqi, 2024; Skehan, 1996). One way of doing so is by examining the Complexity, Accuracy, and Fluency (CAF). Similarly, another study by Chen (2016) utilised VR in TBLT classroom specifically using SecondLife application, but the findings are limited to participants' overall perception. The study is one of the earliest publications on VR in language classroom which explored students' engagement in virtual environment. As VR was relatively new at the time, the study offered valuable insights by incorporating students' perceptions during its implementation. However, with the growing integration of VR in language classroom, there is an increasing need for further research, particularly in quantitative approach, to assess its effectiveness in enhancing language production. Whilst qualitative findings have its own strength and play equally important role in language acquisition research, quantitative data provides more stable, objective, and clear findings. According to Mackey and Gass (2005), quantitative data provides numerical data that is clearer and objective compared to qualitative that tend to be more subjective. Not only that, quantitative data allows researchers to prove certain aspects in the theoretical framework (Chaudron, 2000) which in this case is on language acquisition. In another study, Burkel (2018) compared the effectiveness of VR in task-based instruction with the traditional approach on the

knowledge of phrasal verbs and found that VR offers more authentic, immersive and positive experience to the learners, mirroring a real-life application. Since VR is a relatively new technology, its application is still sparse and not much TBLT literature has covered on this technology. This explains why most recorded studies are focusing on the general perceptions and usage of the technology. Therefore, it is hoped that this study is able to bring a different perceptive on the participants' language performance in terms of fluency through the use of VR in TBLT instruction.

Oral Production in Technology-mediated TBLT

In an online TBLT instruction, a group of researchers from Indonesia found significant improvement in students' speaking skills thorough online presentation, role-play, and online group discussion (Mulyadi et al., 2021). In another study on technology-mediated TBLT, several tools were used including Kahoot!, Quizlet, Padlet, and Google Slides and found higher speaking proficiency and motivation amongst EFL learners (Le & Ziegler, 2025). Similarly, another study by Zhang (2023) found technology-mediated TBLT effective in improving oral communication in China. A study in Iran utilised online video prompts and found this tool to be effective to improve speech production (Alemi et al., 2023). Although these studies greatly contributed to the body of knowledge in TBLT, certain elements are missing. For instance, Zhang (2023) did not report on the data used to highlight on the before-and-after effects post using technology-mediated TBLT. Whilst Mulyadi et al. (2021) provided with impressive details highlighting on the integration of technology-mediated TBLT, one could argue that there are too many variables involved to study two main skills, i.e. listening and speaking. The amalgamation of several technologies into one study could potentially effect on the validity and reliability of the study, finding it hard to establish the cause-and-effect relationship between the variables. Another element missing from these studies are the integration of Complexity, Accuracy, and Fluency (CAF) triad in the study. Most technology-mediated TBLT studies reported on general perceptions or utilising institution's own marking scheme when measuring the language production. However, there is a gap of literature in recent technology-mediated TBLT studies that established the language production using the CAF triad.

CAF triad in TBLT studies

According to Albarqi (2024), CAF triad has always been used amongst TBLT scholars to observe any changes in terms of language processing and production. Skehan (1996) reiterated that language production can be observed through these three components: complexity, accuracy, and fluency.

Complexity refers to how sophisticated the language produced by the learners. (Skehan, 1996; Ellis & Barkhuizen, 2005; Housen & Kuiken, 2009). Accuracy on the other hand, refers to how correct the language produced by the learners in accordance with the language grammar rules (Skehan, 2018). Lastly, fluency refers to the "natural flow of speech" (Segalowitz, 2010) as cited in Albarqi (2024, p. 275). It is believed that learners with higher proficiency can produce more complex, accurate, and fluent language. Ellis (2003) summarised the measures for the CAF as shown in Table 1.

Table 1. Measures of CAF

Dimension	Measures
Complexity	Number of turns per minute
	Anaphoric reference (as opposed to exophoric references)
	Lexical richness, e.g. number of word families used,

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	Percentage of lexical to structural words, type-token ratio
	Proportion of lexical verbs to copula
	Percentage of words functioning as lexical verbs
	Percentage of occurrence of multi-propositional utterances
	Amount of subordination, e.g. total number of clauses divided by total number of c-units
	Frequency of use of conjunctions
	Frequency of use of prepositions
	Frequency of hypothesizing statements
Accuracy	Number of self-corrections
	Percentage of error-free Target-like use of clauses
	Target-like use of verb tenses
	Target-like use of articles
	Target-like use of vocabulary
	Target-like use of plurals
	Target-like use of negations
	Ratio of indefinite to definite articles
Fluency	Number of words per minute
	Number of syllables per minute
	Number of pauses of one/two seconds or longer
	Mean length of pauses
	Number of repetitions
	Number of false starts
	Number of reformulations
	Length of run, i.e. number of words per pausally defined unit
	Number of words per minute

Based on the CAF triad, it can be learned that studying language production through CAF allows the instructors to evaluate learners' language proficiency and development in a more systematic approach. Ellis (2003)'s measures in Table 1 allows instructors to evaluate the learners' development from a quantitative approach provides a numerical and objective perspective on language acquisition. This quantitative approach also allows a clearer finding to establish the cause-and-effect of technology-mediated TBLT treatments.

Amongst the three components in CAF triad, fluency is arguably the most important component in job interview setting (Rasipuram et al., 2016; Spitzberg et al., 2007). According to Rasipruam et al. (2016), fluency is one of the key factors considered in hiring process. This is also concurred by Naim et al. (2015) who created a computational framework in predicting the success of a job interview based on verbal and non-verbal components. It is found that being fluent is one of the key successes in job interviews which is also agreed by Spitzberg et al. (2007). The next subsection provides more detailed description on the importance of fluency in workplace.

Importance of Fluency in Workplace

According to Ardi (2021), there is an increasing demand on communication skills for employment in Asia which stresses on mostly oral production. A study by Heang et al. (2019) studied thousands of job advertisement available in Jobstreet, a job-seeking portal in Malaysia and found that presentation skills is put as required in more than half of the advertisements there. Similarly, another study by Cal et al. (2022) mentioned that many graduates fail to communicate and even speak comprehensible English with other co-workers. These studies suggest the high relevance of being fluent in speaking at workplace which increase the significance of studying and measuring fluency as reported by several other TBLT studies. Past literature has recorded that TBLT instruction greatly improved one's fluency. For

instance, a study by Albaqi (2024) used several measures to calculate the students' fluency including length of pauses and syllables per minute. After two months of technology-mediated TBLT intervention, the students demonstrated increased fluency across the measured indicators. Winarto and Aprianti (2022) utilised speech rate or number of syllables per minute in their study and found greater improvements post TBLT instruction. In particular, the students' speech improvements were evident in rhythm, segmental features, and speech rate.

In the present study, the main objective is to observe any changes of the fluency produced by the learners after three sessions of VR treatment based on a real-life and authentic speaking task of job interview scenario. The two measures used to observe the fluency are number of words per minute and number of syllables per minute. These two measures are chosen because these are speed fluency tests that captured the articulation rate to indicate a person's ability to maintain a smooth and uninterrupted speech which is crucial in job interview situation (Rasipuram et al., 2016). The study suggests that a higher speech rate is associated with improved perceived fluency by the interviewers. Although both measures capture speed fluency but measuring both number of words per minute and number of syllables per minute is crucial to confirm the consistency of speaker's speed.

The formulas to calculate the two measures are referred in Chambers (1997) and can be illustrated as per below.

Number of Words Per Minute

$$\frac{Number\ of\ words\ uttered\ by\ learners}{Number\ of\ seconds\ uttered\ by\ the\ learners} \times 60\ seconds$$

Number of Syllables Per Minute

$$\frac{Number\ of\ syllables\ uttered\ by\ learners}{Number\ of\ seconds\ uttered\ by\ the\ learners} \times 60\ seconds$$

Therefore, the following research questions were formulated for present study:

RQ1: Is there any significant effect of students' fluency in terms of number of words per minute with and without the presence of VR?

RQ2: Is there any significant effect of students' fluency in terms of number of syllables per minute with and without the presence of VR?

Methodology

Participants and Pedagogic Setting

93 students were recruited to participate in this study. They were undergraduate students at a technical university in Malaysia and enrolled in an English Communication course. The participants scored band 2 to 4.5 in their on Malaysian University English Test (MUET) scores which is equivalent to A2 to B2 CEFR levels with the median of band 4.0 (B2 in CEFR level).

The English Communication course is the final English course at the university which designed to prepare the students for future employment. The course consists of three units: Job search skills interview skills, and meeting skills. For the present study, the data collection focused primarily for   the interview skills unit. For this unit, students were exposed to several topics including frequently asked interview questions and dos and don'ts during job interview. The

lessons were designed following Ellis (2009) TBLT three main stages which are pre-task, main task and post-task. Pre-tasks helps to activate students' schemata which is why it is crucial to engage the topic based on students' prior knowledge before starting with the main task. Main task is the highlight of the lesson in which students' linguistic repertoire will be used to complete the main task. Lastly, post-task helps learners to reflect in their lessons and provide feedback. Not only that, the lessons were also designed based on past TBLT literature to improve the tasks which include focused, two-way, and divergent tasks. Two samples of the lesson plans utilised for the interview skills unit are available in Appendix A and B including the one with VR treatment.

Research Procedures

This study utilises pre-test/post-test design. According to Creswell and Guetterman (2020), this research design allows to establish the cause-and-effect relationship for the treatment measured. Therefore, this research design is utilised. To measure the effectiveness of the treatment, the participants were divided into two: Experimental and control groups. The groups were intact groups which is a more convenient and feasible option for the researchers. Figure 1 illustrates the implemented procedures in this study.
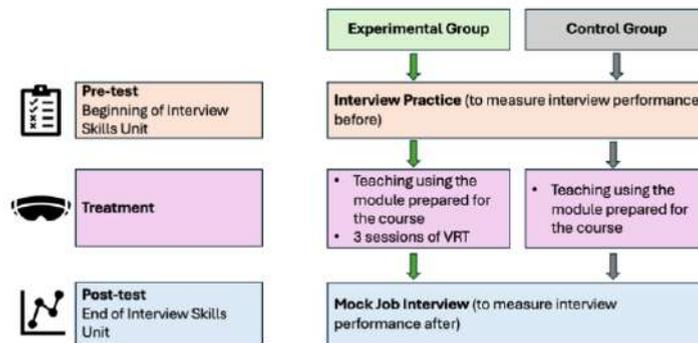

Figure 1. Research Procedures

Firstly, the participants were divided into two groups: Experimental and control groups. The grouping was done through intact group which means the whole class is experiencing the same treatment. The experimental group went through the VR sessions whereas the control group did not.

In the beginning of the interview skills module for English Communication course, participants from both groups were tested on their interview skills to know their levels and performance. Then, the participants from the experimental group went through three sessions of VR treatment using the application /spiːx/. The instructor guided the participants on how to use the VR headsets in the first session and also informed on the possible side effects. The participants were constantly monitored and required to complete a survey on side effects of VR to report on any side effect. Since the participants are digital natives, most of them were able to use the VR headset competently after the first treatment. For each treatment, the participant spent around 10-15 minutes playing the VR game. Lastly, at the end of the module, the participants' interview skills from both control and experimental groups were once again measured through mock job interview practice to indicate if there are any changes after the treatments.

Instruments

Interview Performance

Prior to the commencement of the module, participants underwent a pre-test in which their interview performance was recorded. At the conclusion of the module, another interview session was conducted and recorded as the post-test. For both sessions, each student was asked three questions and evaluated individually.

Their interview performance was recorded using Sony Handy Cam recorder (on the left in Figure 2) and Sony Stereo Digital voice recorder (on the right in Figure 2) was also used to record the voice recordings to ensure clearer sound recordings.

Figure 2. Devices Used to Record the Mock Job Interview

The recordings are then transcribed from video and sound formats (mp4 and mp3) into writings using Turbo Scribe AI Transcription (premium version). With the premium subscription, the transcription is unlimited, more accurate and include more advanced features. For instance, as seen in Figure 3, TurboScribe Premium allows the transcription from different files including audio and video, ability to recognise the speakers, and even restore the audio files. These features could improve the accuracy and speed of the transcription.
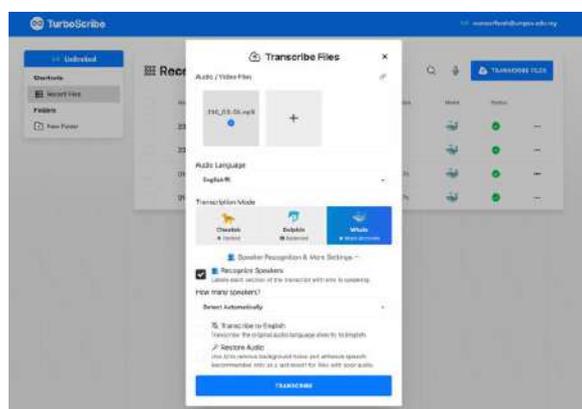

Figure 3. Features available in TurboScribe

After the transcription is done, the data is organised in Microsoft Excel to compare the number of words per minute and number of syllables per minute for both pre-test and post-test of both groups.

VR Headset

For the present study, the VR application was downloaded in several VR headsets. The participants used Oculus Quest 2 Advanced All-In-One Virtual Reality Headset (256 GB) as seen in Figure 4 below.

Figure 4**.** A Participant Is Playing /Spiːx/ Using Meta Quest 2 On the Left and On the Right Is the Room Set Up for VR Treatments

For the experimental group, the participants were invited to the Media Room to complete the VR treatments. Since the VR application does not require much movement except by using the controller, the room is set up by having the participants to seat on a chair to avoid any physical harms while playing with the VR.

VR Application /spiːx/

This study created a VR application called /spiːx/ which aims to   reduce interview anxiety and improve interview performance among students. This application was created by a group of developers from the Faculty of Computing, UMPSA. The main objective of this application is to replicate authentic and localised media to help Malaysian learners to improve their interview skills. The application consists of two scenarios that the players can choose. the first scenario features a local Malaysian interviewer from a Malaysian-grown company called Palm Ventures Sdn Bhd as illustrated in Figure 5 below. The three interviewers are three Malaysians from three main races in Malaysia which are Malay, Chinese, and Indian speaking in local Malaysian English accents to replicate the localised context. Not only that, the Malay interviewer can also be seen wearing hijab which is a local context to replicate authenticity in Malaysian interview context.

Figure 5. First Scenario Featuring Three Malaysian English Speakers

For the second scenario, the interviewers are native English speakers from America, United Kingdom and Australia to represent a multinational company, SynovaTech as seen in Figure 6. The accents are nativised English accents and similar to the first scenario, the panellists ask the player a total of five questions.
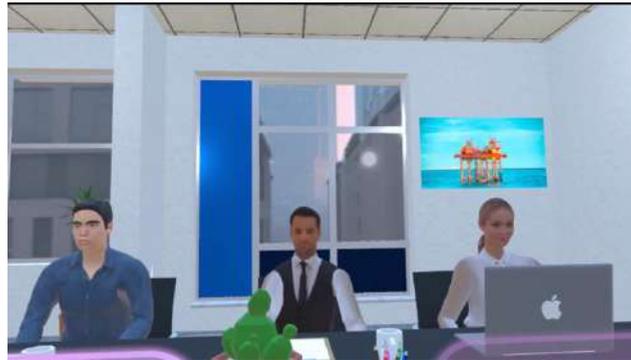

Figure 6. Second Scenario Featuring Three Native English Speakers

Results

RQ1: Is there any significant effect of students' fluency in terms of number of words per minute with and without the presence of VR?

To answer this research question, data are analysed by comparing the means number of words per minute of the experimental and control groups.

Table 2. Comparison on the Number of Words Per Minute from Pre-test to Post-Test for Experimental and Control Groups

| Group | Pre-test | | Post-test | | Difference | Percentage | T-test |
	Mean	SD	Mean	SD			p-value
Experimental (N=44)	106.84	29.53	124.36	35.78	17.52	16.4%	<0.05
Control (N=49)	86.57	28.69	96.52	31.06	9.95	11.5%	<0.05

Table 2 illustrates the descriptive findings of the number of words per minute between the two groups- experimental and control.

Before the VR treatments, participants from the experimental group had a mean of M=106.84, SD=29.53 and then increased to M=124.36, SD=35.78. The mean difference was 17.52 which is 16.4% increment from pre-test to post-test. A paired-samples t-test indicated a significant difference in the increase of words per minute following the VR treatments with p-value of <0.05. This suggests that the VR treatments had a significant effect on the participants' number of words per minute.

On the other hand, the control group recorded a mean of M=86.57, SD= 28.69 in the beginning of the module and M= 96.52, SD= 31.06 at the end of the module. The mean difference was 9.95 which is an 11.5% increase. A paired-

samples t-test was also computed and revealed p-value of less than 0.05 which means there is a significant difference between the number of words means.

The bar graph in Figure 7 illustrates the changes of number of words per minute from pre-test to post-test for both groups. The bar graph shows that experimental group had more increase compared to control group.
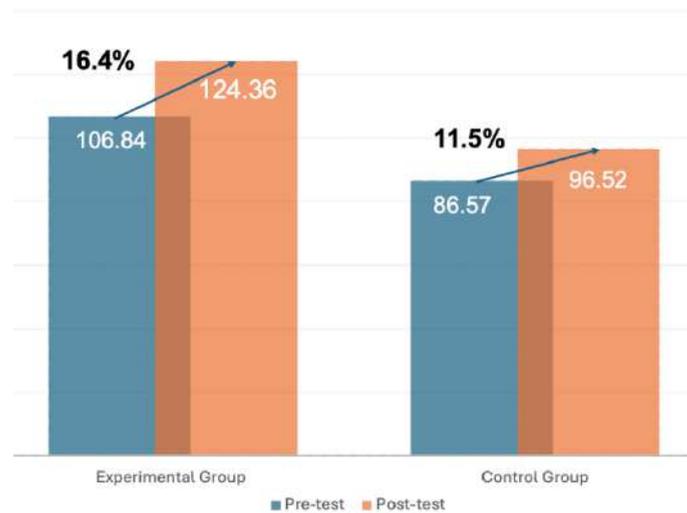

Figure 7. Changes on the Overall Means of Number of Words Per Minute

To further analyse the data, an individual comparison is done look at the changes on the fluency in terms of the number of words per minute (either increase or decrease) for both groups as seen in Table 3.

Table 3. Summary of Individual Changes for Number of Words Per Minute

	Number of Participant	Percentage
Experimental Group (N=44)		
Increase	40	90.9%
Decrease	4	9.1%
Control Group (N=49)		
Increase	29	59.2%
Decrease	20	40.8%

From Table 3, it can be derived that out of 44 participants in experimental group, the vast majority of 40 participants recorded to have higher number of words per minute in the post-test which is 90.9% whereas for the control group, only 29 out of 49 participants recorded increased fluency in terms of number of words per minute. This is only 59.2% from the sample in control group.

RQ2: Is there any significant effect of students' fluency in terms of number of syllables per minute with and without the presence of VR?

For the second research question, the overall means on the number of syllables per minute for both pre-test and post-test in both groups was computed.

Table 4. Comparison on Number of Syllables Per Minute from Pre-test to Post-Test for Experimental and Control Groups

| Group | Pre-test | | Post-test | | Difference | Percentage | T-test |
	Mean	SD	Mean	SD			p-value
Experimental (N=44)	125.79	29.18	158.97	48.00	33.18	26.37%	<0.05
Control (N=49)	104.9	37.60	119.74	42.72	14.89	14.14%	<0.05

From Table 4, it can be seen that the experimental group had an overall mean of M= 125.79, SD= 29.18 before the VR treatments and increased to M= 158.97, SD = 48.00 after the treatment. The mean difference was 33.18 which is 26.37% increase from pre-test to post-test. A paired-samples t-test was calculated to see if there is any significance difference between the increase and revealed p-value of <0.05 which indicated significant difference. As for the control group, the overall means in pre-test was M=104.9, SD= 37.60 and then increased to M= 119.74, SD= 42.72 in the post-test. This means that the difference between pre-test and post-test was 14.89 which is a 14.14% increase. The paired-samples t-test revealed a significant difference between the two tests with p-value of 0.05.
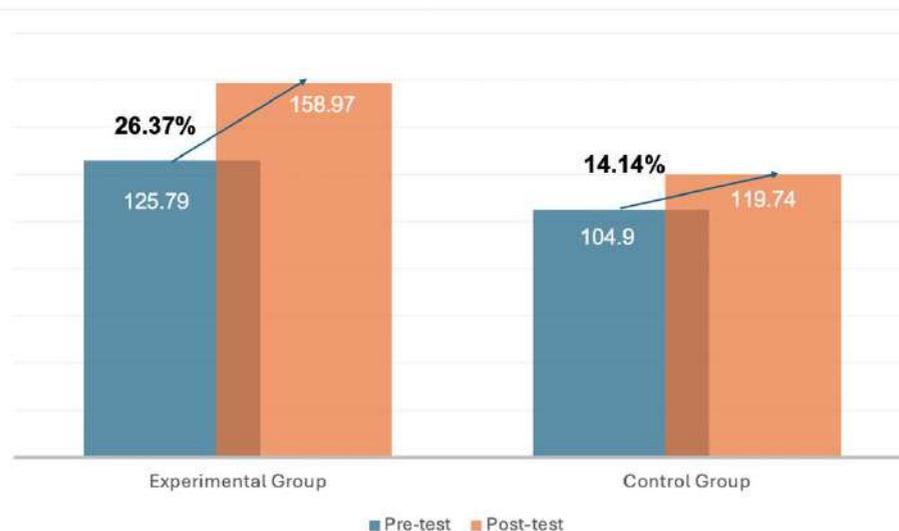

Figure 8. Changes on the Overall Means of Number of Syllables Per Minute

As seen in Figure 8, the experimental group had higher increase from pre-test to post-test compared to control group. To further analyse the findings, each participant in both groups were analysed to observe individual changes. Similar to previous research question, the findings compared the number of participants who had their number of syllables per minute increased or decreased. The table 5 below illustrates this data.

Table 5. Summary of Individual Changes for the Number of Syllables Per Minute

	Number of Participant	Percentage
Experimental Group (N= 44)		
Increase	41	93.18%
Decrease	3	6.82%
Control Group (N= 49)		
Increase	32	65.3%
Decrease	17	34.7%

Table 5 shows that there are more participants from experimental group who had increased fluency in terms of number of syllables per minute compared to control group. For the experimental group, 93.18% recorded an increased number of syllables per minute which is 41 out of 44 participants whereas for control group, only 65.3% reported the increment which is 32 out of 49 participants.

Discussion

The primary objective of this study is to investigate the effects of VR treatments on the participants' fluency. This is achieved by calculating the number of words per minute and number of syllables per minute both in pre-test and post-test to observe any changes between the experimental group and control group.

Present study found that the percentage of increment for the mean number of words per minute in the experimental group was significantly higher than the control group. Not only that, when compared the findings individually, experimental group recorded 90.9% increment compared to control group which is 59.2%. Not only that, the second research question also found that experimental group experienced bigger increment in their fluency through the number of syllables per minute compared to control group. The observed outcomes align with individualised assessments, revealing that 93.18% of the experimental group exhibited improved fluency in post-test evaluations. This contrasts with the control group, in which only 65.31% (32 of 49 participants) demonstrated similar gains in fluency. These suggest that participants who went through three sessions of VR treatment recorded more increment in terms of fluency in the number of words per minute compared to their peers who did not.

The findings aligned with previous TBLT literature on oral production which found that students experienced greater fluency. In one study that probed on the effectiveness of online instruction in speaking task implemented in a technology-mediated TBLT classroom, Albaqi (2024) found increased fluency after two months. Similar findings were found by Winarto and Aprianti (2022) that adapt TBLT instruction in vocational schools which found increased fluency after the implementation. Hanzawa (2021) also reported similar findings in Japanese contexts as does Albino (2017) which found improved speaking fluency after TBLT instruction in South Africa. In many TBLT literature, most studies reported increased fluency after the instruction and Albaqi (2024) pointed out that many TBLT literature predominately focused on fluency due to its high effectiveness in improving students' fluency.

The findings of this study demonstrate that the intervention significantly improved outcomes, aligning with the previous studies. A VR-task based instruction facilitates increased fluency in the context of mock job interview speaking task. According to a study by Burkel (2018) VR task-based instruction allows the learners to engage in communicative meaning tasks that are authentic and real-life which are more applicable to the learners; ergo contributing to the language acquisition. Additionally, study by Chen (2016) reported that the learners view VR as a practice tool that mirror real-life application which increased their motivation in learning. Smith and McCurrah (2021) also found that VR facilitated the language acquisition by replicating "true-to-life communicative skills" (p.161) which aligns with TBLT core principle. Therefore, it can be inferred that VR allows the learner to improve language production by replicating real-life and authentic speaking tasks for them to practice.

Conclusion

In conclusion, present study found that VR is an effective tool to increase language production specifically on the fluency. This is measured by the group who underwent three sessions of VR treatments reported higher number of words per minute and number of syllables per minute compared to the other group who did not. This study sheds some light on the potential of VR in language classroom highlighting on its advantage of creating an immersive, authentic and real-life language task.

Limitations

Although this research has achieved its objectives, there are several limitations from this study. The first limitation is Hawthorne's Effect. In this research context, the phenomenon refers to the potential for subjects to alter their behaviour as a result of being introduced to new technology, specifically VR (Chiesa and Hobbs, 2008).As some participants may be unfamiliar with this technology, the researchers recognised that there is a chance that their responses could be more favourable towards this technology. Similar point was also mentioned in several technology-mediated TBLT studies on the inclusion of technology in language classrooms (Smith & González-Lloret, 2020; Warschauer, 2004). The second limitation is the intact group which means students in the same class experienced the same condition/treatment. Some may argue that randomisation of participants from the same class to different condition/treatment can increase the validity of the study. However, by doing so, this can cause disruption with the class lesson. For that reason, according to Creswell and Guetterman (2020), intact group is the best option. Lastly, another limitation of this study is that the findings are only limited to quantitative approach. This study only utilised the quantitative approach to the fluency by measuring the number of words and syllables per minute. Perhaps a qualitative approach can be considered to serve as an additional data, complementing the present findings and being triangulated to create better a richer and deeper analysis.

Future Studies

To improve in future studies, the researchers plan to study the language productions in terms of accuracy and complexity. This will provide more comprehensive findings on the Complexity Accuracy Fluency (CAF) dimension as mentioned by Albaqi (2024). Not only that, the researchers plan to add more interactive elements in the VR

application /spi:x/ such as linking with Large Language Model (LLM) such as GPT to allow the students to choose their preferred interviewers' accents. This feature will provide more exposure on different world English accents to the learners and create more learning opportunities.

Acknowledgment

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Appendices

Appendix A- Lesson on Mock Job Interview

Subject	ULE2342 (English Communication)
Module	2 (Interview Skills)
Language Focus	Professional language to answer interview questions
Objectives	• To build confidence in using professional language and tone • To practice receiving and applying direct feedback for improvement
Materials	1. Laptop/ Tablet 2. Padlet- Brainstorm Interview Questions 3. Marking scheme for Assessment 2- Mock Job Interview

Pre-task: Warmer

Activity #1 (5 minutes)

In pairs, the students are asked to job interview experience. The following prompts are used to help the students to discuss on the experience:

With your partner, answer to the following questions:

1. Do you have any experience going for a job interview
   -When was it?

   -What company?

   -How many panelists?

   -What language was the interview being conducted?

   -Any questions that you remember from the interview?

Activity #2 (10 minutes)

Brainstorm commonly asked interview questions.

With the same partner, find out 3 commonly asked interview questions and post the questions in the Padlet given.

Note: For students who managed to complete earlier, the students can find the ways/ strategies to effectively answer to the 3 questions given.

Main Task (Speaking)

Marking Scheme Briefing (10 min)

- **Step 1:** Students are required to read silently on the marking scheme as uploaded in the GDrive.
- **Step 2:** Instructor explain the components in the marking scheme- as detailed as possible especially in content. Give samples based on past students' answers.
- **Step 3:** Q&A session

Mock Job Interview Practice (15 min)

- **Step 1:** Pair students as interviewer and interviewee.
- **Step 2:** Interviewers ask commonly questions as seen in the lecture slides and use the marking scheme to evaluate friends' answers.
- **Step 3:** Switch roles and repeat.

Post-task: Recap & Reflection (10min)

Recap: Ask the students what they have learned in the class today. Also ask the students what they think about interview questions and whether they are ready to embark on the job interview journey.

Appendix B- Lesson on Interview Skills (Using VR)

(FOR EXPERIMENTAL GROUP ONLY)

Subject	ULE2342 (English for Professional Communication)
Module	2 (Interview Skills)
Language Focus	Speaking and Listening Skills (Interview vocabulary, responding to common questions
Objectives	- Enhance students' fluency and confidence in spoken English during interviews. - Develop vocabulary and strategies for answering interview questions. - Practice real-life interview scenarios using VR technology.
Materials	4. Laptop/ Tablet 5. VR headsets

Pre-task: Warmer

Activity #1 (5 minutes)

In pairs, the students are asked on their career aspirations.

1. Ask the students to write their dream job in a piece of paper. It has to be specific (with job title and company's name)
2. Exchange the paper with your partner.
3. Tell your steps for you to achieve your dream job.

Activity #2 (10 minutes)

Teacher shows VR headsets to the students and ask if any of them have tried using these.

- Show demo video to learners to help them navigate in the VR game

Main Task (Speaking)

Activity: VR game (75 min)

1. Students are grouped into 6 groups. Students who have played VR before will become the leaders.
2. Each student take turn to play the VR game.

Post-task: Recap & Reflection (10min)

Recap:

- Ask the students what they have learned in the class today. Students discuss their VR interview experience and share what they found challenging.
- Review language used, body language, and provide corrective feedback.

Development and Validation of Technology-Aided Instructional Material on Fish Capture in Agri-Fishery Arts: Madeline Hunter's Model

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Abstract: This study aimed to design, develop, and validate a Technology-Aided Instructional Material (IM) on Fish Capture in Agri-Fishery Arts utilizing Madeline Hunter's model. Each module follows the structured framework of the Madeline Hunter Model, incorporating elements such as objectives, anticipatory set, input, modeling, guided practice, check for understanding, independent practice, and closure. Reinforcement strategies are integrated to strengthen the targeted behaviors, with positive feedback and acknowledgment as essential components. The developmental research design was utilized in this study and was conducted at Caraga State University- Cabadbaran Campus, following the IPO (Input, Process, and Output) model. The researchers selected five experts from both inside and outside the campus in the field of Agri-fishery Arts as evaluators of the research project. The developed instructional material obtained an overall average of 3.50 mean from the IMEC (Instructional Material Evaluation Checklist) result with a descriptive rating of high evidence. This implies that the developed technology-aided instructional material on fish capture in Agri-fishery arts is functional and can be utilized for both face-to-face and online modality. For further research, the researchers can evaluate by implementing this instructional material to its target end-users in an actual classroom setting.

Keywords: Technology-Aided, Instructional Material Development, Madeline Hunter's Model, Strategies

Introduction

Effective instruction relies heavily on high-quality instructional materials, which significantly impact student learning outcomes (Mayer, 2021). These materials serve as crucial tools for educators, enabling them to clarify complex concepts, present information effectively, and facilitate engaging learning experiences (Brown, 2019). For learners, well-designed materials promote knowledge retention, stimulate interest in the subject matter, and foster deeper understanding (Clark & Mayer, 2016). This is particularly true in vocational fields, where practical skills and competencies are paramount.

The agri-fishery sector, a vital intersection of agriculture and fisheries, plays a crucial role in global food security and economic development (FAO, 2022). This interdisciplinary field integrates agricultural practices with the sustainable management of aquatic resources. As the sector evolves with advancements in technology and practices, the demand for high-quality, up-to-date instructional materials becomes increasingly crucial to equip learners with the necessary knowledge and skills for success (OECD, 2023). This is echoed by research highlighting the importance of relevant training materials for effective technology transfer in fisheries and aquaculture (Akintade, 2021). The rapid pace of change in the sector necessitates that instructional materials be regularly updated to reflect current best practices, particularly in this technology era.

In the Philippines, agri-fishery is a key component of the Technology and Livelihood Education (TLE) curriculum, designed to develop students' technical and entrepreneurial skills in agriculture and fisheries (DepEd, 2016). This curriculum, offered at both Junior and Senior High School levels, covers diverse specializations, including crop production, animal husbandry, aquaculture, fish capture, and fish processing. Caraga State University (CSU), formerly the Northern Mindanao State Institute of Science and Technology (NORMISIST), offers programs like the Bachelor of Technology and Livelihood Education and the Bachelor of Technical-Vocational Teacher Education, which include agri-fishery arts as a core subject. These programs aim to equip future educators and practitioners with the skills and knowledge needed to contribute to the growth of the sector.

However, educators often struggle to access current, relevant, and effective instructional materials, particularly in specialized areas like fish capture. This scarcity can hinder effective teaching and limit students' opportunities to develop practical skills. As noted by (UNESCO, 2022), transforming TVET requires continuous development of resources and innovative teaching approaches. To address this challenge and support CSU's initiatives, this study focuses on developing and validating technology-aided instructional materials for Fish Capture in Agri-Fishery Arts, using Madeline Hunter's instructional model.

Madeline Hunter's model, with its emphasis on direct instruction and a systematic approach to lesson design, provides

a strong framework for creating effective instructional materials (Hunter, 2019). By incorporating elements like anticipatory set, objective, input, modeling, checking for understanding, guided practice, and independent practice, the model ensures a structured and engaging learning experience. Integrating technology into these materials can further enhance engagement and provide opportunities for interactive learning (Mayer, 2021). This study aims to contribute to the body of knowledge on effective instructional design utilizing technology in agri-fishery education and provide valuable resources for educators and learners at CSU and potentially beyond. By developing and validating these materials, the researchers hope to improve the quality of agri-fishery education and contribute to a skilled workforce in this essential sector.

Objective of the Study

1.) Design technology-aided instructional material which the topics anchored to CMO no. 78 s. 2017.

2.) Develop technology-aided instructional material on Fish capture in Agri-fishery arts anchored on Madeline Hunter Model.

 3.) Validate the developed technology–aided instructional material.

Framework of the Study

The conceptual framework presented below shows the input-process-output (IPO) model of research.
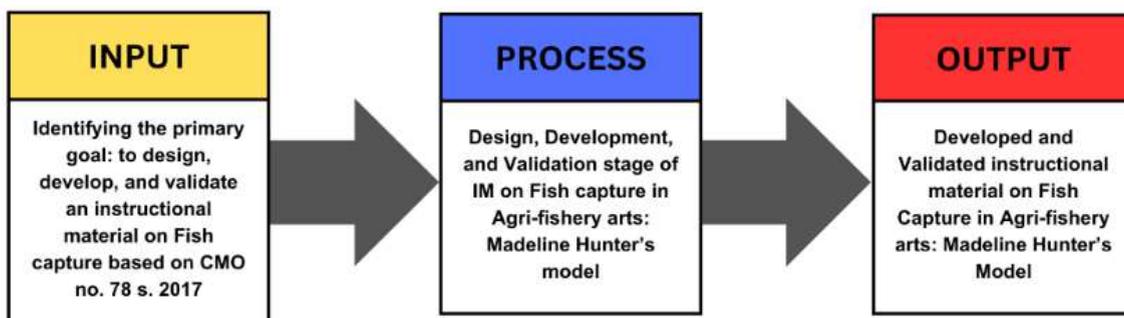

Figure 1. IPO Model

The input phase comprises the established instructional goals and objectives of the instructional material integrating technology on Fish capture in Agri-fishery arts based on CMO no. 78 s. 2017 utilizing the Madeline Hunter model. It includes the identification of the learning competencies of the five lessons of instructional material. It contains lesson format, learning activities, and assessments. Started the lesson format using Madeline Hunter's Model, which includes the following components; Lesson Title: Indicates the specific topic of the lesson; Lesson Objectives: Provide guidelines for designing the teaching, developing materials, and performing teaching activities; Anticipatory Set: A short activity or prompt that focuses students' attention before the actual lesson begins; Input: Vocabulary and conceptual skills that the teacher will impart to students; Modeling: Demonstrates to students what the finished product looks like; Guided Practice: Leads or guides students through the steps necessary to perform the skills; Checking for Understanding: Uses different questioning strategies to determine whether students understand the

lesson and are ready to practice on their own; Closure: Reviews or wraps up what was learned in the lesson. The development process for this material on fish capture in Agri-Fishery Arts is guided by the Madeline Hunter model, as planned by the researchers.

The process phase involves the designing, development, and validation process of five lessons in the technology-aided material for Agri-fishery Arts. The researchers created the instructional material utilizing technology so that it can be used in an online learning modality. Flipping Book was used as an online platform to upload instructional material, which can be easily accessed by the instructors and students. This stage consists of the operations that are needed to apply the data to turn it into information (Roman, 2016). It is a series of steps or operations that were applied to the input phase to convert it into the desired output which the technology-aided instructional material utilizes. The technology-aided instructional material is meant to be reviewed and revised according to any feedback given during the validation using the Instructional Material Evaluation Checklist (IMEC). The IMEC comprises 21 items designed to assess the instructional material's content, organization and structure, and support to learning.

The output phase is the technology-aided instructional material on Fish capture in Agri-fishery arts using Madeline Hunter's model, which has been developed and validated. The developed and validated Fish Capture in Agri-fishery arts instructional material using Madeline Hunter's model contains the lesson format; learning objectives that guide designing instruction, developing material, and conducting activities; the anticipatory set is a short activity or prompt that focuses students' attention before the actual lesson begins; input a vocabulary and conceptual skills that the teacher will impart to students; modeling that shows the student what the finished product looks like; Guided practice lead or guide students through the steps necessary to perform the skills; checking for understanding uses different questioning strategies to determine whether students understand the lesson and have the necessary skills; independent practice again facilitate students to practice on their own based on input and check for understanding; closure review or wrap up what was learned in the lesson.

Method
Research Design

The researchers employed developmental research, characterized as a systematic study of designing, developing, and validating instructional programs, processes, and products that adhere to specific standards and assess their effectiveness. Validation of the instructional materials was carried out by field experts within and outside the campus. The researchers applied the Input Process-Output instructional model for designing, developing, and validating the instructional material.

Participants of the Study

The Agri-Fishery Arts instructors or experts at Caraga State University- Cabadbaran Campus and field experts outside the campus were chosen as the participants of the instructional material from which the researchers collected the data for analysis.

Research Instruments

The Instructional Material Evaluation Checklist (IMEC) was used as a research instrument in this study to comprehensively assess the quality and effectiveness of instructional materials tailored to Fish Capture in Agri-Fishery Arts. The Instructional Material Evaluation Checklist (IMEC) (Alburo, 2022) is a 21-item checklist that evaluates instructional materials for content, organization, structure, and support to learning.

Validation of the Technology-aided Instructional Material

The utilization of the Instructional Material Evaluation Checklist (IMEC) stands as a dependable indicator. (Alburo, 2022) created and incorporated this tool for the summative evaluation of developed instructional materials, a method that Caraga State University has endorsed and employed for IM evaluation. The researchers also sought the expertise of a field specialist familiar with the instructional material's content. This specialist contributed to the study by providing valuable feedback and recommendations on the design, development, and validation of the instructional material. The researchers selected five experts from within and outside Caraga State University Cabadbaran City. After the evaluators reviewed the learning material, the researchers collected the data which determined the results for validation.

Statistical Treatment of Data

The researchers applied statistical analysis to the collected data to gain meaningful insights into the effectiveness of the instructional material on Fish Capture in Agri-Fishery Arts. In addition, the researchers also utilized descriptive statistics, including mean scores and standard deviation to summarize participants' responses to the Instructional Material Evaluation Checklist (IMEC).

Results

The designing phase of technology-aided instructional material which the topics anchored to CMO no. 78 s. 2017.

This section presents the results obtained during the various stages of creating the instructional material on Fish Capture in Agri-Fishery Arts, utilizing Madeline Hunter's Model aided with technology tools. This phase begins with identifying the primary goal: to design and develop instructional material that integrates information and communication technology (ICT) tools. The aim is to create innovative and advanced teaching pedagogy by incorporating these tools into the instructional design and development process. Using Madeline Hunter's Model, the researchers intend to design and develop instructional material for BTLED and Agri-fishery arts students. Their course selection for lesson development is based on the CHED Memorandum Order (CMO No. 78, 2017) which have been cross-referenced to come up with the set of courses offered for BTLED students and students under the Agri-fishery arts course. The CMO No. 78 s. 2017 otherwise, known as "Policies, Standards and Guidelines for the Bachelor of Technology and Livelihood Education (BTLEd)". The CMO provides a new approach to teaching and learning

strategy, infusing outcome-based education, which allows the learners to become active participants in the learning process, and acquire and practice specified skills being provided.

The instructional material (IM) consists of only five lessons on Fish Capture in Agri-fishery arts. The CMO No.78 s. 2017 for (BTLEd) provides a detailed overview of the course outline for Fish Capture. This course aims to educate students on various aspects of fishing, focusing on practical skills and safety measures for successful and sustainable fishing practices. The table below shows a detailed list of selected courses offered under CMO No. 78, Series of 2017, for (BTLEd).

Table 1. Course description for fish capture about CMO no. 78 s. 2017 for the Bachelor of Technology and Livelihood Education (BTLED).

Course Title	Fish Capture
Course Description	This course deals with catching and delivering seafood products. This will train learners in fishing and other related fishing activities in inland bodies of water and marine waters using fishing vessels. The learners are expected to develop skills in applying safety measures, fish capture operations, using tools and equipment, protecting the marine environment, applying basic handling and safety practices, and adjusting and positioning of mesh nets or gill nets, spots, and traps.
Course Credits	3 units
Contact Hours	3 hours per week
Prerequisite	none

From this course description as shown in Table 1, five lessons were developed and presented in detailed below which are Applying Safety Measures in Fish Capture Operation, Tools and Equipment, Protecting Marine Environment, Applying Basic Fish Handling and Safety Practices, and Applying and Positioning of Mesh Nets or Gill Nets, Spots, and Traps offered in the course. The chosen topics as described in this course description were identified by the faculty members hadling the subject on agri – fishery as revealed during the interview conducted to them.

Table 2: The topics covered in the Technology-Aided Material Anchored on the CMO No. 78, s. 2017

Lesson No.	Topics
1	Applying Safety Measures in Fish Capture Operation
2	Tools and Equipment
3	Protecting Marine Environment
4	Applying Basic Fish Handling and Safety Practices
5	Applying and Positioning of Mesh Nets or Gill Nets, Spots, and Traps

The development phase of instructional material on Fish capture in Agri- fishery arts using the Madeline Hunter Model.

The development Curriculum Guide provided by Agri-Fishery Arts - Fish Capture (NC II) and referred to the Fisheries Code of 1998 or RA 8550 to befit the manual to the target students and teachers. Using these resources, the researchers

developed the specific lesson, intended learning outcomes, learning activities, guided practice, and performance tasks for the fish capture lessons, aligning them with the course description of CMO No. 78 s. 2017. Table 3 presents the lesson matrix in Fish Capture containing the final content of this developed learning material. The matrix aims to equip students with the competencies necessary for effective and sustainable Fish Capture Practices through a blend of instructional videos, hands-on practice, and real-world scenarios.

Table 3: Lesson Matrix in Fish Capture for the Bachelor of Technology and Livelihood Education (BTLEd)

LEARNING PLAN

Lesson	Intended Learning Outcome	Learning Activity	Guided Practice	Performance Task
1. Applying Safety Measures in Fish Capture Operation 1.1 Determine areas of concern for safety measures 1.2 Apply appropriate safety measures while working 1.3 Safe keep/dispose of tools, materials, and outfit	a. Identify the key safety regulations and protocols for fishing activities. b. Value the importance of adhering to safety precautions when conducting fishing activities. c. Demonstrate the proper use of safety equipment and personal protective equipment (PPE) required for different fishing tasks.	Students will watch the video and depict a fisherman catching a large, unique fish and answer the following question at the end after they have watched the video.	Students will practice the correct method or step-by-step instructions for wearing personal protective equipment.	tudents will act on the given situation in the following scenario through video presentation, a maximum duration of 10 minutes video presentation. Scenario 1; Life Jacket Practice Scenario 2: Handling Emergencies.
2. 2. Tools and Equipment 2.1 Select and use tools 2.2 Select and operate equipment 2.3 Perform preventive maintenance	a. Identify proper tools and equipment used in fishing. b. Recognize the importance of selecting the proper fishing tools and equipment to enhance fishing experience; and c. Demonstrate proper handling and use of fishing tools and equipment.	Students will be asked questions about their understanding of fishing tools and equipment and identifying different tools and equipment based on the picture that is shown.	Students will be practicing step-by-step on how to tie knots.	Students are given a chance to demonstrate how to use each fishing tool and equipment and explain the purpose and appropriate use of each tool or equipment.
3.Protecting Marine Environment 3.1 Identify garbage disposal procedures 3.2 Perform garbage segregation 3.3 Record garbage segregation	a. Identify common threats to the marine environment. b. Explain the importance of conservation and stewardship in protecting marine ecosystems. c. Perform proper action for recycling and waste segregation.	Students will watch the video about protecting the marine environment and ask them the following question: 1. What have you noticed about these marine environments?	Students comprehend their understanding, and they must explore the causes, consequences, and solutions to protecting the marine environment.	Students are tasked to create video presentations advocating for the protection of the marine environment and performing proper action for recycling and waste segregation. The

4. Applying Basic Fish Handling & Safety Practices 4.1 Identify hazards and risks to seafood and aquatic product 4.2 Follow enterprise hygiene standards, procedures, and practices 4.3 Handle and store seafood and aquatic products and follow the enterprise food safety program	a. Identify hazards and sources of contamination within the workplace. b. Follow enterprise hygiene standards, procedures, and practices. d. Handle and store seafood and aquatic products appropriately	Students will watch the video and learn something new about basic fish handling. At the end, they will be asking questions to comprehend what they have learned.	Set up a simulation where students practice handling different types of fish, emphasizing proper technique such as gripping the fish firmly but gently to avoid injury.	Students will be given problems or situations that are related to basic fish handling and safety practices. They will give solutions that can lessen or avoid that certain problem or solution, and they will select a presenter to present their work.
5.1 Adjusting and Positioning of Mesh Nets or Gill Nets, Spots, and Traps. 5.2 Organize a work area for adjusting mesh nets, or gill nets, spots, and traps. 5.3 Adjust components of a mesh net, or gill net, spots, and traps to optimize catch a. Position mesh nets, or gill nets, spots, and traps to optimize catch	b. Identify the purpose of using mesh nets or gill nets, spots, and traps. c. Explain how important to adjust and position the fishing nets and traps, and **6.** Determining the spots where the fish nets and traps be placed.	Students will be answering the "Four pics, one word".	Students will explore and practice individually on what they have learned about using fishnets.	Students will demonstrate their learning about how to use fishnets.

The lessons were developed following components of Madeline Hunter's Model Lesson Cycle which are elaborated on in detail:

Objectives: The purpose of today's lesson and why the students need to learn it. What will they be able to "do" and how will they show learning as a result?

Anticipatory Set: a short activity or prompt that focuses the student's attention before the actual lesson begins. *Input:* the vocabulary skills and concepts the teacher will impart to the students. The "stuff" the kids need to know to be successful in the lesson.

Modeling: The teacher shows in graphic form or demonstrates what the finished product looks like.

Guided practice: The teacher leads or guides the students through the steps necessary to perform the skills.

Check for understanding: The teacher uses a variety of questioning strategies to determine if the students grasp the subject and have the required skills.

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Independent practice: The teacher releases students to practice on their own based on Input and check for understanding.

Closure: Review/wrap up of lesson "Tell me / show me" what was learned today. Every lesson must have closure.

Canva app was utilized to create an instructional material design (Sugiarni, 2024). The app includes the designing of font size, style, color, and the like to create more detailed and eye-appealing IMs for students and teachers. The researchers also explored a site called FlippingBook.com, using www.flippingbook.com, which enhances the reading experience by simulating the look and feel of a physical book. This site allows users to flip pages with a realistic page-turning effect. If a physical book is not available, you can upload a PDF file to this site and begin reading as if it were a real book. The researchers have extracted all the effective techniques from each lesson. Preparing the tools and materials for these activities requires significant time and effort from both teachers and learners to achieve the desired learning outcomes.

The Validation of the developed technology–aided instructional material

An instructional material evaluation checklist (IMEC) for expert raters was used in validating the technology-aided instructional material, comprising both internal and external instructors.

Table 4. Scoring and Quantification of Data for Instructional Material Evaluation Checklist

Scale	Interpretation
3.31 - 4.00	High Evidence
2.51 - 3.30	Enough Evidence
1.71 - 2.50	Little Evidence
1.00 - 1.70	Very Little/ No Evidence

Table 4 presents the Scoring and Quantification of Data from the IMEC results for the Fish Capture instructional material, with scoring ranges interpreted as follows: A score between (3.31 and 4.00) indicates High Evidence, signifying that the material is well-developed, effective, and meets or exceeds high standards for quality. Scores ranging from (2.51 to 3.30) reflect Enough Evidence, meaning the material meets the criteria but may have areas needing improvement. It is generally acceptable but could benefit from enhancements. A score between (1.71 and 2.50) shows *Little Evidence*, suggesting that the material has several deficiencies or gaps affecting its effectiveness and requires significant revisions or enhancements. Finally, scores from (1.00 to 1.70) indicate *Very Little/No Evidence*, implying that the material is likely ineffective or unsuitable and would need substantial development to address its shortcomings. This scoring system is designed to assess the quality of instructional materials, ensuring they are validated for their effectiveness and alignment with educational standards.

Table 5. Expert Validate the Instructional Material through IMEC in terms of Content.

PARAMETER	MEAN	STD. DEV.	REMARKS
CONTENT			
(C1) Does the content of the instructional material align with the course requirements?	3.60	0.49	High Evidence
(C2) Is the content current or up to date, relevant, complete, and accurate?	3.40	0.49	High Evidence
(C3) Is the level of difficulty of content appropriate for the target end-user in terms of age, abilities, and time/period for teaching?	3.40	0.49	High Evidence
(C4) Does the content involve connections to other disciplines, real-life situations, or students' socio-culture environment to promote the deeper meaning of concepts?	3.80	0.40	High Evidence
(C5) Is IM free of gender, social, and cultural biases?	3.60	0.49	High Evidence
(C6) Are the ideas expressed in unifying themes?	3.00	0.63	Enough Evidence
	3.47	0.25	High Evidence

Legend: **1.00 - 1.70** *No Evidence*, **1.71 - 2.50** *Little Evidence*, **2.51 - 3.30** *Enough Evidence*, **3.31 - 4.00** *High* Evidence

As to the Content shown in Table 5, using the Instructional Material Evaluation Checklist (IMEC), five expert validators assessed the instructional material on Fish Capture in Agri-Fishery Arts. The validation reveals that the material performs well in several key areas. The content excels in connecting concepts to other disciplines, real-life situations, and students' sociocultural environments, achieving a high mean score of (3.80) with a lower standard deviation of (0.40), indicating High Evidence in this aspect. It is also largely free of gender, social, and cultural biases, with a mean score of (3.60) and a standard deviation of (0.49), indicating High Evidence. Additionally, the content aligns effectively with course requirements, also scoring a mean of (3.60) and a standard deviation of (0.49), indicating High Evidence.

The material is mostly current, relevant, complete, and accurate, with a mean score of (3.40) and a standard deviation of (0.49), indicating High Evidence in meeting curriculum needs. It is appropriate for the target audience, scoring a mean of (3.40) and a standard deviation of (0.49), making it suitable for the specified age, abilities, and teaching period, also reflecting High Evidence. However, there is room for improvement in creating unifying themes, with a mean score of (3.00) and a higher standard deviation of (0.63), indicating Enough Evidence in this area. Overall, the material is generally effective, with an overall mean score of (3.47) and a standard deviation of (0.25). This implies that the material has High Evidence of content, but there are specific areas that still need improvement, particularly in aligning the learning material with the ideas expressed in unifying themes.

Table 6. Expert Validate the Instructional Material through IMEC in terms of 0rganization and Structure

PARAMETER	MEAN	STD. DEV.	REMARKS
Organization and Structure			
(OS1) Are the materials easy for students to use and understand?	3.60	0.49	High Evidence

	MEAN	STD. DEV.	REMARKS
(OS2) Are instructions/directions in the IM clear and concise?	3.60	0.49	High evidence
(OS3) Are lesson objectives/outcomes clear and appropriate?	3.60	0.49	High Evidence
(OS4) Are the layout/formats, narrative, and visuals of IM interesting and appealing?	3.20	0.40	Enough Evidence
(OS5) Are the components of IM logically organized, undefined, and consistent?	3.40	0.80	High Evidence
(OS6) Does the IM provide opportunities for students to use ICT?	3.20	0.98	Enough evidence
	3.43	0.18	High Evidence

Legend: **1.00 - 1.70** *No Evidence*, **1.71 - 2.50** *Little Evidence*, **2.51 - 3.30** *Enough Evidence*, 3.31 - **4.00** *High Evidence*

Using the Instructional Material Evaluation Checklist, five expert validators assessed the instructional material on Fish Capture in Agri-Fishery Arts in terms of Organization and Structure as shown in Table 6. The validation reveals High Evidence in several key areas. The material is highly user-friendly because it is easy for the students to use with clear and concise instructions and appropriate lesson objectives, each receives a mean rate indicating a High Evidence of (3.60) and a standard deviation of (0.49).

The components are logically organized, undefined, and consistent, receiving a mean score of (3.40) with some variability (standard deviation of (0.80)), indicating High Evidence with areas for improvement. The layout, format, narrative, and visuals are somewhat appealing, with a mean score of (3.20) and a standard deviation of (0.40), suggesting the need for more engaging elements as they receive Enough Evidence. Opportunities for students to use ICT are present but could be better integrated, as reflected in a mean score of (3.20) and a higher standard deviation of (0.98), also receiving Enough Evidence.

Overall, the instructional material is High Evidence, with an overall mean score of (3.43) and a low standard deviation of (0.18), indicating consistent validation. Enhancing engagement and ICT integration could further elevate its effectiveness.

Table 7. Expert Validate the Instructional Material through IMEC in terms of Support to Learning.

PARAMETER	MEAN	STD. DEV.	REMARKS
SUPPORT TO LEARNING			
(SL1) Does the IM promote collaborative learning?	3.60	0.80	High Evidence
(SL2) Are the learning tasks motivating and engaging to students?	3.60	0.49	High Evidence
(SL3) Does the material involve varied teaching strategies?	3.60	0.49	
(SL4) Are assessments of learning appropriate to achieve the intended learning	3.60	0.49	High Evidence

outcome?

(SL5) Are rubrics to assess learning provided?	3.60	0.49	High Evidence
(SL6) Does the material present opportunities for task-based learning?	3.80	0.40	High Evidence
(SL7) Does the material support self- directed learning?	3.80	0.40	High Evidence
(SL8) Does the IM promote critical thinking, creativity, and problem-solving skills of students?	3.80	0.40	High Evidence
(SL9) Is the IM free from any form of plagiarism?	3.00	0.89	Enough Evidence
	3.60	0.24	High Evidence

As to **Support to Learning** shown in Table 7, using the Instructional Material Evaluation Checklist, five expert validators assessed the instructional material on Fish Capture in Agri-Fishery Arts. The material excels in presenting opportunities for task-based learning, supporting self-directed learning, and promoting critical thinking, creativity, and problem-solving skills of students, each receiving a ***High Evidence*** rate of (3.80) and a low standard deviation of (0.40), indicating strong and consistent evidence.

It effectively promotes collaborative learning, with a mean score of (3.60) High Evidence and a higher standard deviation of (0.80), suggesting some variability but still strong support. The learning tasks are motivating and engaging, and the material involves varied teaching strategies, both with mean scores of (3.60) and a standard deviation of (0.49), consistently meeting High Evidence. Assessments of learning are appropriate to achieve the intended learning outcome, and rubrics to assess learning are provided, each also scoring a mean of (3.60) and a standard deviation of (0.49). However, the IM free from any form of plagiarism, receives a lower mean score of (3.00) with a higher standard deviation of (0.89), indicating Enough Evidence but suggesting the need for more stringent checks. Overall, the material is High Evidence in supporting learning, with an overall mean score of (3.60) and a low standard deviation of (0.24), showing consistent and strong performance with areas for targeted improvement.

The Preview of the Developed Instructional Material on Fish Capture

Figure 1 provides a preview of the developed instructional material on Fish Capture. This resource combines aesthetic appeal with educational effectiveness, making it ideal for Agri-fishery arts students. It features a visually captivating layout with high-quality images, illustrations, and infographics to keep learners engaged and help them grasp complex concepts easily. Following Madeline Hunter's Model Lesson Cycle, the book offers a structured approach to learning with interactive elements like QR codes linking to video tutorials and virtual simulations. Detailed practical guides and assessment tools further enhance its informative and user-friendly nature. By using this eye-catching material, educators can significantly improve the learning experience, ensuring students gain valuable skills and knowledge dynamically and engagingly. The eight components of Madeline Hunter's Model—Objectives, Anticipatory Set, Input, Modeling, Guided Practice, Independent Practice, Check for Understanding and Closure—are well-presented, as shown in the preview lesson in Figure 1. With *the aid of technology, Flipping.com*, the instructional materials were displayed ready to utilize anytime and anywhere.

Figure 1. Lesson 1 Preview

Conclusion

The developed instructional material is functional and can be utilized for both online and face-to-face learning modalities. It promotes active and independent learning since it is accessible in both online and printed formats. This flexibility makes it a highly convenient option for today's educational settings.

Moreover, throughout the validation process, it received high evidence ratings in the Instructional Material Evaluation Checklist (IMEC) concerning Content, Organization, Structure, and Support to Learning; this indicates that this instructional material is efficient as a learning resource for Agri-Fishery Arts students.

Recommendations

Based on the findings and conclusions, the following recommendations were made:

For further research, the researchers can validate by implementing this instructional material to its target end-users in an actual classroom setting and utilizing this instructional material in both online and traditional classroom settings,

specifically for Agri-fishery arts students;

Students may use this instructional material as a guide in their studies, as it provides practical experiences that help them develop essential skills and concepts;

School administrators may implement this instructional material to offer effective learning strategies in both online and traditional classroom environments;

Future researchers may create demonstration videos of the sample activities in the instructional material, thereby enhancing student engagement and making the lessons more interactive;

Future researchers may revise and improve the lessons to better address the needs of 21st-century learners.

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Design Analysis of Book Covers Written on Ahi Community

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Abstract: The function of graphic design is to introduce a product or person, to announce an event and, in essence, to convey a message. For this reason, they are directly related to the understanding of the message, the distribution of the design, and its clarity and comprehensibility. In its simplest definition, the book cover, which is the packaging of the book, should convey a message as a graphic design object. A book cover is a design object that provides information about the content of the book, visualizes the explanations or content of the books, distinguishes it from other books, and directs the potential reader to the book. For a good book cover design, the target audience, whose content is not well known, should be analyzed well and a design idea should be developed accordingly. In this report, 5 book covers written about Ahi Community will be examined. These covers will be examined under various subheadings such as the visual elements used (color, typography, images), themes, symbols, cover and content.

Keywords: Ahi Community, Graphic Design, Book Cover

Introduction

The book cover is the first point of contact between the reader and the text and, therefore, serves as a critical marketing tool in the publishing industry (Genette, 1997; Powers, 2001). Cover design is not merely an aesthetic choice but also a complex communication system that communicates the book's content, target audience, and publishing philosophy (Phillips, 2007). Design and creativity are very important in the fine arts (Ceran, 2022, 2025; Ciddi, 2025; Ozkan & Erdem, 2025; Ozturk & Susuz, 2023; Öztürk & Karatas, 2023) and are the skills that students should have in the 21st century (Öztürk, 2023). Especially in books dealing with historical and cultural themes, cover design offers the reader important clues about the content and also contributes to the processes of collective memory and identity construction (Stoicheff & Taylor, 2004). The Ahilik (Ahi Order) is a socio-economic and moral organization formed by tradesmen and artisans that played a significant role in the Anatolian Seljuk and Ottoman periods (Çağatay, 1989; Ekinci, 2007). This institution, which shaped the social, economic, and cultural structure of Anatolia since the 13th century (Kazıcı, 2003), is notable for its frequent coverage in academic and popular publications today, keeping collective memory alive. The cover designs of books about the Ahi order constitute an important area of study for understanding how they present this historical legacy to contemporary readers. In light of all these definitions, books published about the

influence of the Ahi order on our culture enable us to pass on the Ahi order to future generations, explain it, and keep this ancient tradition alive, thus keeping our cultural memory alive and vibrant. The aim of this study is to analyze the cover designs of books about the Ahi order published in Türkiye between 2000 and 2025, which are either bestsellers or recommended on online book platforms. The research aims to discuss how these covers are constructed in terms of visual language, typography, color use, and symbolic elements, and the potential impact of these choices on reader perception.

Literature Review

The Function and Importance of Book Cover Design

Design, in general, is the act of solving a visual problem. The moment multiple objects are added to a design surface; a design problem begins. When solving these problems, the designer must always consider the relationship between the objects' proportions and the surface. Book cover design is an interdisciplinary field of research at the intersection of literary sociology and visual communication studies. Genette (1997) developed the concept of "paratext" to describe all the textual and visual elements that surround and present a book. This concept explains how the cover design, title, author's name, and other visual elements shape the reader's relationship with the text. The cover creates the reader's first impression of the book, and this impression can be decisive in the purchase decision (Kress & Van Leeuwen, 2006). Powers (2001) emphasizes that book covers are "silent salesmen" and an integral part of publishers' marketing strategies. With the proliferation of online book sales platforms, the importance of cover design has increased, as readers are forced to make a visual assessment before physically holding the book in their hands (Greco, Rodriguez & Wharton, 2007). In this context, cover design serves both an aesthetic and a functional role.

Visual Communication and Symbolism

Kress and Van Leeuwen (2006) systematically explain how images generate meaning in their theory of visual grammar. According to this theory, visual elements such as colors, composition, perspective, and typography, like linguistic structures, carry specific meanings, and these meanings are culturally encoded. Symbols used in book cover design communicate directly with the target audience and convey implicit messages about the book's content (Hall, 1997). The framework of visual grammar is particularly evident in historical and nostalgic content. In works that depict narratives of the past, the selection of visual elements goes beyond mere aesthetic preference and becomes a strategic tool that shapes the reader's emotional and cognitive experience. In this context, the use of traditional and periodical images presents a concrete application of the meaning-making mechanisms offered by visual grammar. In books addressing historical and cultural themes, the use of traditional motifs and periodical images can create a nostalgic effect in the reader and strengthen their perception of authenticity (Boym, 2001). Such design choices also provide clues as to whether the book is written with an academic or popular approach (Papacharissi & Oliveira, 2012; Tekin, 2025).

Typography and Cultural Identity

Typography is one of the most critical elements of book cover design because it both ensures readability and

establishes a visual identity (Lupton, 2010). Font choices provide important signals about the book's genre, tone, and target audience. For example, serif fonts are often associated with seriousness, academic gravity, and tradition, while sans-serif fonts convey a modern and accessible image (Mackiewicz, 2007). In books on Turkish history and culture, the use of typographic elements inspired by calligraphy or traditional Turkish motifs aims to emphasize cultural authenticity and establish an emotional connection with the target audience (Ertuna, 2015). However, overuse of such choices can cause the design to become clichéd and be perceived as outdated by modern readers (Uyan Semerci, 2010). A balanced design approach can both preserve cultural identity and meet current aesthetic expectations by blending traditional elements with contemporary design language. Successful typography should clearly indicate historical references while simultaneously prioritizing the book's scholarly rigor and readability. This balance enhances the book's potential to appeal to a broad audience while maintaining its academic value.

Color Use and Cultural Connotations

Color is an element that creates strong emotional and psychological effects in visual communication (Elliot & Maier, 2014). In a cultural context, colors are associated with specific meanings and values. In Turkish culture, red is often associated with the flag and nationality, green with Islamic values, and gold and earth tones with historical richness and tradition (Özsoy, 2003). The choice of color in book cover design determines the emotional tone of the book and attracts the attention of the target audience (Labrecque & Milne, 2012). In historical themes such as the Ahi movement, the use of warm and earthy tones can aim to convey the warmth and authenticity of a bygone era in the reader (Kürkçüoğlu, 2019). The choice of color in book cover design determines the emotional tone of the book and attracts the attention of the target audience (Labrecque & Milne, 2012). The psychological impact of colors creates certain associations in the viewer, providing preliminary information about the book's content. In historical contexts such as the Ahi movement, the use of warm, earthy tones can convey a sense of the warmth and authenticity of a bygone era in the reader (Kürkçüoğlu, 2019).Strategic use of a color palette goes beyond simply being an aesthetic choice; it creates a visual narrative that aligns with the book's content. Especially in historical works, color choices that reflect the spirit of the period make the reader's initial contact with the book meaningful and shape their expectations of the content. Therefore, color use that is sensitive to cultural values and aligns with contemporary design approaches enhances the book's scientific depth and visual impact.

Ahilik and Cultural Representation

The Ahilik system is a multidimensional structure encompassing moral values, social solidarity, and a vocational training system, beyond being merely an economic organization (Çağatay, 1989). Founded under the leadership of Ahi Evran, this system is considered the Anatolian manifestation of the futuwwa tradition and formed one of the cornerstones of the social order during the Seljuk and Ottoman periods (Ekinci, 2007; Kazıcı, 2003). The way the Ahilik phenomenon is represented in contemporary graphic design requires the reinterpretation of a historical concept through contemporary visual communication tools. In this context, designers integrate traditional symbols and motifs with contemporary aesthetics, creating a visual bridge between the past and the present. Thus, design ceases to be merely a surface conveying historical information; it also becomes a narrative tool that emphasizes the continuity of cultural identity. Today, publications on Ahilik examine this historical legacy from different perspectives. While some

publications offer analyses based on historical documents with an academic approach, others discuss the applicability of Ahilik to modern business ethics in a popular language (Genç, 2014). These content differences are also reflected in the cover designs, and visual strategies tailored to each publication's target audience are developed.

Method

This research utilizes qualitative research methods such as literature review and visual analysis. The scope of the study was determined from best-selling or recommended books published in Türkiye between 2000 and 2025 and listed with the keyword "Ahilik" on online book sales platforms (such as Kitapyurdu, İdefix, and D&R). The number of book covers to be analyzed was limited to five, and books with multiple editions were considered as a single work. Purposive sampling was used in sample selection, taking into account sales figures, reader reviews, and the platforms' recommendation algorithms. This approach allows for the analysis of covers with high market visibility and preferred by readers. The visual grammar framework of Kress and Van Leeuwen (2006) was used as the basis for the analysis of book covers, and the following categories were examined:

a) **Visual elements and composition:** The nature, placement, and hierarchy of photographs, illustrations, motifs, and other visual elements used on the cover.

b) **Typography:** Font choices, point sizes, alignment, and typographic hierarchy.

c) **Color palette:** The nature, saturation, and cultural connotations of the colors used.

d) **Symbolic elements:** Traditional motifs associated with the Ahi community, historical references, and iconographic elements.

e) **General design approach:** Academic/popular, traditional/modern, minimal/maximal design trends.

Each cover was descriptively analyzed and comparative evaluations were made within the framework of these criteria.

Conceptual Framework

Visual Rhetoric in Book Cover Design

Visual rhetoric, a field that examines the persuasive and semantic power of images, offers an important theoretical foundation for understanding book cover design (Foss, 2005). Aristotle's classic rhetorical triad of ethos (credibility), pathos (emotional appeal), and logos (logical structure), when applied to visual design, can explain how covers influence the reader (Hill & Helmers, 2004). A book cover visually establishes the credibility of the author and publisher (ethos), evokes emotional responses in the reader (pathos), and enables them to draw logical inferences about the book's content (logos). This theoretical framework offered by visual rhetoric necessitates a systematic examination of not only the formal but also the semantic layers of visuals. The persuasive functions carried by design elements, combined with a semiotic approach, reveal the multilayered meanings of book covers. In this context, a joint evaluation of the denotative and connotative meanings of images enables an understanding of both the functional and ideological dimensions of design. Barthes (1977) notes that images carry both denotation and connotation. Images used on book covers often carry cultural and ideological meanings beyond their superficial representations. A handicraft image on the cover of a book about the Ahi movement may evoke not only craftwork but also traditional values, the master-apprentice relationship, and moral excellence.

Cultural Memory and Visual Representation

Assmann (1995) argues that cultural memory shapes how societies remember and make sense of their past. Books, especially those dealing with historical themes, function as carriers of cultural memory, and their cover designs visually represent this memory. The covers of books about a significant institution in Turkish history, such as the Ahilik, appeal to collective memory while also defining how they wish to present that institution to contemporary readers. With the concept of "sites of memory" (lieux de mémoire), Nora (1989) draws attention to the symbolic spaces and objects where collective memory crystallizes. In this context, book covers can be considered micro-sites of memory; they represent history through specific visual elements and symbols and evoke specific associations in the reader's mind (Erll, 2011).

Paratextuality and Reader Experience

Genette's (1997) paratext theory explains how all the elements surrounding a book (cover, title, foreword, back cover text, etc.) influence the understanding and reception of the text. The cover is the most visible and influential paratextual element because it is the reader's first contact with the book. Gray (2010) emphasizes that paratexts are not mere additions but rather active spaces where the meaning of the text is constructed. Book covers shape reader expectations and provide immediate information about the book's genre, tone, and target audience (Phillips, 2007). The cover of an academic Ahilik book will differ significantly in terms of paratextual strategies from one written with a popular approach. The former aims to convey seriousness, scholarly authority, and authority, while the latter may aim for accessibility, attractiveness, and broad audience reach.

Semiotic and Cultural Codes

The semiotic approach, based on the work of Saussure (1916/1983) and Peirce (1931-1958), examines how signs produce meaning. Book cover design is a complex system filled with visual signs, and these signs carry culturally encoded meanings. Eco (1976) notes that signs are interpreted at both individual and cultural levels, and that meaning can vary depending on the reader's cultural background. The symbolic elements used in Ahi-themed book covers— for example, shalwar, turban, handloom, and traditional motifs—hold specific historical and cultural meanings for Turkish society. The selection and presentation of these symbols reflects the designer's intended dialogue with the target audience (Hall, 1997). However, these symbols also risk becoming clichéd; excessive use can diminish reader interest and undermine the originality of the design.

Consumer Behavior and Visual Marketing

Book publishing is a commercial activity as well as a cultural industry, and cover design is a critical component of marketing strategy (Thompson, 2012). Kotler and Keller (2016) thoroughly examine how visual elements influence consumer perception and purchase decisions in the marketing literature. Cover design provides product differentiation and establishes brand identity. The proliferation of online book sales platforms has further increased the importance of cover design. Readers see a scaled-down cover image on the screen before picking up the physical book and decide

within a few seconds whether they find it appealing (Cardon & Marshall, 2008). In this context, visual hierarchy, color contrast, and readability become the key criteria for successful cover design in the digital environment.

Analysis of Samples
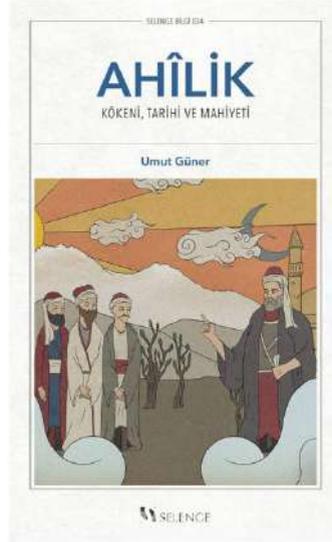
Picture 1 (Kitapyurdu, 2025)

Table 1.Ahîlik Kökeni, Tarihi ve Mahiyeti - Umut Güner

Category	Sub-Criteria	Evaluation
Visual Elements	Use of Photography/ Illustration	The cover uses a traditional miniature-style illustration, but the miniature drawing gives the impression of being computer-aided rather than traditional. The figures' clothing, architectural elements, and natural elements support a historical narrative. The choice of drawing over photography adds cultural and historical depth.
	Composition and Layout	The image is framed in a horizontal rectangle at the bottom of the cover, with typographical space (book title, subtitle, author) at the top, arranged in a simple layout. Placing the image in the center, rather than at the top, balances the focus downward.
	Visual hierarchy	The main title is displayed in large font at the top; the image draws attention on a secondary level. However, the image's colorful and detailed structure draws the eye after the title, creating a good hierarchical balance.
Typography	Font Family	A modern, simple sans-serif font was used. This choice aims to present the historical subject in a modern setting.
	Point and Size Relationships	The word "AHÎLİK" appears in capital letters, bold, and the highest font size. The subheading ("Origin, History, and Essence") is in smaller, lighter font. The name "Umut Güner" is presented at a separate hierarchical level, with sufficient spacing between them.
	Legibility	It has high legibility; the white background and simple typography provide excellent readability in print and digital environments.
Color	Primary Color Palette	The cover is dominated by pastel colors like light beige, earth tones, blue-grey, and red. The typographic area at the top is kept simple on a white background.
	Color Saturation and Contrast	The colors are low-saturated, with pastel tones creating a soft effect. This creates a sense of historical and academic calm.
	Cultural Connotations	Earthy and red tones evoke the Anatolian landscape, while blue tones evoke spirituality and wisdom. The color palette is balanced to reflect the miniature aesthetic.
Symbolic Elements	Traditional Motifs	Miniature-style figures, headdresses, clothing, crescent motif and architectural structure (minaret) make direct reference to traditional Turkish-Islamic culture.
	Iconographic Elements	The teacher-student relationship between the figures symbolically references the "master-apprentice" system of the Ahi organization. The sun and crescent symbols represent the illumination of knowledge and spirituality.
	Originality/ Cliche Balance	Although the design evokes clichéd historical motifs, it offers a modernized traditional narrative thanks to its simplified miniature style and pastel tones.

| General Approach | Academic/ Popular Tone | Although the design evokes clichéd historical motifs, it offers a modernized traditional narrative thanks to its simplified miniature style and pastel tones. |
| | Traditional/ Modern Aesthetics | The visuals are traditional, while the typography and layout are modern. The combination of these two creates a balanced visual identity that represents a "modern interpretation of tradition." |
| | Minimal/Maximal Design | A minimalist design approach prevails. The use of white space, a limited color palette, and a single illustration create a simple yet effective look. |
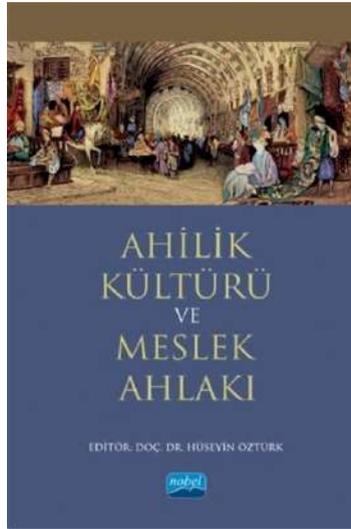
Picture 2 (Amazon, 2025)

Table 2. Ahîlik Kültürü ve Meslek Ahlakı – Editor: Assoc. Prof. Dr. Hüseyin ÖZTÜRK

Category	Sub-Criteria	Evaluation
Visual Elements	Use of Photography/ Illustration	The cover features an illustrative Ottoman bazaar scene. This evokes the period when Ahi culture emerged, fitting the historical context. The choice of illustration over photography emphasizes a cultural and artistic approach.
	Composition and Layout	The image is placed horizontally at the top of the cover, while the typography area below is arranged within a wide color block, clearly separating the image and text.
	Visual hierarchy	The illustration is the focal point at the top, while the title is highlighted in large font at the bottom. The image highlights the historical atmosphere and professional life.
Typography	Font Family	A serif font is used in the title. This choice conveys a traditional, academic character. Serif details are in keeping with classic book design.
	Point and Size Relationships	The phrases "AH-Islamic Culture" and "Professional Ethics" are written in capital letters and a high font size. The word "and" serves as a bridge between the two, in a smaller font. However, a lighter font draws undue focus to the conjunction. The editor's name is placed lower and at the bottom, creating a hierarchical order.
	Legibility	Its readability is quite high. Color contrast and large font make it easy to read in both digital and print environments.
Color	Primary Color Palette	The lower part of the cover is dominated by cool navy-blue tones; the upper illustration is made up of warm beige, brown and earth tones.
	Color Saturation and Contrast	Color saturation is moderate. The navy blue and beige contrast provides visual balance. The text color (light yellow) is well separated from the background.
	Cultural Connotations	The blue and gold hues evoke trust, wisdom, morality, and spirituality, which supports the book's theme of "morality."
Symbolic Elements	Traditional Motifs	The illustration uses traditional trade symbols such as the Ottoman bazaar, tradesmen, fabrics and architectural details.
	Iconographic Elements	There is no direct logo or symbol representing Ahilik; however, the craftsmen, the shopping scene and the environment reminiscent of the Ahilik guild iconographically support the subject.
	Originality/Cliche Balance	The design explores traditional themes without becoming clichéd. The choice of historical illustrations adds originality, while avoiding excessive ornamentation.
General Approach	Academic/Popular Tone	The cover is designed with an academic tone. The editor's name, simple typography, and layout suggest the book is a textbook or research book.
	Traditional/Modern	Traditional aesthetics prevail. The visual language evokes a historical and cultural period.

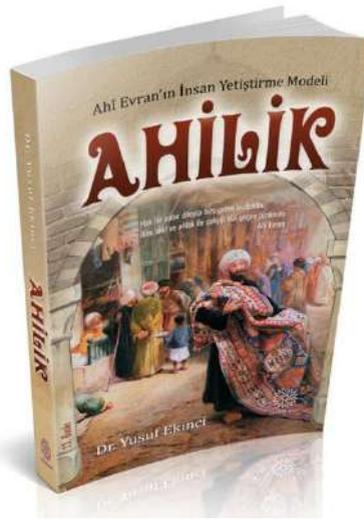|	Aesthetics	
	Minimal/Maximal Design	A semi-minimal approach: the visuals are limited to a single scene, the text area is simple. No clutter, but not completely minimal either.
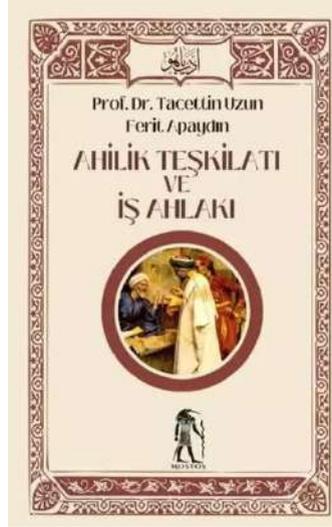
Picture 3 (İdefix, 2025)

Table 3. Ahilik Teşkilatı ve İş Ahlakı – Prof. Dr. Tacettin UZUN, Ferit APAYDIN

Category	Sub-Criteria	Evaluation
Visual Elements	Use of Photography/ Illustration	A circular illustration, referencing the historical context of the subject, occupies a central position on the cover. This image symbolizes the socio-economic structure of the Ahi organization and fundamental moral principles, such as the tradesman-apprentice relationship.
	Composition and Layout	The design exhibits symmetry and balance along a vertical axis. The main title and author information are positioned hierarchically at the top, the illustration at the center, and the publisher information at the bottom. A border surrounded by traditional motifs reinforces the composition's unity.
	Visual hierarchy	Visual priority was given to the large, prominent illustration, followed by the main headline in a large font. Author names were placed secondary, ensuring a clear flow of information. The border around the cover draws attention to itself due to its color. A lighter tone could have been considered for hierarchical purposes.
Typography	Font Family	Serif characters are preferred for the title and author names. This choice lends the text a traditional, classical, and academic quality and reinforces the historical weight of the book's content.
	Point and Size Relationships	The main title's font is significantly larger than the authors' names. This size variation effectively establishes a typographic hierarchy. The stylized Arabic script at the top serves as a decorative element. The phrase "Edep ya hu," associated with the Ahi order, is chosen to summarize the book and reinforce its moral emphasis.
	Legibility	Despite the traditional structure of the fonts used, the readability of basic texts is high thanks to sufficient color contrast.
Color	Primary Color Palette	The dominant color palette in the design consists of a cream/beige base and warm earth tones like brown/burgundy. This palette creates a cohesive visual effect that complements the vibrant central illustration.
	Color Saturation and Contrast	Colors are generally low-saturated and pastel. Contrast is achieved through smooth transitions rather than sharpness, giving the cover a sober atmosphere.
	Cultural Connotations	Brown and cream tones are directly associated with historical manuscripts, parchments, and traditional artwork. These colors serve to symbolize the historical and cultural depth of the book's content.
Symbolic Elements	Traditional Motifs	The geometric and floral motifs surrounding the cover bear references to traditional decorative arts from the Seljuk or Ottoman periods.
	Iconographic Elements	The central illustration provides an iconographic reference to the cultural and social life of the Ahilik organization. This image directly reflects the main theme of the book.
	Originality/Cliche Balance	The design uses the expected traditional motifs that are compatible with the historical nature of the subject, while presenting these elements in an original arrangement, ensuring the integrity of

|		the subject.
General Approach	Academic/Popular Tone	The design language is sober and academic. This aesthetic is intended for an academic audience, suggesting that the work is a scientific investigation or cultural study.
	Traditional/Modern Aesthetics	The aesthetic approach is distinctly traditional. Modern/minimalist design principles are avoided, and a visual language befitting the historical origins of the subject is adopted.
	Minimal/Maximal Design	The design has a medium density due to the use of detailed framing and illustration. This provides the reader with a rich visual experience while avoiding excessive complexity.

Picture 4 (D&R, 2025)

Table 4. Ahilik – Dr. Yusuf EKİNCİ

Category	Sub-Criteria	Evaluation
Visual Elements	Use of Photography/ Illustration	The cover is based on a rich and detailed oil painting or high-quality illustration image containing intense figurative elements, thought to date from the Ahi period.
	Composition and Layout	The image completely fills the middle and bottom sections of the cover, creating a dynamic and profound composition. The top section and the arch motif serve as a frame for the title.
	Visual hierarchy	The most dominant element in the visual field is the central figure in traditional garb, carrying a carpet. In the typographic hierarchy, the main title "AHİLİK" (AHILIK), written in the largest font, stands out.
Typography	Font Family	The main title, "AHİLİK," is stylized in a bold, strong, slightly rounded, decorative font. A modern serif font is used for subheadings and the author's name, while a simpler sans-serif font is used for quotations.
	Point and Size Relationships	A distinct hierarchy of information flow was created by using different font sizes for the title, author, and publisher information. The inclusion of a relevant Ahi Evran quote in smaller font below the main title reflects a strategy of primarily conveying the content's importance through the title.
	Legibility	The contrast between the main heading and subtexts and the background color was kept high, which maximized the perception of visual texts in digital and printed formats.
Color	Primary Color Palette	The cover is dominated by warm earth tones, a creamy beige base, and intense colors like brown/burgundy. The vibrant reds and blues in the figures' clothing add depth to the palette.
	Color Saturation and Contrast	Colors are highly saturated and vibrant. The use of deep shadows and highlights in the image creates strong contrast, heightening the drama of the scene.
	Cultural Connotations	The warm and rich color tones used evoke the artistic texture of Ottoman and Anatolian culture, giving the book a historical seriousness and cultural richness.
Symbolic Elements	Traditional Motifs	The image features a strong presence of traditional motifs and cultural symbols, such as carpets, archways, and period clothing. The decorative typography also supports these traditional motifs.
	Iconographic Elements	The atmosphere of an arched marketplace or bazaar directly references the Ahilik's character as a trade and artisan organization. The central figure carrying a valuable product such as a carpet symbolizes the union of business ethics and art.
	Originality/ Cliche Balance	While the theme of the historical marketplace, frequently used for the visual representation of the Ahilik subject, carries the risk of becoming a cliché, the artistic depth of the image and the use of the Ahi Evran quote powerfully reflect the essence of the subject.
General	Academic/	While the design is academic, its visual intensity and dramatic use of color convey a tone that appeals to a

Approach	Popular Tone	broad audience, namely the popular sphere. The subtitle suggests a practical approach, focusing on the book's "Human Cultivation Model."
	Traditional/ Modern Aesthetics	Although the typography is blended with modern elements, the aesthetics that dominate the cover are historical and traditional.
	Minimal/ Maximal Design	Given the density of visual and typographic elements, this design has a maximalist approach; the reader is presented with a rich and detailed image.
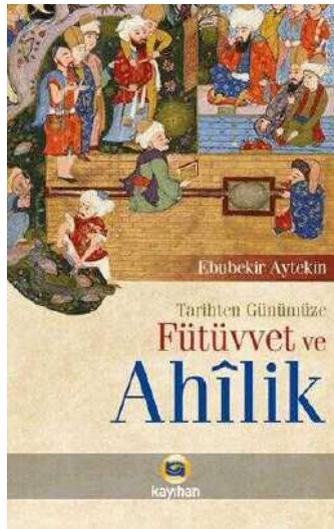
Picture 5 (Bkmkitap, 2025)

Table 4. Tarihten Günümüze Fütüvvet ve Ahilik – Ebubekir AYTEKİN

Category	Sub-Criteria	Evaluation
Visual Elements	Use of Photography/ Illustration	The top of the cover features an illustration typical of traditional miniature art. These drawings are intensely figurative, depicting a meeting or educational scene from the period.
	Composition and Layout	The design features a horizontal division between the visual and typographic areas. The upper half houses the thumbnail image, while the lower half houses the typographic elements and the author's name.
	Visual hierarchy	The most striking visual element is the miniature's traditional style and richness of color. In the typographic hierarchy, the word "Ahilik" is prominently highlighted over other titles.
Typography	Font Family	A serif character was preferred for the author's name, the subtitle ("Futuvvet from History to the Present"), and the keyword "Ahilik".
	Point and Size Relationships	There is a gradual font size difference between the heading elements. "Ahilik" appears in the largest font size, "Futuvvet" in the second largest, and "From History to the Present" in the smallest, reflecting the order of importance of the information.
	Legibility	The placement of the text on a simple, modern background and the use of blue and red enhance the clarity and readability of the text. However, instead of including the book's full title, the emphasis is solely on "Ahilik."
Color	Primary Color Palette	The cover balances a warm beige background with the vibrant reds, blues, greens, and yellows from the miniature, with a neutral gray band at the bottom.
	Color Saturation and Contrast	The colors in the miniature are highly saturated and vibrant, while the contrast between blue and red in the typographic area enhances the emphasis of the text.
	Cultural Connotations	The beige background evokes traditional manuscripts or parchment paper. The miniature art directly references the cultural heritage of the Ottoman/Seljuk period.
Symbolic Elements	Traditional Motifs	Miniature art is itself a traditional artistic motif, containing costume and figurative details related to the lifestyle and social environment of the period.
	Iconographic Elements	The miniature probably symbolizes an educational environment, an exchange of ideas or the transfer of mastery; this provides an iconographic reference to the educational and guidance function of Ahilik.
	Originality/Cliche Balance	The use of miniatures is an aesthetically unique choice, befitting the historical and artistic roots of the subject. This approach embraces a different artistic language compared to the photo-realistic images of previous covers.

General Approach	Academic/Popular Tone	The book's academic content is reinforced by the use of a specialized term like "Futuvvet" in the title. However, the aesthetic appeal of the miniature and the simple typography also support the work's aim to reach a popular audience.
	Traditional/Modern Aesthetics	The cover exhibits a hybrid approach by successfully combining traditional miniature aesthetics at the top with modern typographic arrangement at the bottom.
	Minimal/Maximal Design	The design presents a neat and clean appearance with separation of visual and text areas.

Discussion

Book cover design, as the critical interface between reader and text, is not merely an aesthetic choice but also a complex production process situated at the intersection of cultural representation, marketing strategy, and visual communication. The cover designs of books addressing a historically and culturally significant topic like the Ahilik (Islamic order) constitute an important area of study for understanding how they present this heritage to contemporary readers and the visual strategies they employ to capture their attention.

A literature review demonstrates that book covers function as paratexts, allowing readers to draw immediate conclusions about the content, tone, and value of the text (Genette, 1997; Phillips, 2007). In this context, covers of books about the Ahilik (Islamic order) represent a historical institution while simultaneously striking a balance between various strategies, such as academic rigor, popular accessibility, and nostalgic appeal. Visual symbolism plays a central role in these cover designs. Traditional motifs, craft tools, period clothing, and historical locations visually construct the Ahilik's cultural identity. However, the use of these symbols requires careful balancing. Overly stylized or clichéd visuals can be perceived as old-fashioned or inauthentic by modern readers (Uyan Semerci, 2010). On the other hand, minimalist or overly modern designs may fail to convey the historical depth and cultural weight of the subject.

Typographic choices are also important factors in determining the impact of the cover design. The preference for serif fonts in academic texts is consistent with the goal of conveying seriousness and credibility (Lupton, 2010; Mackiewicz, 2007). However, designs inspired by calligraphy or integrating traditional Turkish motifs into the typography, while emphasizing cultural authenticity, can create readability problems. Such design decisions should be aligned with the target audience's expectations and the book's marketing objectives.

The use of color is a critical design element in terms of emotional associations and cultural meanings. Warm colors such as earth tones, gold, and deep reds evoke historical richness and traditional values, while cool, neutral tones can signal a modern and academic approach (Elliot & Maier, 2014; Labrecque & Milne, 2012). In books about the Ahi movement, the choice of color palette provides clues as to whether the book adopts a nostalgic or critical-analytical approach. The proliferation of online book sales platforms has transformed the function of cover design. In the digital environment, covers are displayed at smaller sizes, requiring stronger visual contrast, clear typography, and instantly recognizable symbols to capture readers' attention (Greco et al., 2007; Cardon & Marshall, 2008). This challenges designers to develop solutions that are effective in both print and digital formats. The inability to fully experience the physical and tactile richness of authentic printing techniques and binding details, particularly those applied to book covers such as embossing (relief printing), gold foil, or special die-cutting, through digital visualizations used on

online book sales platforms, creates a significant limitation in book design practices. This inadequacy exacerbates the inability to convey the aesthetic and tactile values derived from the material's tangible nature in the context of digital representation, limiting the perceived interactivity of the design.

In conclusion, the cover designs of books on Ahilik reflect the opportunities and challenges encountered in visually representing a historical subject. These covers must balance multiple objectives, such as preserving cultural memory, making academic knowledge accessible, and achieving commercial success. Design choices play a significant role in determining reader perception, purchasing decisions, and ultimately, the book's social impact.

Conclusion

This study aimed to examine the cover designs of books on Ahilik (Islamic order) published in Türkiye between 2000 and 2025. The literature review and conceptual framework revealed that book covers are not merely aesthetic objects but also complex paratextual structures where cultural representation, visual communication, and marketing strategies intersect. The theoretical basis of the study is based on Genette's (1997) paratext theory, Kress and Van Leeuwen's (2006) visual grammar approach, and Barthes's (1977) semiotic analysis. These theoretical frameworks offer powerful tools for understanding how book covers generate meaning and shape reader perception. The visual representation of a subject with deep historical and cultural roots such as Ahilik presents special challenges for designers. It is necessary to reflect traditional values and historical authenticity while simultaneously meeting the aesthetic expectations of modern readers and achieving commercial success. Striking this balance requires careful selection of visual elements, typography, colors, and composition.

Future research could expand on the findings of this study and comparatively examine the cover designs of books addressing different historical and cultural themes. Furthermore, reader perception studies and eye-tracking technologies could be used to measure the tangible impact of cover design on purchasing behavior. With the development of digital publishing, the design features of e-book covers and their comparison with print books are also emerging as an important area of research. In conclusion, by emphasizing the interdisciplinary nature of book cover design, this study aims to bridge the gap between visual communication, cultural studies, and publishing research. The cover designs of books about the Ahilik system provide a valuable example for understanding how a historical institution is represented in contemporary visual culture and the potential impact of this representation on collective memory.

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Appendixes

Appendix 1: Visual Analysis Criteria Table

Category	Sub-Criteria	Evaluation Questions
Visual Elements	Use of Photography/Illustration	What type of images were used on the cover?
	Composition and Layout	How are the images organized?
	Visual hierarchy	Which elements are highlighted?
Typography	Font Family	Which fonts are preferred?
	Point and Size Relationships	How are the title, subtitle, and author name hierarchized?
	Legibility	What is the readability situation in digital and print formats?
Color	Primary Color Palette	Which colors are dominant?
	Color Saturation and Contrast	How vibrant/passive are the colors?
	Cultural Connotations	What meanings can colors convey?
Symbolic Elements	Traditional Motifs	What historical/cultural symbols were used?
	Iconographic Elements	What images are directly related to Ahilik?
	Originality/Cliche Balance	How original or cliché is the design?
General Approach	Academic/Popular Tone	Which target audience does the design appeal to?
	Traditional/Modern Aesthetics	Which period does the design language belong to?
	Minimal/Maximal Design	What is the density level of the design?

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Appendix 2: Online Book Platforms Research Protocol

The following online book sales platforms were searched for use in this research. For books on sale at the time of the search:

1. Kitapyurdu.com: Searched with the keyword "Ahilik" and applied "bestsellers" and "featured" filters.
2. Amazon.com: Searched with the keyword "Ahilik" and sorted by sales figures.
3. Idefix.com: Searched with the keyword "Ahilik" and considered sales rank and user ratings.
4. D&R.com.tr: "Most popular" ranking was used in the search results for "Ahilik."
5. Bkmkitap.com: "Most popular" ranking was used in the search results for "Ahilik."

Selection Criteria:

• Published between 2000 and 2025
• Featured on a "bestseller" or "recommended" list on at least one online platform
• Published in Turkish
• Addressing Ahiism as the main topic (not side references)
• Evaluating the cover of the most current edition of books with multiple editions
• Books not currently on sale were not considered in the lists generated by the search. If the same book was listed first on different sales sites, the next book on the list was examined.

Appendix 3: Methodological Limitations and Future Research Suggestions
Limitations of the Study

This research has certain methodological and scope limitations. First, limiting the sample size to five books makes it difficult to draw broad generalizations. However, this limitation allowed for in-depth qualitative analysis. Secondly, the study focused solely on the visual aspects of the cover design, excluding detailed analysis of the inside cover, back cover, and textual elements on the cover. Thirdly, this study did not include reader perception research. Surveys, focus group interviews, or eye-tracking technologies could be used to measure the actual impact of cover designs.

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Crunching into Innovation: The Acceptability and Market Potential of Pako Chicharron

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Abstract: A study of the acceptability and market potential of Pako (Diplazium esculentum) Chicharon as a snack in Caraga. A sensory evaluation determined its attractiveness based on its visual appearance, aroma, taste, and texture. In contrast, the commercial potential was evaluated via a market survey. The pilot study conducted in some regions of Caraga, Philippines, resulted in high acceptability scores for appearance (8.16), aroma (7.87), taste (8.03), and texture (8.23). The scalability for the price (4.30) and pack (4.43) also indicated a good market opportunity for the product. It can be concluded from the results that Pako Chicharon is acceptable in sensory qualities, specifically in texture and appearance. A good reception regarding the product's price and packaging further highlights its marketability as a snack. The result of the study also shows how Pako Chicharon could be marketed and promoted as a healthy, potent alternative to ordinary chicharon offered to health seekers. This study shows the potential of utilizing local food systems, such as pako, as one of the innovative products to meet healthy, new, and safe consumer specifications. This knowledge leads to possibilities for developing healthy snacks with local ingredients in a regionally inspired manner. Keywords: Pako Chicharon, Snack Acceptability, Market Viability, Sensory Evaluation, Healthy Alternative.

Introduction

Consumers have increasingly strongly preferred healthier, more sustainable food options in recent years. This trend has led to a dynamic shift in food innovation, where fresh, local ingredients are being rediscovered and repurposed into modern snack foods that meet both nutritional needs and sustainability goals. As the global demand for nutrient-rich, minimally processed foods continues to rise, locally sourced products with functional health benefits are gaining significant traction in consumer markets (Asioli et al., 2017). This transition presents an opportunity to introduce regionally inspired products that satisfy evolving consumer demands and bolster local economies through sustainable agricultural practices.

In the Philippines, the fiddlehead fern (*Diplazium esculentum*), locally known as "pako," has been traditionally utilized as a vegetable in many rural households, valued for its tender texture and rich nutritional content, including dietary fiber, essential vitamins, and minerals. Despite its nutritional benefits, pako remains underutilized in mainstream food product development. This study explores the potential of transforming pako into a novel snack product, *Pako Chicharon*, to address younger Filipino consumers' health, sustainability, and sensory preferences, particularly in the Caraga Region.

Furthermore, the development of *Pako Chicharon* carries socio-economic implications for indigenous and rural communities in the Caraga region. Fiddlehead ferns grow abundantly in forested and upland areas, and their sustainable harvesting can create new income opportunities for local farmers and indigenous peoples. Additionally, the study explores the innovative use of pako stalks—parts typically discarded during traditional preparation—contributing to a waste-reducing food production model. By maximizing the utilization of the whole plant, the production of *Pako Chicharon* minimizes agricultural waste and adds value to indigenous agricultural practices.

Nutritionally, *Diplazium esculentum* is known for its high antioxidant content, anti-inflammatory properties, and potential health benefits, making it a suitable candidate for incorporation into health-oriented snack products (Roy & Chaudhuri, 2020). Thus, promoting pako-based products aligns with broader public health initiatives to encourage increased consumption of plant-based foods for disease prevention and overall well-being. *Pako Chicharon*, as a snack option in Caraga, represents an intersection of food innovation, sustainability, and cultural preservation. By leveraging local biodiversity and traditional food knowledge, this study contributes to broader sustainable development goals (SDGs), particularly SDG 2 (Zero Hunger), SDG 12 (Responsible Consumption and Production), and SDG 15 (Life on Land). Drawing on the background and significance of this study, the following research questions were proposed

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To determine the demographic profile of the respondent who participated in the survey in terms of:

1.1 Age;

1.2 Sex.

To assess the level of acceptability of Pako Chicharon in terms of:

2.1 Appearance;

2.2 Aroma;

2.3 Taste;

2.4 Texture.

To assess the level of salability of Pako Chicharon in terms of:

3.1 Packing;

3.2 Price.

To determine if there is a significant relationship between the level, acceptability, and salability of Pako Chicharon.

Exploring Sensory Acceptability, Market Scalability, and Indigenous Innovation

The innovation of traditional snacks into healthier alternatives has gained momentum over recent years. As global health awareness rises, consumers demand food products that balance nutrition with sensory satisfaction (Aschemann-Witzel et al., 2020). Acceptability is heavily influenced by sensory characteristics such as appearance, aroma, taste, and texture, each decisive factor in consumer preference and purchase behavior. Blijlevens and Schoormans (2009) argue that sensory cues are primary drivers of product evaluation, with first impressions significantly impacting consumer acceptance. This trend is evident among younger generations who place heightened value on food products that are both sensorially appealing and aligned with healthy living standards.

In the case of emerging food products like Pako Chicharon, achieving high acceptability in sensory attributes is crucial. A favorable reception in appearance, taste, aroma, and texture increases the likelihood of consumer loyalty and market success. Products that fail to meet sensory expectations often experience poor market performance, regardless of their nutritional advantages. Therefore, any innovation in traditional snack foods must prioritize sensory evaluation as a core determinant of product viability.

Scalability, defined as a product's potential to be produced, marketed, and distributed efficiently on a larger scale, is another critical factor influencing market success (Kotler & Keller, 2016). In food innovation, scalability encompasses production feasibility, consistent quality, packaging appeal, and price competitiveness. To achieve commercial success, new snack products like Pako Chicharon must demonstrate consumer acceptability and scalability. Price sensitivity among consumers, particularly in emerging economies, highlights the need for affordable yet high-quality products. Moreover, appropriate packaging plays a significant role in attracting consumers and maintaining product freshness, especially in the snack food sector, where visual presentation can heavily sway purchasing decisions.

Several studies emphasize that even if a product has high sensory appeal, market penetration may be limited without accessible pricing and attractive packaging (Grunert, 2005). Thus, scalability factors such as price and packaging must be evaluated alongside sensory acceptability to holistically understand a product's market potential.

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Using indigenous plants, such as *Diplazium esculentum* (pako), in modern food products aligns with ongoing efforts to promote biodiversity, sustainable agriculture, and cultural preservation. Pako, widely found in rural areas of the Philippines, is traditionally consumed as a vegetable rich in nutrients and antioxidants (Roy & Chaudhuri, 2020). In food innovation, scalability encompasses production feasibility, consistent quality, packaging appeal, and price competitiveness. To achieve commercial success, new snack products like Pako Chicharon must demonstrate consumer acceptability and scalability. Price sensitivity among consumers, particularly in emerging economies, highlights the need for affordable yet high-quality products. Moreover, appropriate packaging plays a significant role in attracting consumers and maintaining product freshness, especially in the snack food sector, where visual presentation can heavily sway purchasing decisions.

Several studies emphasize that even if a product has high sensory appeal, market penetration may be limited without accessible pricing and attractive packaging (Grunert, 2005). Thus, scalability factors such as price and packaging must be evaluated alongside sensory acceptability to holistically understand a product's market potential. Using indigenous plants, such as *Diplazium esculentum* (pako), in modern food products aligns with ongoing efforts to promote biodiversity, sustainable agriculture, and cultural preservation. Pako, widely found in rural areas of the Philippines, is traditionally consumed as a vegetable rich in nutrients and antioxidants (Roy & Chaudhuri, 2020). However, its commercial potential remains underexploited. Transforming pako into a value-added snack like chicharon offers an innovative approach to revitalizing local food systems while addressing consumer trends toward plant-based, healthful snacking options. Furthermore, tapping indigenous plants supports sustainable development goals (SDGs), particularly those related to responsible consumption, production, and poverty alleviation in rural communities (FAO, 2019).

Value addition through indigenous products like Pako Chicharon presents significant socio-economic opportunities. Studies have demonstrated that empowering rural and indigenous communities by engaging them in the supply chain, from raw material collection to product processing, enhances local livelihoods and strengthens community resilience (Altieri & Nicholls, 2017). Additionally, utilizing parts of the plant that are typically discarded, such as fern stalks, aligns with sustainable food production practices by minimizing waste. In the context of Pako Chicharon, promoting stalk usage offers dual benefits: environmental sustainability and increased income streams for agricultural workers. While prior literature has extensively discussed sensory evaluation in food products and the growing market for healthy, sustainable snacks, there remains a significant gap specifically examining the integration of indigenous ingredients like pako into snack products for mainstream markets. There is also limited empirical research on how acceptability (sensory attributes) and scalability factors (price and packaging) jointly affect the market potential of such innovative products in regional contexts like Caraga, Philippines.

Thus, this study addresses these gaps by systematically investigating the sensory acceptability and market scalability of Pako Chicharon. By combining sensory evaluation and market survey methodologies, it provides valuable insights into how indigenous, health-focused snack innovations can successfully penetrate regional markets. Furthermore, it highlights how value-adding local crops can contribute to sustainable development and community empowerment, offering a replicable model for similar rural-based food innovations.

Method

Anchored in **descriptive quantitative research design with the survey design**, this study determines the sensory acceptability and market viability of *Pako Chicharon* among Three Hundred Eighty-Four individuals residing in Cabadbaran City. Enabled the evaluation of market-related aspects, including packaging and pricing. According to Creswell (2012), descriptive research effectively portrays a population's characteristics and identifies behavioral patterns and preferences Figures illustrate the demographic profile of the respondents.

Data were gathered using a structured survey instrument that consisted of a 9-point **hedonic scale** to assess sensory characteristics and a **5-point Likert scale** to evaluate respondents' opinions on packaging and pricing. A panel of three experts validated the instrument to ensure content reliability and alignment with accepted sensory evaluation procedures. Respondents were selected purposively and were provided with samples of *Pako Chicharon* to facilitate accurate and experiential feedback during the survey process. This approach helped ensure the responses' authenticity and increased the data's reliability.

The data were analyzed using statistical tools such as mean, standard deviation, and analysis of variance (ANOVA) to identify significant trends and differences in responses across various demographic groups. A professional statistician processed the data to ensure precision and validity. Ethical standards were strictly observed, including obtaining informed consent, maintaining respondent confidentiality, and ensuring voluntary participation. This methodological approach provided meaningful insights into the product's potential in the market while supporting the goal of promoting sustainable food innovations based on indigenous ingredients.
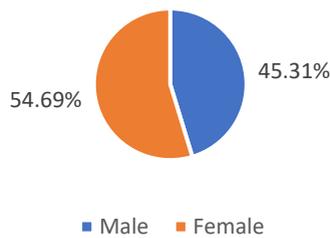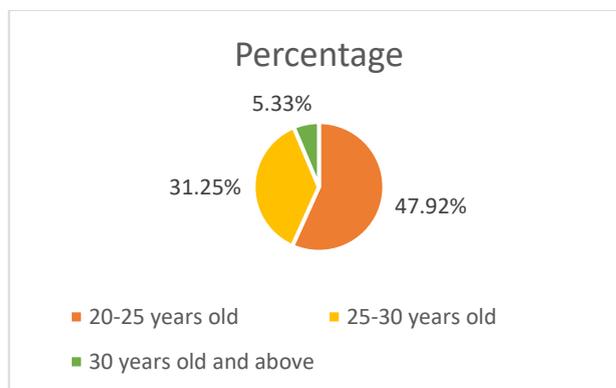

Figure 1. Participants' gender

2. Participants' ages

Table 1 Questionnaire for Participants

No.	Questions	9	8	7	6	5	4	3	2	1
1.	Appearance (The Product has a lightly brown colour.)									
2.	Aroma (The Product has a pleasant smell of spices.)									
3.	Taste (The Product has a salty and spicy flavour.)									
4.	Texture (The Product has a crunchy texture.)									

No.	Questions	Response
1.	How acceptable is Php 20.00 price for 20grams per pack of Pako Chicharon?	[ ] 5 Highly Acceptable [ ] 4 Acceptable [ ] 3 Moderately Acceptable [ ] 2 Slightly Acceptable [ ] 1 Not Acceptable
2.	How acceptable is the price of the product compared to the similar products in the market?	[ ] 5 Highly Acceptable [ ] 4 Acceptable [ ] 3 Moderately Acceptable [ ] 2 Slightly Acceptable [ ] 1 Not Acceptable
3.	How likely would you be to buy this product?	[ ] 5 Highly Acceptable [ ] 4 Acceptable [ ] 3 Moderately Acceptable [ ] 2 Slightly Acceptable [ ] 1 Not Acceptable

Item	Questions	Response
1.	How acceptable is the packaging of the product?	[ ] 5 Highly Acceptable [ ] 4 Acceptable [ ] 3 Moderately Acceptable [ ] 2 Slightly Acceptable [ ] 1 Not Acceptable
2.	How acceptable is the label of the product?	[ ] 5 Highly Acceptable [ ] 4 Acceptable [ ] 3 Moderately Acceptable [ ] 2 Slightly Acceptable [ ] 1 Not Acceptable
3.	How acceptable is the design of the product?	[ ] 5 Highly Acceptable [ ] 4 Acceptable [ ] 3 Moderately Acceptable

		[ ] 2 Slightly Acceptable
		[ ] 1 Not Acceptable

The responses were evaluated using a structured survey instrument designed to assess the sensory attributes and market acceptability of *Pako Chicharon*. Sensory evaluation was carried out through a 9-point hedonic scale, where respondents rated four product characteristics—appearance, aroma, taste, and texture—based on their level of liking. Additionally, market viability was examined using a 5-point Likert scale that measured consumer perceptions of price, packaging, labeling, and design and their likelihood to purchase the product. These instruments enabled the collection of comprehensive, quantifiable data reflecting consumer preferences, perceptions, and potential buying behavior, thereby supporting the study's objective of determining the product's overall acceptability and scalability.

Results

Based on the responses of the participants, the study focused on capturing consumer perspectives regarding the sensory qualities of Pako Chicharon, the acceptability of its pricing and packaging, and their overall likelihood of purchasing the product as an innovative, locally sourced snack option.

Level of Acceptability

Table 2. Results of the Sensory evaluation

Indicators	Mean	Standard Deviation	Verbal Description
Appearance	8.160	0.987	Like Extremely
Aroma	7.867	1.234	Like Very Much
Taste	8.027	1.252	Like Very Much
Texture	8.227	1.290	Like Extremely

Table 2 presents the summarized results of the sensory evaluation conducted to assess the consumer acceptability of Pako Chicharon across four key indicators: appearance, aroma, taste, and texture. Each indicator was rated using a 9-point hedonic scale, and the resulting mean scores provide insights into which respondents' most and least favored sensory attributes. The interpretation below discusses these results in descending order of their mean values, offering a deeper understanding of consumer preferences.

Firstly, **texture** received the highest mean score of **8.227** (SD = 1.290), with a corresponding verbal description of **"Like Extremely."** This indicates that the respondents found the crunchiness of *Pako Chicharon* highly satisfying and appealing, which aligns with consumer expectations for snack products that emphasize texture as a key sensory attribute. The result suggests that the product's texture was one of its most favorable features and may serve as a primary driver of consumer acceptance and repeat purchase intention. This high rating also reflects effective product development in achieving a desirable mouthfeel, an essential factor in snack innovation.

Furthermore, **appearance** ranked second in the evaluation, obtaining a mean score of **8.160** (SD = 0.987), also described as **"Like Extremely."** The high score implies that the visual appeal of *Pako Chicharon*, characterized by

its light brown color, was positively perceived by consumers. Given that appearance is the first point of sensory contact for food products, this strong rating highlights the product's potential to attract consumer attention and encourage trial. The low standard deviation further indicates consistency in respondents' favorable evaluations, affirming that the product's visual presentation is a competitive advantage in the market.

Taste was rated with a mean of **8.027** (SD = 1.252), categorized under the verbal description **"Like Very Much."** While slightly lower than the texture and appearance ratings, this score still reflects a strong positive reception to the product's flavor profile, which was described as salty and spicy. The result suggests that *Pako Chicharon* effectively met the flavor expectations of consumers seeking a savory snack. However, it may offer room for refinement to elevate its taste experience to match the excellence of its texture and appearance. Nonetheless, the high level of acceptance demonstrates the product's sensory strength in delivering a culturally relevant and enjoyable taste.

Level of Salability

Table 3. Level of Salability in terms of Price

Indicators	Mean	Standard Deviation	Verbal Description
1. How acceptable is the Php 20.00 price for 20 grams per pack of Pako Chicharon?	4.307	0.944	Highly Acceptable
2. How acceptable is the product's price compared to the similar products in the market?	4.240	1.101	Highly Acceptable
3. How likely would you buy this product?	4.347	1.145	Highly Acceptable
Average	4.298	1.063	Highly Acceptable

Figure 3 **summarizes respondents' evaluation of the salability of Pako Chicharon based on three key indicators: price acceptability, market competitiveness, and purchase intent.** Using a 5-point Likert scale, consumers rated how acceptable the product's price was, how it compared with similar items in the market, and how likely they would be to buy the product. All indicators received high scores under the verbal interpretation "Highly Acceptable," suggesting strong commercial potential. The following interpretations explain each item's result in descending order of mean score.

The highest-rated item was the consumers' likelihood to purchase the product, with a mean score of **4.347** (SD = 1.145), described as **"Highly Acceptable."** This result indicates that the majority of respondents expressed a strong intention to buy *Pako Chicharon*, reflecting positive overall reception and market readiness. The high score in

purchase intent confirms that the product meets consumer expectations in terms of value, quality, and appeal. This also suggests favorable consumer behavior trends and signals a strong foundation for future marketing and distribution strategies.

The second highest mean score was observed when evaluating the product's price point, with a mean of 4.307 (SD = 0.944), which was also categorized as **"Highly Acceptable."** This finding reveals that consumers perceived the Php 20.00 pricing for a 20-gram pack as reasonable and within their willingness to pay. The relatively low standard deviation implies a consistent agreement among participants regarding the product's affordability. This strengthens the product's price positioning and supports the feasibility of introducing it to the market without major pricing adjustments.

Compared to similar products in the market, the perceived acceptability of the price yielded a mean score of **4.240** (SD = 1.101), still rated as **"Highly Acceptable."** This suggests that, while consumers acknowledged some differences, the price of *Pako Chicharon* remained competitive and acceptable within the snack food category. The slightly higher standard deviation in this item may reflect varying levels of familiarity or access to comparable products among respondents. Nevertheless, the positive rating affirms that the product holds its value against existing alternatives and can compete effectively in its market segment.

Level of Salability

Table 4. Level of Salability in terms of Packaging

Indicators	Mean	Standard Deviation	Verbal Description
1. How acceptable is the packaging of the product?	4.493	1.107	Highly Acceptable
2. How acceptable is the label of the product?	4.347	1.236	Highly Acceptable
3. How acceptable is the design of the product?	4.440	1.338	Highly Acceptable
Average	4.427	1.227	Highly Acceptable
Overall Average	4.363	1.145	Highly Acceptable

Table 4. **Presents the results of the respondents' evaluation on the packaging features of** *Pako Chicharon*, **explicitly focusing on packaging, labeling, and product design.** These components were assessed using a 5-point Likert scale to determine how each aspect contributed to the product's overall salability and consumer appeal. All indicators received a verbal rating of **"Highly Acceptable,"** highlighting the favorable impression made by the product's presentation. The interpretations below provide detailed insights into each indicator, from the highest to the lowest mean score.

Packaging received the highest mean score of 4.493 (SD = 1.107), verbally describing **"Highly Acceptable."** This suggests that the respondents viewed the physical packaging of Pako Chicharon very positively, likely due to its durability, functionality, or suitability for the product's nature. Good packaging protects the product and serves as a

key marketing element. The high rating implies that the product's packaging successfully fulfilled both practical and aesthetic expectations, making it more attractive and purchase-ready in consumers' eyes.

The product's design was followed closely, with a mean score of 4.440 (SD = 1.338), also classified as **"Highly Acceptable."** This indicates that respondents appreciated the product's overall visual and structural design, including layout, colors, and artistic presentation. Although slightly lower than the packaging score, this strong rating confirms that the design contributed positively to the product's marketability. A visually appealing design can significantly influence consumer perception and buying decisions, especially in competitive snack categories.

Labeling received a mean score of 4.347 (SD = 1.236), and, while the lowest among the three indicators, it was still rated as **"Highly Acceptable."** This suggests that the information and visuals presented on the product label were clear, relevant, and satisfactory to consumers. The slightly lower score may reflect opportunities for improvement in enhancing the label's informativeness, branding elements, or legibility. Nonetheless, the high acceptance level implies that the labeling remains an effective component of the product's overall presentation strategy.

The average rating across all packaging-related indicators was 4.427, while the **overall average salability rating was 4.363**, both under the category **"Highly Acceptable."** These results confirm that the visual and physical presentation of *Pako Chicharon* is a strong asset to its commercial potential, reinforcing its appeal to consumers and enhancing its competitiveness in the local snack market.

Table 5. Correlation between Acceptability and Salability of Pako Chicharon

Variables	Mean	Std. Deviation	r-value	p-value	Interpretation
Acceptability	8.070	1.191			
Salability	4.363	1.145	0.642	0.000	Significant positive correlation

Table 5. Shows the Pearson correlation coefficient (**r = 0.642, p < 0.001**) reveals a **moderate to strong positive relationship** between the level of acceptability and the salability of *Pako Chicharon*. This implies that as consumers' sensory acceptability of the product (in terms of appearance, aroma, taste, and texture) increases, so does their perception of its salability (price, packaging, design, and purchase intent). The result is statistically significant at the 0.05 level, supporting the conclusion that consumer liking is directly related to their willingness to purchase and accept the product in the market.

Discussion

The study results revealed that *consumers received Pako Chicharon's sensory attributes well*, with all indicators rated as "Highly Acceptable." Among the four dimensions—texture, appearance, taste, and aroma—**texture** obtained the highest mean score, indicating that the product's crispiness was the most appreciated attribute. This finding is consistent with existing literature emphasizing that texture is vital in snack food satisfaction, especially in products that mimic pork chicharon. Likewise, the favorable ratings for appearance and taste confirm that the product appeals

to visual and flavor-based consumer expectations. Although aroma scored the lowest among the four, it was still rated positively, suggesting only minor areas for enhancement.

The **salability** indicators also garnered high acceptance levels, with the **likelihood of purchasing the product** being the strongest driver of market viability. This suggests that *Pako Chicharon* is appealing in sensory terms and holds strong consumer purchase intent. Furthermore, the Php 20.00 price point for a 20-gram pack was perceived as reasonable and acceptable. This pricing strategy aligns with consumer expectations for affordability and value, which is particularly important in local markets. The high acceptance of price competitiveness further supports the product's readiness for market entry, indicating that it compares favorably with similar snack items in terms of cost-benefit perception.

Regarding **packaging evaluation**, respondents rated the product's **packaging, design, and labeling**, with packaging receiving the highest score among the three. This highlights the importance of visual presentation and protective functionality in consumer decision-making. While labeling scored slightly lower, it remained within the "Highly Acceptable range," suggesting that the product communicates essential information effectively but may benefit from minor improvements in clarity or branding elements. Overall, the packaging profile reinforces the product's commercial viability and complements its strong sensory appeal.

A **Pearson correlation analysis** was conducted to explore the relationship between acceptability and salability, yielding a **moderate to strong positive correlation (r = 0.642, p < 0.001)**. This statistically significant result demonstrates that increased consumer liking of sensory attributes is strongly associated with higher willingness to purchase and favorable evaluations of price, packaging, and design. The implication is clear: enhancing product acceptability through refined sensory qualities directly boosts its salability. This reinforces the importance of a holistic approach to product development—where taste, appearance, and texture are just as vital as competitive pricing and attractive packaging.

The findings of this study affirm that *Pako Chicharon* holds significant promise as an innovative, culturally relevant, and health-oriented snack option. Its strong performance across sensory and commercial indicators, supported by a statistically significant relationship between acceptability and salability, positions it as a viable product for broader distribution and commercialization. Additionally, using locally sourced ingredients such as *Diplazium esculentum* contributes to sustainable food innovation and economic empowerment in indigenous communities. Future efforts should focus on scaling production, refining branding strategies, and exploring retail channels to expand market reach while preserving the product's unique identity and nutritional value.

Conclusion

In conclusion, this study explored the sensory acceptability and market viability of *Pako Chicharon*, a locally developed snack made from *Diplazium esculentum*, among consumers in Cabadbaran City. Findings revealed that the product was highly acceptable in terms of its texture, appearance, taste, and aroma, with texture receiving the highest level of approval. Salability indicators, including purchase intent, price acceptability, and packaging appeal, also received strong ratings. The packaging, in particular, was deemed highly acceptable, reinforcing the product's

readiness for market exposure. These results demonstrate that *Pako Chicharon* meets consumer expectations for quality and sensory satisfaction and holds strong market potential based on favorable pricing and presentation.

Moreover, the significant positive correlation between acceptability and salability underscores the importance of aligning sensory development with market strategies. As consumers' favorable perceptions of taste, texture, and visual appeal increase, so does their likelihood of purchasing and endorsing the product. This insight is valuable for local producers and entrepreneurs aiming to introduce health-conscious and culturally inspired food alternatives. Overall, *Pako Chicharon* offers a promising opportunity to support sustainable food innovation, generate livelihood for indigenous communities, and promote locally sourced, nutritious snack options in the Philippine market.

Recommendations

Based on the results and conclusions of this study, it is recommended that the developers of *Pako Chicharon* proceed with product scaling and commercial distribution, particularly targeting health-conscious consumers and local markets seeking sustainable snack alternatives. Given the high acceptability of texture, appearance, and overall product experience, promotional strategies should highlight these sensory strengths alongside the product's health and environmental benefits. Enhancing the aroma through further product refinement may also improve the overall sensory profile, potentially increasing consumer satisfaction.

To strengthen market competitiveness, improving product labeling by incorporating more detailed nutritional information, sustainable sourcing messages, and culturally relevant branding is also recommended. These enhancements can appeal to socially and environmentally conscious consumers, particularly younger ones. Furthermore, partnerships with local farmers and indigenous communities should be formalized to ensure a consistent supply of *Pako* and to foster inclusive, community-based production. Finally, future research may explore broader demographic responses, shelf-life stability, and expansion to regional and international markets to maximize the product's reach and impact.

Acknowledgements

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The Efficacy of Sports Massage for Enhancing Mental Toughness and Psychological Well-Being among Elite Athletes: A Quasi-Experimental Study

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Abstract: Mental toughness and psychological well-being are essential for optimal performance in elite athletes, enabling them to cope with stress, recover from setbacks, and sustain competitiveness. Although sports massage is widely used for physical recovery, its psychological benefits remain underexplored. This study investigates the effects of sports massage on the mental resilience and psychological well-being of high-performance athletes. Using a quasi-experimental design, 32 athletes were divided into two groups: a treatment group receiving massage interventions and a control group without intervention. Mental resilience was measured using the Sport Mental Toughness Questionnaire (SMTQ), while psychological well-being was assessed through the Depression Anxiety Stress Scale (DASS-21). Data was analyzed using paired and independent sample t-tests. Results showed a statistically significant improvement (p < 0.001) in both mental resilience and psychological well-being in the treatment group compared to the control group. These findings indicate that sports massage, beyond its physical benefits, serves as a valuable psychological support tool for managing stress, anxiety, and mental fatigue while enhancing mental toughness. The study recommends incorporating structured sports massage into regular training routines to support holistic athlete development and promote both physical and psychological health in competitive sports.

Introduction

Mental toughness is a vital determinant of sustained characterized by emotional balance, happiness, and life satisfaction for both within and beyond the sports domain. In summary, sports massage represents a holist excellence among high-performance athletes. Competing at recovery tool that enhances not only physical readiness but lite levels often entail facing continuous physical and also psychological strength. In the high-pressure world of psychological challenges such as rigorous training elite sports, integrating massage as a mental recovery schedules, intense competition, and public scrutiny. This strategy may help athletes perform at their peak. Continued pressures can lead to adverse mental health outcomes, research is essential to better understand its long-term including anxiety, depression, emotional exhaustion, and psychological effects and implementation in high- sleep disturbances (Anderson & Williams, 2020). Therefore, performance settings a well-rounded recovery approach is essential to maintain both mental and physical balance in athletes. In this context, sports massage has emerged as a potentially effective intervention.

Traditionally, sports massage is utilized to enhance blood circulation, alleviate muscle tightness, and support injury recovery. However, its influence extends beyond physiological benefits. Recent research suggests that sports massage may also contribute significantly to psychological resilience. For instance, it can reduce cortisol levels that commonly associated with stress, while promoting the release of dopamine and serotonin, which aid emotional regulation and mental well-being (Taylor et al., 2021).

Psychologically, massage therapy not only fosters relaxation but also enhances focus and intrinsic motivation. Rivera et al. (2022) reported that athletes receiving regular massage sessions experienced improvements in sleep quality, confidence, and stress coping mechanisms. Since quality sleep is essential for optimal emotional and cognitive performance, these benefits are particularly meaningful for athletes in demanding environments. Moreover, the calming experience of a massage session provides athletes with a reflective space free from external pressures. Liu et al. (2023) describe this phenomenon as a form of active meditation that helps athletes balance their stress and recovery cycles. On a social level, the interaction between athlete and therapist can strengthen feelings of support and trust, both critical components of mental toughness. A positive therapeutic relationship provides emotional validation, reducing feelings of isolation and increasing athletes' resilience to stress (Lee & Kim, 2023).

Different massage techniques may offer tailored benefits based on an athlete's needs. Brown et al. (2020) recommend a personalized approach, noting that athletes under competitive stress might benefit most from interventions focused on muscle relaxation and mood stabilization. However, the effectiveness of sports massage depends on several factors, including frequency, duration, technique, and the individual preferences of athletes, which may be influenced by cultural background, gender, and personality. Thus, evidence-based protocols are necessary to optimize outcomes. Conceptually, mental toughness refers to an athlete's ability to remain focused, confident, and resilient under stress, encompassing emotional control and the capacity to endure competitive pressure. Psychological well- being, meanwhile, encompasses a broader mental state that.

Problem Statement

Mental toughness among Malaysian high-performance athletes has emerged as a pivotal concern for national sport development. Although extensive initiatives target physical conditioning and international competitiveness, the psychological dimension often receives limited attention. The National Sports Institute (ISN, 2021) notes that intensive training schedules, public expectations and challenges in balancing personal life generate high stress levels, which, if untreated, lead to emotional exhaustion, persistent anxiety, burnout and premature retirement. Within Malaysia's sport system, psychological preparation frequently plays second fiddle to physical training. Many programmed priorities fitness and technical proficiency while overlooking athletes' mental needs, leaving them isolated and under supported when coping with competitive pressure. Mohamad et al. (2020) reported that the absence of structured mental-toughness interventions has coincided with rising anxiety and depression among professional athletes.

Financial and performance pressures further compound this situation. Elite athletes must deliver consistent results to retain sponsorship, governmental funding and organizational backing. Those who underperform at marquee events such as the SEA Games or Asian Games endure intense media and societal criticism, amplifying psychological strain. Yet sports massage is an accessible tool for stress regulation and emotional balance to remains underutilized in Malaysia. Complicating matters is a scarcity of qualified sports- therapy personnel, especially trained massage therapists. Data from the Ministry of Youth and Sports (2021) reveal therapist numbers lagging well behind demand, restricting access for athletes outside major urban centers and curbing coaches' awareness of massage's psychological benefits. Stigma also looms large. Mental-health concerns are still equated with weakness, discouraging athletes from seeking help, including massage-based interventions. Lee et al. (2021) identified the prevailing "must-be-strong" culture as a significant barrier to addressing mental-toughness issues, leaving many problems unresolved and performance jeopardized.

Although sports massage is entrenched in physical- recovery routines, it is seldom integrated with mental- toughness strategies. Recovery programmed typically focus on injury rehabilitation, ignoring massage's potential psychological pay-offs. Yet Zulkifli et al. (2022) documented Malaysian athletes' reports of relaxation and reduced stress after massage was benefits rarely harnessed within formal psychological interventions. Empirical evidence on massage's efficacy for enhancing mental toughness among Malaysian athletes remains sparse. Existing studies are largely international or examine only physiological outcomes, creating a data gap that hampers culturally tailored programmed design. Psychological well-being itself is routinely overshadowed by physical performance goals, despite mounting evidence that chronic stress, anxiety and mental fatigue erode both health and results. Gupta et al. (2020) linked relentless pressure to athlete burnout, while Chung et al. (2021) showed that high performance anxiety undermines well-being and competitive output was exemplified by Simone Biles's withdrawal at the Tokyo 2020 Olympics. Collectively, these gaps underscore the urgency of investigating sports massage as a holistic intervention for Malaysian elite athletes. Rigorous, context-specific research is required to establish evidence-based protocols that harness massage not only for physiological recovery but also for reinforcing mental toughness and safeguarding psychological well-being on the world stage.

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Research Objectives

1. To examine the level of mental toughness in high- performance athletes before and after undergoing sports massage therapy.

2. To evaluate the level of psychological well-being in high- performance athletes prior to and following sports massage intervention.

3. To determine whether there are significant changes in mental toughness among high-performance athletes after receiving the sports massage treatment.

4. To determine whether there are significant changes in psychological well-being among high-performance athletes following the massage intervention.

5. To compare the levels of mental toughness and psychological well-being between athletes in the treatment group and those in the control group.

Research Questions

What is the level of mental toughness among high-performance athletes before and after receiving sports massage therapy?

1. What is the level of psychological well-being among high-performance athletes before and after receiving sports massage therapy?

2. Does the sports massage intervention significantly influence mental toughness among high-performance athletes?

3. Does the sports massage intervention significantly influence psychological well-being among high-performance athletes?

4. Are there any significant differences in mental toughness and psychological well-being between the treatment group and the control group?

Null Hypothesis

H_{01}: There is no significant difference in mental toughness among high-performance athletes before and after receiving sports massage intervention.

H_{02}: There is no significant difference in psychological well-being among high-performance athletes before and after receiving sports massage intervention.

H_{03}: The sports massage intervention does not significantly affect the level of mental toughness among high-performance athletes.

H_{04}: The sports massage intervention does not significantly affect the level of psychological well- being among high-performance athletes.

H_{05}: There is no significant difference in mental toughness and psychological well-being between the control group and the treatment group.

Literature Review
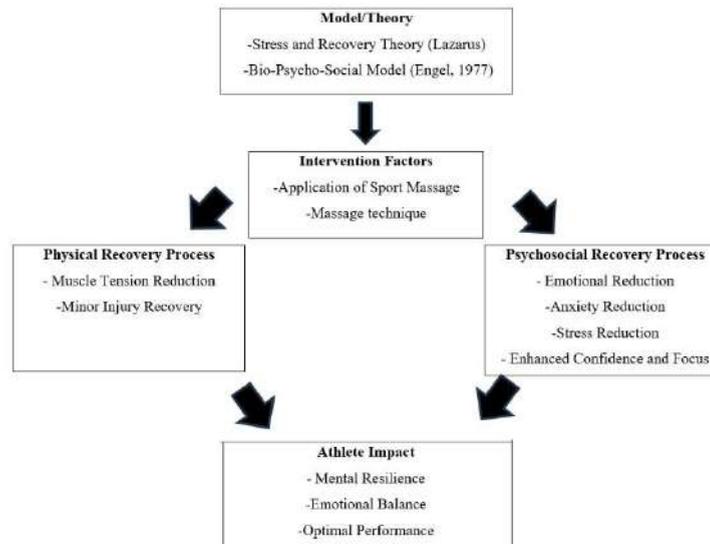
Research Theoretical Framework

Figure 1. Research Theoretical Framework

This theoretical framework outlines the relationship between the implementation of sports massage and the development of mental toughness among high-performance athletes. It is grounded in two foundational models: the Stress and Recovery Theory proposed by Lazarus (1966) and the Bio-Psycho-Social Model introduced by Engel (1977). According to the Stress and Recovery Theory, athletes are frequently exposed to substantial physical, emotional, and psychosocial stress during rigorous training and competitive events. To sustain performance and prevent burnout, these stressors must be counterbalanced with structured recovery strategies. In this context, sports massage functions as a recovery modality that facilitates both physical and psychological relaxation, thereby helping athletes return to an optimal state of balance.

The Bio-Psycho-Social Model emphasizes that an individual's mental toughness is shaped by the interplay of three core dimensions: biological, psychological, and social. The biological component relates to physical factors such as muscle condition, flexibility, and injury recovery. The psychological dimension encompasses emotional regulation, mental stress, and confidence. The social dimension involves the support systems available to the athlete, including coaches, teammates, and the broader training environment. Within this integrated model, sports massage acts as a holistic intervention that bridges biological recovery and psychological well-being to enhance athletic resilience.

In this study, sports massage is the primary intervention, incorporating various techniques designed to alleviate both physical and mental strain. Physiologically, massage reduces muscle tension, promotes healing of minor injuries, and enhances flexibility and mobility. Psychologically and socially, it mitigates emotional distress, promotes mental relaxation, and improves athletes' focus and self-confidence. Collectively, these effects contribute positively to athletes' mental toughness and overall performance. The reduction of stress and anxiety promotes emotional stability, sharper concentration, and enhanced athletic output. Additionally, these benefits extend beyond the competitive domain, improving the athlete's quality of life in both personal and professional contexts.

In summary, this framework links the application of sports massage to enhanced mental toughness through interconnected physical and psychosocial recovery mechanisms. The theoretical underpinnings provided by Lazarus and Engel underscore the importance of addressing not only the physiological but also the emotional and cognitive aspects of athlete well-being to achieve peak performance.

Mental Toughness of High-Performance Athletes

Mental toughness is a core determinant of elite athletic performance because it underpins an athlete's capacity to manage training stresses and competitive pressures. Positive mental well-being was marked by emotions such as happiness and satisfaction was a bolsters motivation, self-confidence and resilience. Gustafsson et al. (2020) found that athletes who report higher levels of happiness and performance satisfaction exhibit significantly greater mental toughness, whereas those who struggle to regulate stress often experience performance declines and heightened risks of anxiety or depressive disorders. O'Connor et al. (2021) further highlight that factors such as performance anxiety, coach-induced pressure and feelings of underappreciation are negatively linked to mental toughness. Athletes with stronger psychological resilience confront stress more calmly and effectively, enabling superior decision-making and achievement in high-stakes situations. Social support is another pivotal influence. Athletes surrounded by supportive family members, friends and coaches generally demonstrate healthier mental well-being. Gustafsson et al. (2020) note that such support networks provide safe spaces for discussing concerns and obtaining constructive feedback, thereby diminishing anxiety and stress. Moral encouragement from significant others also spurs perseverance when athletes face limitations.

In tandem with social backing, systematic stress- management practices, such as meditation, visualization and controlled breathing, are instrumental in maintaining psychological fortitude. Smith et al. (2020) showed that athletes who employ these techniques consistently experience reduced anxiety and enhanced mental toughness, an asset when emotional control is essential for peak competitive focus. Mental well-being is intertwined not only with emotional states but also with physical outcomes. Fletcher and Hanton (2022) emphasize that elite performers frequently encounter mental challenges such as pre- competition nerves, self-doubt and relentless performance expectations that can derail preparation and execution. Effectively addressing these psychological hurdles helps athletes train and compete without excessive cognitive distraction.

Consequently, mental toughness safeguards athletes from the "psychological injuries" that can arise under chronic pressure while simultaneously elevating performance. Sports massage, widely adopted for physical recovery, contributes to this resilience by relieving muscular tension and promoting relaxation, thereby supporting the mental toughness continuum.

Athlete Emotional Well-being and The Influence of Sports Massage

An often-overlooked component of athletic performance is the emotional well-being of athletes. Emotional well-being refers to a stable psychological state characterized by the absence of excessive anxiety, depression, or overwhelming worry. McGuigan and Foster (2020) emphasize that emotional stability is essential for athletes to manage competitive stress effectively. When emotional issues are poorly managed, negative feelings may impair cognitive clarity and behavioral responses, ultimately diminishing performance.

Sports massage has been shown to significantly enhance emotional well-being among athletes. Coutts et al. (2021) discovered that post-training or post-competition massage reduces muscular tension and elevates mood. This benefit stems from the stimulation of the parasympathetic nervous system, which facilitates stress reduction and induces a state of relaxation. By calming the body and mind, massage enables athletes to experience increased feelings of tranquility and positivity is the key elements in psychological well-being. Smith et al. (2021) further found that sports massage promotes optimism among athletes. The perception of receiving physical and psychological care instills greater self-assurance when facing future challenges. Massage also facilitates emotional regulation by allowing athletes to process and release internal stressors. Athletes who feel acknowledged and supported during massage sessions often report enhanced self-confidence and a strengthened capacity to maintain a positive mindset under pressure.

Sports massage also has immediate emotional benefits following strenuous activity or competition. Jones et al. (2023) reported that massage significantly reduces post- competition anxiety symptoms. Athletes receiving massage felt more emotionally grounded, enabling clearer thinking and sharper focus. This emotional reset helps release residual tension and supports a healthier mental state. Beyond individual effects, sports massage may also foster improved interpersonal dynamics among athletes and their coaches or teammates. Lavallee et al. (2021) observed that the relaxing environment created during massage sessions strengthens social bonds and facilitates more positive interactions. Such social cohesion contributes further to emotional resilience and psychological wellness. In conclusion, sports massage contributes not only to physical recovery but also plays a pivotal role in managing emotional stress and fostering psychological stability. Athletes who experience a calm, positive, and optimistic mental state are better equipped to perform at their best across various competitive settings.

Sports Massage and its Relationship with Athlete Psychological Well-being Management

Psychological well-being plays a pivotal role in enabling high- performance athletes to function effectively across various competitive scenarios. McGuigan and Foster (2020) assert that psychological stability significantly influences athletic performance, as it enhances the athlete's ability to navigate mental challenges with greater resilience. Sports massage contributes to psychological well-being by alleviating muscular tension and inducing a state of physical and mental relaxation, which supports emotional equilibrium. Czech et al. (2023) found that sports massage effectively reduces symptoms of anxiety and depression— common psychological obstacles faced by elite athletes. The practice creates a restorative environment for both body and mind, thereby reducing stress and fostering a sense of calm and emotional control, which are critical for sustaining mental well- being. Ultimately, by enhancing both physical condition and psychological balance, sports massage serves as a vital tool in promoting holistic well-being. This integrated recovery approach positions athletes to attain greater success in the demanding arena of high-performance sport.

Materials And Methods

Research Design

This study adopts a quantitative research design employing a quasi-experimental approach involving two distinct groups: a treatment group and a control group. The primary objective is to evaluate the impact of a sports massage intervention on the mental toughness and psychological well-being of high-performance athletes. A total of 32 athletes,

which 16 in each group were selected through purposive sampling, a method deemed appropriate for research involving targeted and relatively small populations (Patton, 2002).

The research process is structured into three key phases: (1) pre-test data collection, (2) implementation of the intervention, and (3) post-test data collection, followed by statistical analysis. This design facilitates a systematic assessment of the intervention's effectiveness by comparing pre- and post-intervention outcomes, while controlling for external influences. Such a framework enhances the internal validity of the study by attributing observed changes specifically to the sports massage treatment. As highlighted by Cohen, Manion, and Morrison (2011), this quasi-experimental methodology is well-suited for evaluating intervention effects within the field of sports psychology.

Additionally, sports massage positively influences athletes' perceptions of self-efficacy. According to Williams et al. (2021), athletes who feel physically rejuvenated following massage sessions tend to experience heightened confidence in their abilities. This boost in self-belief enhances their preparedness to confront challenges, directly contributing to improved athletic performance. Another key benefit of sports massage lies in its ability to strengthen the mind-body connection. Bishop et al. (2022) emphasize that a harmonious relationship between mental focus and physical readiness allows athletes to operate at optimal levels. Massage supports this synergy by fostering bodily relaxation and mental clarity, empowering athletes to persist toward peak performance goals.
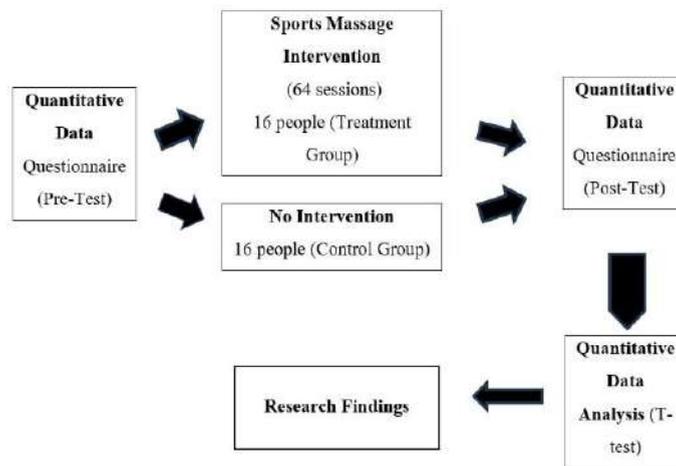

Figure 2. Quasi-Experimental Quantitative Data Collection and Analysis

Methods Research Sample

The study involves two groups: a treatment group and a control group, each comprising 16 high-performance athletes. The treatment group receives structured sports massage intervention sessions aimed at examining their influence on mental toughness and psychological well- being. In contrast, the control group does not participate in any intervention and continues with their standard training and recovery routines. By comparing the pre- and post-test outcomes   of both groups, the study seeks to determine the effectiveness of the massage intervention in improving the targeted psychological constructs. Maintaining an equal number of participants in each group supports the internal validity of the study and enhances the reliability of the results by minimizing potential sampling bias.

Research Instruments

This study employs two main psychological assessment instruments. The Sport Mental Toughness Questionnaire (SMTQ), adapted from Sheard, Golby, and Wersch (2009), includes 14 items designed to evaluate various dimensions of mental toughness in athletes. To measure psychological well-being, the study also utilizes the Depression Anxiety Stress Scale (DASS-21), a 21-item instrument developed by Lovibond and Lovibond (1995), which assesses symptoms related to depression, anxiety, and stress. In addition to these psychometric tools, the intervention component requires specific physical equipment, including a portable massage table, massage oil, and a stopwatch, all essential for delivering consistent and standardized sports massage sessions throughout the study.

Data Analysis

The data analysis process in this study incorporates both descriptive statistics and inferential statistical testing using T-tests. The analysis is conducted with the aid of the Statistical Package for the Social Sciences (SPSS) software, which facilitates accurate computation and interpretation of quantitative data. Descriptive statistics are employed to summarize and present the distribution of participants' responses, offering a general overview of the dataset. Meanwhile, T- tests are applied to determine whether statistically significant differences exist between the treatment and control groups, thereby assessing the effectiveness of the sports massage intervention.

Data Collection Procedure

The research procedure begins with the administration of pre-test questionnaires to all 16 athletes in both the treatment and control groups. Following this baseline assessment, the treatment group participates in a four-week sports massage intervention, comprising a total of 64 sessions, while the control group continues their regular activities without receiving any intervention. Upon completion of the intervention phase, post-test questionnaires are distributed to both groups to measure any changes in the two psychological variables under investigation. To evaluate the effectiveness of the intervention, a paired samples T-test is employed to compare pre- and post-test scores within the treatment group. In addition, an independent samples T-test is conducted to determine whether significant differences exist in the mean scores between the treatment and control groups. These inferential analyses enable the study to determine whether the sports massage intervention produces a statistically significant improvement in mental toughness and psychological well-being among high-performance athletes.

Ultimately, the collection and analysis of quantitative data through validated questionnaires are intended to generate meaningful insights that directly address the research questions and contribute to the broader understanding of psychological interventions in sports performance.

Results

Table 1 outlines the demographic characteristics of the study's participants, comprising a total of 32 high-performance athletes, evenly assigned to the treatment and control groups, with 16 participants (50.0%) in each

group. All participants in this study are male (100.0%), indicating that the research exclusively focuses on male athletes in evaluating mental well-being and anxiety in a sports context.

In terms of age distribution, the largest proportion of athletes falls within the 24–27 age range (43.8%), followed by those aged 20–23 (37.5%), while 18.8% are aged 28 and above. Regarding the type of sport, football represents the highest participation rate at 34.4%, followed by judo (25.0%), rugby (21.0%), and hockey (18.8%). With respect to competition level, 50.0% of the athletes compete at the national level, while 25.0% represent their respective states, and another 25.0% participate at the international level.

Overall, this demographic profile provides essential context for interpreting the study's findings. It offers a comprehensive snapshot of the athletes' backgrounds, which is critical for understanding how the intervention outcomes may apply to similar populations within elite sports settings.

Table 1. Demographic Profile of the Sample

Profile	Demographic	Frequency (N)	Percent (%)
Group	Control	16	50.0
	Treatment	16	50.0
Gender	Male	32	100.0
	Female	-	-
Age	20-23 Years	12	37.5
	24-27 Years	14	43.8
	27 Years and Above	6	18.8
Sports	Hockey	6	18.8
	Football	11	34.4
	Rugby	7	21.0
	Judo	8	25.0
Sports Level	State	8	25.0
	National	16	50.0
	International	8	25.0

Based on Table 2, the pre-test results indicate that participants had a low level of mental toughness or psychological well-being, with an average score of 2.10. The standard deviation value of 0.49 suggests slight variation among participants, indicating that most were at a similarly low level.

After the intervention, the post-test results show an improvement, with the average score increasing to 3.09, reflecting a moderate level of mental toughness or psychological well-being. This suggests that the intervention, such as sports massage, had a positive effect on the changes in participants' mental toughness or psychological well-being.The lower standard deviation of 0.41 in the post-test indicates that changes in participants' scores were more consistent, with minimal differences among them.

Overall, there was a significant increase in scores after the intervention, shifting from a low to a moderate level. Although participants' mental toughness or psychological well-being remained at a moderate level post-intervention, this positive change highlights that sports massage can be beneficial in enhancing the psychological well-being and mental toughness of high- performance athletes.

Table 2. Mental Toughness Level of High-Performance Athletes for Pre-Test and Post-Test

	N	Min	Standard Deviation	Level/Interpretation
Pre-test	32	2.10	0.49	Low
Post-test	32	3.09	0.41	Moderate

Based on Table 3, the pre-test average score of 2.65 indicates that participants' psychological well-being or stress levels were in the moderate category before the intervention. The standard deviation value of 0.73 suggests some variation among participants, meaning their scores differed slightly from the average but were generally within the moderate range.

After the intervention, the post-test average score increased to 2.92, showing a slight improvement while still remaining in the moderate category. The higher standard deviation of 0.90 after the intervention indicates greater variation in participants' responses, which may reflect differences in how effective the intervention was for each individual.

Overall, although the average score increased from 2.65 to 2.92, the change was not substantial, and the final score remained within the moderate category. This small improvement suggests that the intervention may have had a positive effect, but its impact varied among individuals. For a more in-depth assessment of the intervention's effectiveness, further statistical analysis, such as a paired t-test, can be conducted to determine whether the observed changes are statistically significant.

TABLE 3. Psychological Well-Being Level of High-Performance Athletes for Pre-Test and Post-Test

	N	Min	Standard Deviation	Level/Interpretation
Pre-test	32	2.65	0.73	Moderate
Post-test	32	2.92	0.90	Moderate

Based on Table 4, the results indicate an increase in participants' mental toughness scores after the intervention, with a mean difference of 1.20. This increase suggests that, on average, participants' mental toughness levels improved after receiving the intervention compared to before. The standard deviation of 0.72 indicates moderate variation among participants in terms of changes in mental toughness, meaning that the intervention's effects differed between individuals.

The standard error of the mean (0.18) reflects the precision of the estimated average change in mental toughness, suggesting a relatively accurate estimate. Furthermore, the positive t-value (6.60) signifies that the difference between pre-test and post-test scores is highly significant, confirming that the observed change is unlikely due to chance but rather a strong effect of the intervention on participants' mental toughness. The Sig.(2-tailed) value < 0.001 indicates that the difference between pre-test and post-test scores is statistically significant. With a p-value much smaller than 0.05, this strongly confirms that the improvement in participants' mental toughness is statistically significant.

Overall, this analysis demonstrates that the intervention had a positive and significant impact on participants' mental toughness, with a notable increase in average scores after the intervention. However, the variation among participants suggests that the intervention's effects may differ for each individual. Therefore, further research is needed to explore the factors influencing changes in participants' mental toughness.

Table 4. Paired Sample t-Test for Differences in Mental Toughness of High-Performance Athletes After Receiving Sports Massage Intervention

	Min	Std. Deviation	Std. Error Mean	t	df	Sig. (2-tailed)
Pre-Post test (Mental Toughness)	1.20	0.72	0.18	6.60	15	<.001

Based on Table 5, the results indicate an increase in participants' psychological well-being scores after the intervention, with a mean difference of 1.40. This positive increase suggests that, on average, participants' psychological well-being improved after receiving the intervention. The standard deviation of 0.84 indicates considerable variation among participants regarding changes in their psychological well-being, meaning the extent of improvement differed among individuals.

The standard error of the mean (0.21) reflects the accuracy of the estimated average change in psychological well-being, suggesting a relatively precise estimate. Furthermore, the negative t-value (-6.66) signifies a highly significant difference between pre-test and post-test scores, indicating a strong effect of the intervention on participants' psychological well-being. The Sig. (2-tailed) value < 0.001 confirms that the difference between pre- test and post-test scores is statistically significant. With a p-value much smaller than 0.05, this strongly validates that the improvement in participants' psychological well- being is statistically significant and unlikely to be due to chance.

Overall, this analysis demonstrates that the intervention had a positive and significant impact on participants' psychological well-being, with a notable increase in average scores after the intervention. However, the variation among participants suggests that the effectiveness of the intervention may differ for each individual. Further research may be required to identify the factors influencing the intervention's effectiveness.

Table 5. Paired Sample t-Test for Differences in Psychological Well-being of High-Performance Athletes After Receiving Sports Massage Intervention

	Min	Std. Deviation	Std. Error Mean	t	df	Sig. (2-tailed)
Pre-Post test (Psychological Well-being)	1.40	0.84	0.21	6.66	15	<.001

Based on Table 6, the analysis reveals significant differences between the control and treatment groups in several tests. In the Pre-Test (Mental Toughness), there was no significant difference between the two groups, with a p-value of

0.82, indicating that both groups had similar variance and there was no notable difference in mental toughness before the intervention. However, in the Post-Test (Mental Toughness), a significant difference was observed, with a p-value of 0.001, confirming that the treatment group experienced a significant improvement in mental toughness after the intervention compared to the control group.

Additionally, in the Pre-Test (Psychological Well- Being), a significant difference was recorded, with a p-value < 0.001, indicating that the treatment group experienced a substantial increase in psychological well- being after the intervention. The Post-Test (Psychological Well-Being) results showed the same trend, with a p-value < 0.001, further reinforcing the positive and significant impact of the intervention on participants' psychological well-being.

Overall, this analysis demonstrates that the sports massage intervention had a significant effect on both mental toughness and psychological well-being in high-performance athletes, with notable improvements occurring after the intervention.

Table 6. Independent Sample t-Test for Differences in Mental Toughness and Psychological Well-Being of High-Performance Athletes Between the Control and Treatment Groups

	Levene's Test for Equality of Variances				t-test for Equality of eans		
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Mental toughness (Pre test)	1.65	.208	-.230	30	.820	-0.04	0.18
			-.230	23.93	.820	-0.04	0.18
Mental toughness (Post test)	7.90	.009	-3.62	30	.001	-0.45	0.12
			-3.62	19.26	.002	-0.45	0.12
Psychological well- being (Pre test)	8.80	.006	3.80	30	<.001	0.82	0.22
			3.80	17.94	.001	0.82	0.22
Psychological well- being (Post test)	2.90	.100	-7.32	30	<.001	-1.43	0.20
			-7.32	26.30	<.001	-1.43	0.20

Discussion

Based on the demographic analysis, this study involved 32 high-performance athletes, evenly distributed between the control and treatment groups. This balanced sample allows for a more accurate interpretation of the potential effects of sports massage on mental toughness and psychological well-being. The findings align with those of Ismail & Ismail (2021), who also demonstrated the positive impact of recovery-based interventions on athletes' psychological states. These results reinforce the importance of incorporating structured components, such as sports massage, into training programmed to enhance psychological resilience among elite athletes.

For Research Question 1, the results showed a notable improvement in mental toughness, with participants advancing from a low to a moderate level after undergoing the sports massage intervention. This finding is consistent with the work of Kemp & Burch (2022), who also identified sports massage as a beneficial recovery tool for improving psychological resilience. The stress- relieving effects of massage likely contributed to this improvement; however, the variability in outcomes among participants suggests that personal background and individual needs may influence the overall effectiveness of the intervention.

Addressing Research Question 2, the study recorded an increase in psychological well-being, although overall levels remained within the moderate range. This echoes the findings of Munsif Wan Pa et al. (2021), who noted that while recovery techniques are beneficial, short- term effects or unanticipated stressors can moderate overall outcomes. These findings underscore the value of integrating sports massage into a broader, more s u s t a i n e d recovery programmed to support long-term psychological well-being.

With regard to Research Question 3, the analysis revealed a statistically significant enhancement in mental toughness among participants following the intervention, as indicated by a strong p-value. These outcomes are supported by Czech et al. (2023), who reported that sports massage helps reduce stress and anxiety in athletic populations. The findings further confirm that recovery strategies not only promote physical recuperation but also have important psychological benefits. However, individual differences in response warrant further exploration to identify underlying moderating factors.

In response to Research Question 4, the study demonstrated a meaningful increase in psychological well- being scores post-intervention. These results are in line with Smith et al. (2021), who found that sports massage sessions, when properly administered, significantly reduce anxiety symptoms. Nonetheless, the substantial variation in individual responses suggests that a personalized approach may be necessary to optimize the intervention's effectiveness.

Finally, Research Question 5 revealed a statistically significant difference between the treatment and control groups after the intervention, confirming that sports massage contributes positively to both mental toughness and psychological well-being. This supports earlier findings by McKeon & Williams (2020), who noted the effectiveness of recovery techniques in alleviating psychological stress in athletes. Although the current results are encouraging, future research is recommended to uncover the mechanisms underlying these improvements and to further refine sport-specific recovery interventions for enhanced effectiveness.

Conclusion

This study affirms that sports massage has a significant and positive effect on the mental toughness and psychological well-being of high-performance athletes. The findings suggest that regular massage interventions can effectively lower stress hormone levels, enhance emotional regulation, and improve sleep quality, all of which are critical components of optimal athletic functioning. These outcomes highlight the importance of adopting a structured and holistic approach that values mental health on par with physical conditioning.

While the results demonstrate marked improvements following the intervention, the limited availability of trained sports therapy professionals in Malaysia remains a pressing challenge. Bridging this gap is essential to ensuring athletes have sustained access to high-quality recovery interventions, while also helping to break the stigma surrounding mental health in competitive sports environments.

In conclusion, this study advocates for the systematic integration of psychological recovery strategies, such as sports massage, into the training regimens of Malaysian athletes. Prioritizing both psychological and physiological development will not only foster greater resilience but also equip athletes to manage competitive pressures more effectively and perform at their highest potential. Future research should explore the long-term effects of such interventions and develop culturally sensitive programmed tailored to the unique demands and backgrounds of Malaysian athletes.

Acknowledgements

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Predicting Foreign Language Writing Competency Through Reading Scores and Course Engagement

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Abstract: Writing in a foreign language is a key aspect of students' academic success at English-medium universities. It is also a particularly challenging activity that may demand remedial actions. In this action-research study, we examined the extent to which foreign language writing proficiency in a written composition course could be predicted by reading comprehension, course engagement, and self-efficacy (i.e., confidence in one's abilities to communicate in a foreign language). First-year undergraduate students for whom Arabic was the native language were the participants. Before enrollment, a standardized English test (IELTS) judged their English language competency to be at least at the modest user level. The course was taught through a student-centered pedagogy based on self-directed learning and infused with co-curricular activities. During the first part of the semester, students completed a self-efficacy inventory and a reading comprehension test. Their engagement was measured as the percentage of co-curricular activities they completed out of those offered during the entire semester. In this study, reading competency (i.e., the extraction of factual information and the exercise of inferential processing) as well as engagement predicted course grades in written communication. These findings suggest that first-year foreign language learners may benefit from engaging in co-curricular activities, fostering reading comprehension.

Keywords: Writing, Reading, Engagement, Foreign Language

Introduction

Reading is an active, interactive set of processes that involve not only the understanding of words and sentences but also the development of mental models that bring meaning to the text being read. Reading comprehension relies on the activation of stored knowledge to process factual information and develop inferences (i.e., reasoning beyond the text through generalizations and explanations). Writing is a kind of verbal production skill whereby text is generated to meet the demands of a particular communication. As per reading comprehension, writing relies on the activation of stored knowledge to process factual information and develop inferences. According to Fitzgerald and Shanahan (2000), reading and writing share four types of knowledge: metaknowledge (i.e., the functions and aims of the act of reading or writing), domain knowledge (i.e., content), knowledge of elements (i.e., letters, words, and rules for sentence and discourse construction), and procedural knowledge (i.e., the proper use of knowledge to recall, predict, question, infer, and evaluate). The overlap of knowledge and processes between reading comprehension and writing has been used to account for the fact that children who experience reading difficulties tend to also experience writing difficulties (Graham et al., 2021). It has also been used to account for the purported impact of reading practice on writing (Graham et al., 2018). Thus, it is not surprising that a number of studies have reported that reading and writing in a foreign language are related. For instance, Flahive and Bailey (1993) found reading comprehension test scores and holistic scores of an argumentative essay to be related. In foreign language learners, Janopoulos (1986) found a relationship between the breadth of pleasure reading and writing proficiency. Namely, the more learners read, the greater their writing proficiency. However, Hedgcock and Atkinson (1993) found writing proficiency and various reading habits to be related in native English speakers, but much less in foreign language learners. Consequently, whether reading competency can adequately predict writing competency in foreign language learners is still a debatable matter.

Proficiency in both reading and writing is necessary for success in university studies. Yet, writing is much more effortful and complex than reading and perhaps less practiced. As such, it often creates substantial challenges for foreign language students enrolled in written communication courses offered by English-medium institutions. Challenges may exist even though their overall English-language competency scores have warranted university admission. Thus, predicting the factors that may ameliorate writing performance in such students is critical to the development of suitable interventions. To this end, action research can help.

Our study is an instance of the first step of action research (Lufungulo et al., 2021). It began with the recognition that students who met the proficiency requirements for admission at an English-medium university (i.e., IELTS modest-user level or above) experienced difficulties in written communication courses of the general education curriculum. As these courses build the foundations for courses in students' majors, an intervention was planned. It began with finding predictors of writing competency that could guide the development of co-curricular and curricular activities tacitly, fostering writing skills specifically for this group of students. Besides reading, self-efficacy (i.e., confidence in one's abilities) was targeted for assessment because it exemplified the extent to which students believed that their efforts might lead to the desired outcomes. As writing is an effortful and time-consuming activity, self-efficacy might illustrate students' disposition to devote attention and effort to the act of writing or shy away from it through procrastination and withdrawal. Another factor targeted for assessment was course engagement (as indexing the

amount of effort), coarsely measured by the number of co-curricular activities that students selected to perform during the semester. Co-curricular activities were voluntary tasks offered to students to enrich the curriculum of written communication, promote student self-directed learning, and thus enhance the overall quality of their learning experiences (Camerato et al., 2019). A relationship between students' engagement and writing competency was thought to index the degree to which co-curricular activities might be further developed as a means to offer a context for the practice and development of writing as a self-directed pursuit.

Hypotheses

Among foreign language learners who have met the language threshold for admission at an English-medium university (i.e., IELTS modest-user level or above), differences in writing and reading proficiency may exist. Thus, we predicted that the degree to which reading competency and writing competency shared processes and contents in this group of learners would be indicated by the strength of the relationship between reading and writing. A strong relationship (i.e., a large portion of the variance in reading comprehension scores predicted by writing competency) would support the development of a variety of reading activities in written communication courses intended to benefit students' writing.

Students' performance in a written communication course may also rest on effort. The key propeller of effort is self-efficacy. Indeed, if students are not confident in their abilities, they may see as futile the effort that is demanded by writing. Thus, we predicted that this disposition would be related to students' written communication proficiency. The latter may also rest in the actual amount of effort exerted, as indirectly measured by students' participation in co-curricular activities linked to the course. We predicted that greater engagement would be reflected in higher written communication performance.

Of course, all the factors (reading comprehension, self-efficacy, and engagement) selected for the present investigation were assumed to co-exist in students' minds, affecting information processing during course activities. Thus, a key issue was to identify the factor or factors that would best predict written communication proficiency. If interventions were to be performed, their effectiveness might vary as a function of the relative strength of the relationships between predictors and performance. All factors, when considered together, might contribute to performance, but for different reasons. Namely, the relationship between reading and writing stems from the fact that they share many cognitive operations and rest on common knowledge. However, to translate into observable performance, students need to exert effort in activities related to the course. Furthermore, to exert effort, students need to believe that their abilities, if exercised, will be conducive to desirable outcomes.

Method

Participants

Ninety-six female undergraduate students in their first year volunteered for participation credits. Their ages ranged from 18 to 26 years. They were enrolled in a written communication course offered by an English-medium institution as part of the general education curriculum. They had to reach an average IELTS score of 6 (modest user level) or

above to enroll. They represented a convenience sample of foreign language learners who might differ in English proficiency but were not beginners.

Materials and Procedure

The written communication course selected for the present investigation followed a US curriculum and a student-centered pedagogy. The course was intended to foster self-directed learning and was infused with co-curricular activities. Students enrolled in the course were required to complete four essays, each with a separate aim (informing, defining, persuading, and describing). Writing was mostly performed in class through workshops devoted to specific features or properties of each essay type. It included prewriting exercises and draft writing with an emphasis on revising text for content, organization, and mechanics. In addition to writing essays, students completed a midterm exam (formative assessment) and final exam (summative assessment) in which they were to write paragraphs to inform, define, persuade, and describe.

In this course, engagement was considered essential to the academic success of the learners. Thus, students were offered a series of 10 co-curricular activities, among which they could select a minimum of 5 for participation. Activities concerned tasks that were part of the curriculum of written communication. They were intended to offer students some feedback about their performance and personal dispositions to enhance the quality of their learning experience (Camerato et al., 2019). For instance, students could complete a self-efficacy inventory about the confidence they experienced in English communication. They could also complete a practice reading test that would offer feedback on their reading comprehension skills. The students included in the present study were those who chose to complete both the self-efficacy scale and the reading comprehension test during the first part of the semester. Informed consent was collected from the participants before the completion of either measure.

The general self-efficacy inventory of Chen et al. (2001) served to capture students' confidence in their ability to communicate in a foreign language. It specifically measured students' beliefs in their capabilities to deploy effort and cognitive resources and select a course of action suitable to the demands of a given communication task or situation. Thus, students were first encouraged to think about settings demanding English language communication. Then, 8 generic statements of confidence in one's abilities to function in such settings were presented. Students reported their agreement with each statement on a 5-point Likert scale from strongly disagree (0) to strongly agree (4). The middle score (2) served as the neutral answer. The values on the scale were used exclusively for statistical purposes. They were not visible to participants. Cronbach's alpha, a measure of internal consistency, was 0.80.

The reading comprehension test consisted of a passage from the WIAT-III entitled "Humpback Whales" (American Educational Research Association & National Council on Measurement in Education, 2014; Wechsler, 2009). It was followed by 3 factual questions and 5 inferential questions. The test was presented as a basic reading-to-write task in which, after having read the passage, participants typed their responses onto a Google form presented on a laptop. Each response was scored as 0 (incorrect answer), 1 (partial answer), or 2 (complete answer). Cronbach's alpha, a measure of internal consistency, was 0.77. Inter-rater reliability was 0.97.

Course engagement was indexed by the participation records in co-curricular activities (i.e., number of activities attended / number of activities offered * 100). At the end of the semester, course grades were collected from the instructors and recorded as percentages. All data were anonymized after connecting the scores of different measures to individual participants and before statistical analyses were carried out. The study was approved by the Deanship of Research of the hosting institution as complying with the ethical guidelines of the American Psychological Association.

Results

Descriptive statistics are displayed in Table 1. Inferential statistics are considered significant at the 0.05 level. All scores were translated into percentages for ease of comparison with written communication course grades. Two writing proficiency groups were created based on course grades: competent writing (i.e., satisfactory or above satisfactory grades, $\geq 70\% - 100\%$) and poor writing (i.e., less than satisfactory grades, $0 - < 70\%$). The rationale for creating two writing performance groups was that a minimum grade point average (a 2.0, which is equivalent to a C grade = 70%) is generally required to satisfy graduation requirements.

Table 1. Descriptive statistics (mean, *M*, and standard deviation, *SD*) organized by writing proficiency level

Variables	Poor Writing		Competent Writing	
	M	*SD*	*M*	*SD*
Reading: Factual Comp. (%)	41.67	25.03	76.28	24.78
Reading: Inferential Comp. (%)	49.77	23.67	79.23	20.57
Engagement (%)	68.07	19.24	89.51	12.74
Self-Efficacy (%)	57.32	9.90	72.96	14.06
Writing (%)	64.13	7.13	85.98	5.25

Can Writing Competency be Predicted?

A point-biserial correlation analysis was conducted between selected predictors and writing performance as a dichotomous variable. Predictors were reading comprehension scores for factual questions and inferential questions, engagement (as measured by the percentage of participation activities completed), and confidence (as indexed by self-efficacy, a disposition to exert effort based on beliefs of competence). In Table 2, correlation coefficients (*r*) are accompanied by coefficients of determination (*CoD*), which illustrate the percentage of variance in writing performance grades independently accounted for by reading comprehension, engagement, or self-efficacy. For this sample of participants, factual or inferential reading comprehension, engagement, or self-efficacy almost evenly predicted grades in the written communication course.

Correlation analyses treated predictors as separate and isolated entities, each assessed in its relationship with writing performance. Yet, these factors coexisted in students' minds, thereby making it necessary to examine their relative contribution if interventions were to be developed to target writing competency. Thus, a linear regression analysis was conducted to determine the relative contribution of each predictor to writing performance treated as a continuous

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variable (range: 0-100). When all predictors were considered simultaneously, only reading comprehension and engagement contributed to writing competency as defined by course grades. Our main hypothesis was not supported, as the selected factors did not contribute equally to written communication grades, and one (self-efficacy) did not contribute at all when all factors were considered simultaneously.

Table 2. Point-biserial correlations and coefficients of determination

Predictors	Writing	*r*	*CoD* (%)
Reading: Literal Comp. *	0.57	33%	
Reading: Inferential Comp. *	0.56	31%	
Engagement *	0.56	31%	
Self-Efficacy *	0.54	29%	

Note: Significant correlations are marked with an asterisk

Table 3 displays the results of the regression analysis. In the last column, semi-partial correlations are displayed, which illustrate the relationship between each predictor and the part of the outcome variable that is not explained by the other predictors.

Table 3. Regression analysis

Predictors	Outcome Variable: Writing			
	B	*SE B*	β	Semi-partial *r*
Constant	36.65	4.57		
Reading: Literal Comp. *	0.12	.04	0.28	0.20
Reading: Inferential Comp. *	0.14	.05	0.29	0.17
Engagement *	0.24	.05	0.37	0.32
Self-Efficacy	0.06	.10	0.07	0.04

Note: $R^2 = 0.65$. * < 0.05

Discussion

The results of the present study indicate that the main contributors to performance in a written communication course are engagement (as indexed by the effort devoted to co-curricular activities) and reading comprehension, involving both the extraction of factual information and inferential processing. Thus, if instructors of written composition wish to identify students at risk of poor performance, a reading comprehension test may be considered a sensitive measure. For remedies, instructors may stress the importance of reading and develop reading tasks as co-curricular activities inside and outside the classroom. However, activities need to be perceived as doable (within the zone of proximal development; Gao, 2024). Otherwise, anxiety (i.e., uneasiness, apprehension, and stress) may be experienced either when reading a foreign language text (Li, 2022a) or when writing in a foreign language (Waked et al., 2023) because the two types of anxiety are correlated (e.g., Li, 2022b). In addition, training to conceptualize unfamiliar and effortful activities as challenges rather than threats may also be desirable (Pilotti et al., 2024). Of course, the subjective

feasibility of an activity is merely a prerequisite for students' engagement. The latter may be tackled by developing assignments that fit students' interests and concerns (see Pilotti et al., 2023). Thus, a brief survey at the start of the class about students' preferences may help educators develop learning tasks (including curricular and co-curricular activities) that suit such preferences.

Our findings about reading comprehension as a predictor of writing proficiency are consistent with frameworks that acknowledge the overlap of reading and writing concerning either content or operations. For instance, according to Shared Knowledge Theory, the knowledge on which reading comprehension relies overlaps with the knowledge on which writing relies (Shanahan, 2016). Cognitive models of writing, such as that of Hayes (1996), consider reading a component of writing competency. The model proposes that reading serves multiple functions during the act of writing. For instance, writers may need to read and understand instructions that provide information about what they are expected to accomplish in their writing. Writers may need to read source materials to gather information. Writers are also likely to read and reread the sentences and paragraphs they have written to assess whether the generated text so far conveys the intended meaning or needs revising. Thus, both reading and writing rely on a continuous critical evaluation of text materials, a problem-solving attitude in which the reader/writer identifies problems, attempts to fix them, and determines whether remedies have worked through rereading. Although our results regarding the contribution of reading to writing are consistent with both models, they go beyond reading comprehension with the inclusion of engagement.

Our findings about reading comprehension as a predictor of writing proficiency are also consistent with those of empirical studies that have reported that practice with reading can improve foreign language writing skills, including content, organization, and communication quality (e.g., Bartan, 2017). Our findings specifically agree with those of Cho and Brutt-Griffler (2015), who reported writing gains after implementing integrated reading and writing instruction, but only for students at intermediate and advanced levels.

The present study has limitations that may be addressed in future research. First, correlations between reading and writing may be sensitive to the proficiency level of the participants. Cho and Brutt-Griffler (2015), for instance, showed that integrated reading and writing instruction benefited the writing of students at intermediate and advanced levels but not beginners. Thus, our findings may not generalize to students who are at the beginner level. It may also not generalize to courses employing a didactic approach in which the instructor is the 'sage on the stage' and learning is assumed to be the transfer of knowledge from the instructor to the learners.

Conclusion

Our action research study began with the recognition that students who met the proficiency requirements for admission at an English-medium university (i.e., IELTS modest-user level or above) experienced difficulties in written communication courses of the general education curriculum. A convenience sample of students in a written communication course indicated that course engagement and reading comprehension predicted written communication proficiency. Based on these findings, faculty members have been tasked to rethink curricular and co-curricular activities outside and inside the classroom that can foster engagement in both writing and reading. Game-

based activities have emerged as useful tools for practicing reading comprehension and writing essays (Castillo-Cuesta, 2022). Recognizing that the two competencies are linked in learners at the modest-user level or above can spur the development of exercises in which reading and writing are mutually reinforced. Of course, these are just steps in the action research cycle of continuous improvement, whereby what has been developed will be implemented and the outcomes of the implementation will dictate further changes.

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Supervision In Higher Education with Philosophy for Children Approach

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Abstract: Supervision in higher education is essential to accomplishing a writing thesis or project paper. However, there are some challenges between supervisor and supervisee, such as the difficulty of sharing chemistry between them, plagiarism and varieties of background. There are several strategies in supervision to overcome these obstacles, and Philosophy for Children is one of them. It can assist students in accelerating their reasoning abilities, critical thinking, and creativity, as well as in developing their social and interpersonal skills and revitalizing the philosophical inquiry community. It is hoped that Philosophy for Children will benefit lifelong supervision.

Introduction

Supervision refers to providing oversight, guidance, and support to students' research at various levels of their educational careers, including Colleges of Education, university, and postgraduate students. It entails assisting students in gaining knowledge, provoking critical thinking, and learning practical skills via feedback, demonstration, and dialogue (Wisker et al., 2021). In the context of education, supervision plays a critical role in shaping students' learning experience. Supervision provides guidance and support; it helps students navigate their academic journey and develop a profound understanding of the subject matter. Lambie and Stickl Haugen (2021) state that supervision provides structure to establish clear goals and expectations, advice and factual information to plan and conduct research, and practical guidance and resources to teach and complete research activities.

Inadequate supervision consists of a supervisor and supervisee working together to accomplish a master's or PhD for several years. Evidence indicates that supervisors often "become" supervisors through their practical experience rather than formal training, as most standard teacher training programmes do not include supervisory training, and only a

few universities offer regular formal supervisory programmes (Bills, 2004; Halse, 2011). Consequently, much of the supervision relies heavily on the supervisor's own experiences. So, what do supervisors expect from a PhD student? Since supervision primarily stems from the supervisor's experience, they expect a competent, reliable, and self-directed researcher (Jusoff & Morni, 2010). They also expect the researcher to maintain integrity when citing the work of others and be innovative.

As a student, what are the expectations of a supervisor? The supervisor should be the focal point of the interaction. The supervisor should be able to provide guidance and be able to advise and monitor the progress of the PhD student's research but they should refrain from spoon-feeding the students, as this could lead to them asking the supervisor for knowledge instead of seeking it on their own. Supervisors need to be innovative, creative problem solvers, resource-orientated, work-focused, technical experts, decisive and dependable (Jusoff & Morni, 2010).

My experience as a doctoral student, supervised by two supervisors, has indeed provided me with excellent guidance to illustrate the role of supervisor and supervisee. This beneficial supervision includes sharing information, knowledge, and experiences; learning strategies; writing guidance; article reviews; motivation; support; and reminders. All of these have positively impacted my ability to learn in a more organised, disciplined, and dedicated manner, as I am aware that my work will be reviewed, recalled, and evaluated. The tendency to be careless and indifferent can be avoided with regular supervision from time to time. The supervisors are also expert references for any issues and problems encountered throughout my studies. These issues and problems usually revolve around the research process, thesis writing, data collection procedures, finding experts, data analysis, financial funding for studies, publication, and so on. Without supervisors, it would be challenging to resolve these matters on my own.

The experience I gained is extremely valuable because I have a good and responsible supervisor who frequently meets with their students and is easy to communicate with. Such an arrangement represents an ideal supervisory situation where the supervisor truly guides their students as they should. This does not mean that the supervisor controls every aspect of the students' studies but rather provides teaching and guidance. As a doctoral student, it is a lengthy process that can sometimes feel overwhelming and exhausting with one's own research. Feelings of frustration, fatigue, weakness, loss of direction, burnout, failure, confusion, and so on can occasionally diminish motivation, and these experiences are indeed inevitable. This is where the supervisor plays a crucial role in rekindling the student's motivation, offering advice and support to help them rise again and strive until the end of their studies.

In time, as a supervisor and supervisee understand more of their roles in supervision. So, what is next? To resolve this, we have to explore the issues and obstacles in supervision, as their experience embodies the truth that life begins to be tested and the consequences during supervision.

Walking Through the Rhythm of Supervision

The experience of being a supervisor and being a supervisee is a valuable experience, as it indirectly will impact life; either we can manage when there is a challenge, or we fail to get up to fight the challenge. This is the vibrant "ABC" of pursuing a PhD. Fr Alfred D' Souza indicates that, for a long time, it has seemed to me that life was about to

begin—real life. However, there was always some obstacle in the way. There were always obstacles to overcome, unresolved matters to attend to, time to fulfil, and a debt to settle. Then life would begin. At last, it dawned on me that these obstacles were my life."

There were several obstacles when doing a master's or PhD that we can categorise as obstacles from cognitive ability, attitude, social, and technology. Firstly, the obstacles of cognitive ability whereby students were stuck and did not know how to start. It seems that the students have a lot of ideas but do not know which are suitable for doing research. It is almost like peeking at the other side of the fence, aiming for that juicy apple hanging on the tree, but you do not know how to get there to pluck that apple from the tree. Hence, it comes to your mind to get a shortcut, which is to ask the supervisor about the title of your research or have some discussion about the research topic. Consequently, the students will drag out the time in completing their PhD. Students need to have an affirmative decision on what to do.

Second is the issue of attitude, which consists of AI issues of ethics and plagiarism. As we live in the modern world today, there is a new trend to help students complete a PhD journey, which is to ask an artificial intelligence, or AI, to get the student some information about the research topic. Here, the landscape of education had been changing day by day, as the knowledge could be reached using a fingertip. It is agile and helpful when doing a PhD, especially in writing a thesis or dissertation. Say, students can grab the information by clicking ChatGPT, WeChat, etc. However, this information from the AI is mostly in secondary materials, not primary materials. If the student only uses the earlier materials rather than the latter ones, the student probably has the issues of validity and reliability of the information. If there is a lot of the secondary information, the primary materials become faded. Mostly the primer materials come from the original book and may be expensive, but still the information from the book has a lot of elaboration to obtain.

The use of AI would lead to plagiarism indirectly, as we do not know the sources of the information. Plagiarism is presenting work or ideas from another source as your own, with or without consent of the original author, by incorporating it into your work without full acknowledgement, either using materials wholly or in part or using artificial intelligence. Plagiarism can also include re-using your own work without citation. If the student was involved with the plagiarism, there is no novelty and uniqueness in doing and writing a thesis or dissertation. The student's loss of critical thinking skills, creative thinking skills, and the values of doing a PhD. Some of the values have been forgotten when students are pursuing a PhD. Believe it or not, there is a short way to do a PhD when you do not care about the values such as integrity, sincerity, respect, resilience, etc.

Moreover, as we are now blessed with technology, communication becomes as easy as closing your eyes. When you want to talk, just text or voice note and give some emojis to the supervisor, but avoid lack of discussion and arguments. This can lead to misunderstandings and affect the quality of communication between the supervisor and students. Occasionally the supervisor does not understand the student's text, or there is an ambiguity in transferring the knowledge and information.

Such perspectives often overlook the complexities of communication in supervision, including the unequal institutional and social positions of supervisors and students, which lead to differing expectations and practices. Meanwhile, Phillips and Pugh, among others, acknowledge the presence of power dynamics in supervision (e.g., Johnston, 1995; Leder, 1995; O'Rourke, 1997); their adherence to the rational ideal tends to downplay these effects, favoured by the belief that rational solutions can resolve supervisory issues. This view reduces effective supervision to merely applying the right skills and tools and achieving the correct balance.

Regardless of the difficulty of having a chemistry between supervisor and students, there is a lack of meetings to discuss the students' research. Occasionally, the student either disappeared after the initial meeting or never had the opportunity to meet the supervisor. Hence, the thesis or dissertation does not work at all, as Boote and Beile (2005) argue that there is a low quality of student reviews in writing and an insufficient pedagogical focus on this critical aspect of doctoral education. Boote and Beile (2005) argue that a comprehensive and substantive literature review is essential for conducting in-depth and sophisticated research.

There are also challenges to achieving the role of supervisors, as the students come from a variety of backgrounds in education and varieties of cultures. It is not easy to build open and honest relationships between the supervisor and the student. Even more, not all students are of the same age, with some being younger or older than the supervisor. Different ages of the students will contribute to the difficulty of supervision. Hence, supervisors must acquire the necessary skills to effectively communicate and build relationships with students of all ages, ensuring a harmonious supervision environment over the course of a three-year PhD programme.

From this circumstance with many obstacles and issues in experiencing supervision, what exactly is a solution to make better supervision or sustainable supervision? In response to this, we should develop a clear strategy during supervision.

Strategies In Supervision

Literature on graduate research supervision has identified various models, including functional, relational development/qualities, emancipation, enculturation, critical thinking, and feminist approaches (Lee, 2008). Differences in supervisory practices across these models arise from the supervisor's own views on research and its purpose. For instance, a supervisor operating within the functional model focuses on equipping students with the academic skills necessary for research and often provides them with a "toolkit" of research methods (Zhao, 2003). Lee (2008) acknowledges that personal beliefs significantly influence supervisory practices and also considers personal experiences as a contributing factor. Just as many educators teach in the manner they were taught (Frank, 1990; Kerekes & King, 2010), supervisors often draw upon their experiences of being supervised as graduate students (Ferman, 2002; Lee, 2008).

There are various types of supervision models, such as (1) Traditional Model: This approach involves a one-on-one relationship between a supervisor and a student. (2) Group Supervision: In this model, there are interactions not only between the supervisor and individual students but also among the students themselves. (3) Mixed Model: This

combines elements of both the traditional and group models and incorporates new technologies, such as online programmes and teleconferences.

The traditional model of supervision is designed to prepare students for independent research. It operates on the premise that the supervisor is the expert and the student is an apprentice who learns through practical experience (Manathunga, 2005a; Nulty, Kiley, and Meyers, 2009; Parker, 2009). Typically, two supervisors work with each student, meeting regularly to discuss and document progress. Although this model appears highly structured, closer examination reveals that supervisors also engage in mentoring, sponsoring, progressing, and coaching (Pearson and Kayrooz 2004). This approach often suits intelligent, self-directed students who can develop into independent researchers with minimal supervision (Manathunga and Goozee 2007). However, students may miss broader interactions with other students and faculty, which can limit their development if contributing to the knowledge economy is a key requirement (Neumann, 2005; Walker, 2010).

Wisker, Robinson, and Shacham (2007) argue that group supervision offers an alternative model that fosters supportive cohort interactions. In this model, informal peer support complements the formal supervision process. Although group learning aims to promote intellectual independence (Manathunga & Goozee, 2007) and provides social and emotional support, it does not always advance scholarly development (Parker, 2009). Parker (2009) suggested a community learning approach to research supervision, proposing that scholarly writing groups can positively influence students' attitudes toward writing. Evidence indicates that doctoral writing groups can enhance writing outputs (Aitchison & Lee, 2010). Under the community model, supervisors organise workshops on topics such as regulations, research design, writing, library skills, research problem-solving, and method classes, which collectively support learning. Moreover, forming networks across the university can create a research community for idea exchange, complementing supervisory input. Some evidence suggests that the group supervision model can improve the overall supervisory process (Buttery & Ruchter, 2005).

The third model of supervision is the blended learning approach (De Beer & Mason, 2009), which effectively utilises the environment (Boud & Lee, 2005). This environment encompasses not just immediate infrastructure but also includes intellectually, socially, and geographically diverse communities. The blended learning approach integrates individual sessions between a supervisor and a student with a virtual classroom environment, incorporating teleconferences, online resources, discussion groups, and self-paced online courses (Morrison, 2003). Crossouard (2008) argued that this model is particularly effective in strengthening relationships between supervisors and students and in creating communities of practice (Wisker, Robinson, & Shacham, 2007). This model aligns with recent shifts in higher education towards blended teaching methods that combine face-to-face interactions with online learning.

There are also collaborative learning approaches like Harrison and Grant (2015), which examine collaborative learning approaches in the Higher Degree Research (HDR) field, focusing on one-to-one supervision models in Australia, the UK, Belgium, and the Netherlands. While doctoral students are generally expected to complete various courses and engage with a doctoral committee, some participants highlighted that coursework was a crucial complement to their supervisory meetings. The key factors for students' success in HDR highlighted by the scholars include: (1) High-quality supervisor support throughout HDR studies, typically provided through the traditional one-

to-one supervisor-student model (e.g., Gurr, 2001; Pearson & Brew, 2002; Sinclair, 2004); (2) Increased diversity in research degrees, exemplified by the rise of professional doctorates, which has led to a more varied student population with a broader range of learning styles and needs (Engebretson et al., 2008); and (3) A broader range of motivations for pursuing studies (Harrison, 2011). For HDR students, these changes mean they must adapt to rapidly evolving educational models, cope with increased expectations for independence, and meet tighter deadlines for completion (Harrison & Grant, 2015).

Bakokonyane and Pansiri (2024) also used a collaborative approach in supervision in higher education, revealing four themes such as using the socialisation, externalisation, combination, and internalisation dimensions. In contrast, Oluwaseyi et al. (2024) assert that using remote supervision gives rise to several obstacles: time management, communication barriers, and high purchase costs. The strategy is to use motivational strategies in digital tools, enhance communication, and prioritise self-discipline.

Choo et al. (2024) claim that an online group supervision model was developed to respond to the plight of postgraduate students forced to complete their research theses in China due to the COVID-19 pandemic border closures in 2020–2022. The findings revealed that group supervision provided students with opportunities to participate within a dynamic team that was relationship- and knowledge-rich. Academics developed greater intercultural understandings of the important research contexts in which students operated and valued their students' positioning.

Habsah et al. (2024) contend that there are seven stages (components) of postgraduate behavioural supervision: listening/clarifying, encouraging, presenting/demonstrating, negotiating/problem-solving, directing, standardising, and reinforcing. he findings help create better supervision methods and improve how postgraduate supervision works in higher education both nationally and internationally. Social implications These supervision measures, if practised by the supervisors and postgraduate students, will accelerate and achieve the aspirations of the Ministry of Higher Education. In general, based on the needs identified, the positive impact of this study can improve national and international postgraduate programme educational outcomes. There are a limited number of empirical research studies that have resulted in postgraduate behavioural supervision measures in the context of higher education.

Hladchenko (2024) illustrates four strategies in supervision with four different groups, which are Ensuring employability for PhD candidates, Between the researcher and the thesis, Shifting the focus primarily onto the thesis, and Focusing only on the thesis. Holstun and Bohecker (2022) assert humanistic principles for providing culturally sensitive corrective feedback in supervision, such as a non-treatment environment, affective bias, evaluation with an emphasis on self-evaluation and connectedness, self-determination, and personal growth orientation.

Given the abundance of supervision strategies, which one is most appropriate for a graduate student? This question is difficult to answer. Do we need to have a traditional, group or mixed approach to sustainable development goals in higher education, especially under supervision? This sustainable supervision needs to cater to the balance between cognition, affect, and attitude. So why do we need sustainable development goals in higher education? It can be argued that we want to produce a graduate student with knowledge and virtue ethics, as values have always been forgotten when achieving victory. We also aim to have a graduate student who is resilient in the face of VUCA challenges, and

most importantly, we want a candidate who is wise in every aspect. Wisdom is synonymous with philosophy, and why not? We should try philosophy for children as an alternative approach to supervision.

Unwavering Effort to Philosophy for Children in Supervision

Philosophy for Children helps sustain supervision as it inspires cognitive and non-cognitive skills. For cognitive skills, the supervisee can accelerate reasoning ability and intensify critical, creative, design and innovative thinking skills, while for non-cognitive skills, the supervisee can develop personal and interpersonal skills and revitalise the Community of Philosophical Inquiry. Philosophy for Children starts with arranging the students in a U-shape, and then the students are asked to read the stimulus materials, such as text, observe visuals, or perceive audio. Then they need to ask questions and write them down either on the whiteboard or digital board. Then they will choose to discuss the question in order to gather more critical information.

Inspiring Cognitive Skills
Accelerate Reasoning Ability with P4C

Bear in mind, what is the answer for the students when the supervisor asked, "What is your intent in pursuing a master's or PhD? Some of them will say, "I just do it because I need some space not to teach in school" or "I just want to have some information" or "I need to fulfil my requirement for promotion" or "I want to seek the knowledge and become knowledgeable in my area of expertise" or some cliché answer, "I do not know why I am doing a master's or PhD; it is my luck". So, if this question were being asked of you, what would be your answer?

Thinking about the answer means you brainstorm your reasoning ability to give the best logical and rational answer. The path to rationality is hard because rational reasoning can be good or bad. The path to rationality is fraught with numerous pitfalls, which we must rectify if our reasoning is flawed and we feel the need to improve. As Lipman et al. (1980) assert that "…reasoning consists of homely warnings descended from ancient times concerning the danger of accepting advice from people who are not authorities on the subject, or concerning the gullibility of those who are easily flattered, or concerning the mistake of thinking that if one event precedes another, the first must inevitably be the cause of the second".

Now let us think and recall from your childhood life; you know nothing, and you ask for help from your parents to give the information you want to know. You will persistently seek information, akin to a chirping bird, until you find satisfaction. Say, 'What is it, father?' Upon receiving the information, you may nod, indicating your understanding. When you begin to question why it occurs, it's a turning point. So, you will begin to think philosophically. It goes the same for the children; when they start to ask 'why' questions, they can very early be considered to be engaged in philosophical behaviour.

Children are interested in both purposes and causes, and they constantly blend this usage of the question, "Why?" or seek to distinguish one from another. Thus, the child may ask why there is a moon accompanying us and may appear to accept the scientific explanation offered by the teacher about the causes of the moon accompanying us or may be the child wants to hear the justification rather than the explanation.

Along the way, the children grow up, and they ask fewer "Why" questions, as they may realise that they have enough knowledge and stop asking why. Many of us no longer wonder why things are the way they are. According to Lipman et al. (1980), we have come to acknowledge certain aspects of life as puzzling and enigmatic because they have always been that way. Many adults have ceased to wonder because they feel that there is no time for wondering or because they have come to the conclusion that it is simply unprofitable and unproductive to engage in reflection about things that cannot be changed anyhow.

As for graduate students, the wondering period has faded, especially during the supervision session. When there is a lack of curiosity, it leads to students not engaging in reasoning or contributing ideas during discussions about the research topic. The students did not answer the questions properly and did not try to give statements or opinions to state their ideas about the topic. Is this the nature of local culture, or is this a catastrophe? In this way, supervision should be moulded with the spark of philosophy that triggers the minds of the students to think beyond their limits. It is noticeable that P4C in supervision elicits reasoning and views as they have a conversation or discussion about the research. Supervisors can spark students' interest by helping them understand their research and asking for opinions like:

> Why did you find your research valuable or interesting?
> Are you familiar with this research topic?
> Which views do you agree with, and which do you disagree with?
> Is there anything about this research topic you found puzzling?

The supervisor will discover that numerous questions should be discussed, but the supervisor should not hesitate to ask questions that are most probably pertinent to the agenda under the item discussed.

P4C provides students with reason statements, especially in dissertation chapter 5, respectively. Chapter 5 is a chapter that students need to consider a defence about their findings, address the purpose of doing research, back up entirely and tell a story of the research. By doing P4C, the students are familiar with the reasoning process and can integrate the discussion into the dissertation. For instance, in qualitative research, the students' findings must provide a reason for their conclusions.

The process involves exploring the reasoning behind the theme, testing the student's ideas, and stimulating their reasoning skills. The student must have an art of drawing reasoning and various inferences, such as perceptual inferences, which are inferences from single perceptions, logical inferences and evidential inferences. When the student consistently engages in P4C, it can enhance their reasoning skills for writing a dissertation.

Intense the Critical, Creative, Design and Innovative Thinking Skills

Philosophy for Children aims to unlock the full potential of the brain and achieve the highest aspirations. How does Philosophy for Children (P4C) facilitate the process of brainstorming ideas for master's or doctoral students? During P4C, students are required to discuss various issues, such as plagiarism and copying others' theses. The discussion

will start by eliciting views or opinions on what plagiarism is. Hence, the students need to ponder whether plagiarism is right or not. This is the critical thinking phase. Then, the supervisor will continue to ask about the solution to the problem of plagiarism. This part is called creative thinking, whether you give a variety of solutions or a new idea. Later, the student may come up with an innovative idea for a product that can detect plagiarism. Thus, critical thinking yields your own ideas of plagiarism; thus, it helps master's or doctoral students indirectly understand the meaning of plagiarism in their own beliefs and need to compare their work with others as well as be able to analyse the knowledge.

On the other hand, P4C is also offering solutions by pursuing creative thinking. Imagine if the idea of green tea using palm oil is beyond the reach of our brains. That is a crazy idea and a brilliant idea, but it is too ambitious and too risky, but it is possible. Indeed, creative thinking involves thinking beyond conventional boundaries, serving as a powerful tool for innovation. Creativity can also be applied when students converse about the novelty and uniqueness of their research.

During supervision, the student may struggle to think critically about their research and may exhibit a lack of creativity. However, frequent use of P4C can gradually enhance their critical and creative thinking skills. Say, when there is a challenge during a PhD, the student's title has actually been done by others, so the student will be disappointed and stressed. However, as students gradually develop their creative thinking skills, they may encounter a gap in their research title.

Lipman et al. (1980) posited that philosophy concerns itself with many things, but three things are most important: we must learn to think as clearly and logically as possible; we must show the relevance of such thinking to the problems that confront us; and we must think in ways that search out fresh alternatives and that open up new options. Moreover, P4C can assist PhD students in enhancing their design thinking, which has emerged as a significant methodology for problem-solving, actively utilising empathy, brainstorming, and testing to generate innovative solutions. However, contrary to popular belief, this methodology is not just a handy tool for designers and has found application in multiple different industries. Design thinking has five steps: empathise, define, ideate, prototype, and test.

Enriching a Non-Cognitive Skills
Develop Personal and interpersonal growth

P4C benefits master's and doctorate students in a non-cognitive way, such as personal and interpersonal growth. In responding to personal growth, P4C provides self-improvement before being better in this world. This is because we are not the same person again as we grow up, with new challenges, circumstances, and abilities to face. At this point, P4C can improve your personal communication, and you can navigate two-way communication in a natural way, as P4C uses dialogue or conversations. For instance, there is a situation where the students will be asked how often they meet their supervisor, how often they have a conversation about the research of their study and how well the communication is with their supervisor. Undoubtedly, students would argue that frequent meetings with their supervisors are unnecessary in today's digital world, where information can spread quickly through email, text, or even voice notes on WhatsApp. It is noticeable that sometimes we misunderstand the text or the emoji or even become

bewildered by the text, which can lead to straining a relationship. The ambiguity of conversation between students and supervisors can be improved by doing P4C, whereby P4C provides face-to-face discussion and gives space to ask questions and can discuss in a democratic way. Therefore, it can foster a positive and healthy relationship between students and supervisors.

Additionally, P4C will give impactful feedback on the emotion, like having an equation of emotion. Living with your PhD journey collects a lot of positive and negative emotions that sometimes you can and cannot control or manage, but with P4C, you can gradually learn to control your emotion. Occasionally the students will feel fear, shame, joy, greatness, excruciation, betrayal, passion, empathy and many more during the journey of a PhD. Occasionally, you need to see a therapist. Therefore, P4C can function as a therapist, managing emotions through dialogue and conversation. The role of dialogue in emotion is a tool of intervention in P4C that can be discovered through experience and interaction. Sitting in a U-shape in P4C helps a lot to build trust and to ease the conversation. Within the framework of the conversations, one of the key elements that affects students is explanation. P4C provides the opportunity to explain and voice up your feelings and favour grateful understanding about the emotion.

When students understand their emotions, it will automatically promote social competence among them. Social competence is helping students understand themselves so that they can better work with the people around them and better understand the world around them. There are some elements in social competence, such as social values, positive self-identity, interpersonal skills, self-regulation, planning and decision-making, and emotional intelligence.

Revitalize the Community of Philosophical Inquiry

Do you remember the last time you discussed knowledge or argued about the issues in research? I guess maybe on your undergraduate research, which seems many years back, right? So, during the journey to attain a master's or PhD, the need to discuss, argue, and gain some new perspectives is crucial to making you a knowledgeable person and useful to others. In these conditions, P4C opens the students to being involved in a community of philosophical inquiry, as it provides a discussion and conversation among them somehow about the thesis or the dissertation and so on.

The community of philosophical inquiry is a new way to practise philosophy in a group which is characterised by conversation which creates its discussion agenda from questions which are posed by the conversant as a response to some stimulus, whether text or some other media, and which includes discussion of specific philosophers or philosophical traditions, if at all, only in order to develop its own ideas together about the concepts under discussion. - David Kennedy *Metaphilosophy* 35, 4 (October 2004).

Say if the students are confused about the qualitative methodology, such as in doing a case study, which to choose: whether to do an individual case study, a social group case study, a study in an organisation and institution or a set of individual case studies? The philosophical inquiry prepares to provide the dialogical activity that can evaluate the arguments of the types of case studies that students choose to conduct and why the students choose them and what the benefits of that are and many more to argue and gain new knowledge and perspectives. The supervisors and

supervisees can explore ideas, assumptions and reasoning, as everyone has valuable insights to contribute. However, in this community of philosophical inquiry, supervisors work as facilitators; they do not transmit the knowledge. It is in line with the quote, "The role of the facilitator is to act, among other things, from the Socratic "position of ignorance," as a bridge between concepts and arguments, and as a trigger for conceptual system transformation (Kennedy, 1999).

Kennedy (1999) asserts that a community of philosophical inquiry assumes several things about the logic of communal inquiry: first, that the critical faculty—the capacity to evaluate arguments according to logical principles—is generic, *in potentia* anyway, to humans, based as it is on the schematics of logic, language, thought, and their interaction; and second, that when faced with a situation of collaborative inquiry into matters of philosophical meaning, interactions based on that critical faculty are triggered which act to evaluate, deconstruct, or build upon the arguments of the assembled interlocutors. The pedagogical locus of control of CPI is, in other words, shifted from one individual to the group as a whole, which is now understood as potentially self-regulating through a process of ongoing dialectical transformation.

As time rapidly changes, many works have been taken by AI, or artificial intelligence, as a helper for supervisees to solve their problems, but the in-depth arguments are not there, and the self-belonging is not applied. AI can help with pros and cons, but to know the truth, discussion is better. As previously mentioned, when it comes to self-belonging issues in supervision, CPI celebrates diverse backgrounds, resilience, and wellbeing, given that a PhD student's journey spans more than a year. If self-belonging does not exist in the journey of PhD students, many graduates will fail or stop in the middle of their study as they will be left behind.

Do you want this calamity to happen whereby our graduate student does not finish their studies? What is the impact on our education? Can we proceed with the education if there are fewer graduate students than contribute to the development of the world and country? What happened to the social life, funding, etc.? We will lose a lot of potential achievement. The community of inquiry can be done regularly, not weekly, and can cover integrity, the thesis chapters, supervision values, and the supervisor's role.

Conclusion

P4C is suitable for implementation during supervision, as it gives many benefits, such as enhancing cognitive and non-cognitive skills. The limitation of this study is that the researcher only does an observation and document analysis. However, the researcher was aware of ethics in doing this research. P4C had given timely and impactful feedback to supervision. The supervisor and student engage in mutual exchange to maintain harmony in supervision.

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Numerical Simulation on Shear Performance of Rectangular Roughness Tooth at Concrete Cool Joint Interface

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Abstract: The interface between different concrete casting time and strength at the cool joint in concrete structure extension is crucial for maintaining the structural integrity. This possess the challenges on effective shear transfer between that two concretes interface, particularly when the concrete strength between the interface is not same. Hence, this study aims to examine the influence of different thicknesses rectangular roughness tooth at the new-old concretes interface on the shear transferring behavior through numerical simulation and prediction. Nine thicknesses of rectangular concrete roughness tooth, ranging from 30 mm – 90 mm, are numerically modelled in a finite element software and tested under the shear test condition. The numerical results show that thicker rectangular roughness tooth able to attain 15.81% of higher normalized shear strength, when the roughness tooth increase from 30 mm to 70 mm. Significant hinge-like behavior is noticed between the roughness tooth when load increases, where the male joint with higher concrete strength plays more dominant role in influencing the overall shear strength, instead of the interface bond strength. This provides the researchers that detail observation and test data collection can be focused more on this part during the physical experimental testing in order to confirm this phenomenon.

Keywords: New-Old Concrete Interface, Concrete Cool Joint, Rectangular Roughness Tooth, Shear Performance.

Introduction

In the construction industry, structural extensions and repairs are often occurred over an old concrete structure. Therefore, in the process of extending a concrete structure, new concrete elements are typically cast side by side to the existing concrete members. Several studies (Wu, Ayinde and Zhou, 2023; Ayinde, Wu and Zhou, 2022; Ayinde, Wu, Zhou and Malidadi, 2022; Zhou, Micklebrough and Li, 2005) have shown that the interface between old and new concrete is the most vulnerable region for effective force transfer in the structure. It is because the texture of this interface plays a significant role in determining the shear behaviour of the concrete-to-concrete bond (He, Zhang, Hooton and Zhang, 2017).

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Wu, Ayinde & Zhou (2022) conducted a study to examine the impact of multiple triangular grooved surfaces on the shear behaviour of the concrete interface. Their findings revealed that various patterns and angles of the multiple triangular roughness tooth that formed the grooved surface exert varying degrees of influence on the roughness of the interface. Basically, the larger interface's contact area and higher friction coefficient can be obtained when increasing the roughness teeth angle. Hence, the authors (Wu et al., 2023) has furthered the investigation by concentrating on the effect of single triangular roughness tooth with various degree of angles and depths. Monserrat-L´opez, Nogales and Fuente (2023) conducted an experimental programme to evaluate the interface shear strength between two concrete layers that cast at different times. The test revealed that multiple shallow rectangular indented surface performed better shear transfer and higher interface strength than steel rods, left-as-cast, and epoxy bonding bridge surface texture. It is due to concrete indentations able to act as like shear keys, which can generate clamping forces that similar way to shear reinforcement that crosses the concrete interface. Nonetheless, Zhou et al. (2005), and Ahmed and Aziz (2019) found that utilisation of key joints and adhesive materials managed to show significant enhancement in the shear capacity of the interface. Additionally, the application of confining pressure has been identified as a crucial factor in improving shear capacity (Wu et al., 2023; Wu et al., 2022; Niwa et al., 2016). Hu, Li and Liu (2020) experimentally evaluated the shear bond behaviour of a row of rectangular grooves, arranged in slanted surface condition, for the interface between new and old concrete. The authors discovered that the same width and spacing of rectangular grooves on the inclined interfaces might cause the surface roughness provides less influence on the slant shear behaviour of the concrete-to-concrete interfaces. However, further research work on the effects of geometry variations of the rectangular grooves to the shear behaviour can be focused.

Numerical finite element (FE) modelling is commonly being employed to analyse shear transferring mechanism and strength prediction of concrete interface that casted in different time and strength. It enables the researchers to determine the influence of geometry variations, different surface roughness and concrete strength of roughness tooth to the structural shear performance. Wu et al. (2023) successfully replicated the shear capacity, achieving a simulated to the experimental values ratio between 0.99 and 1.09. The authors utilised the numerical model to numerically analysed the effect of roughness tooth's angle and depth to the shear capacity and shear behaviour of new concrete to old concrete interfaces. Meanwhile, Shamass, Zhou and Alfano (2015) had developed the FE model for single trapezium shaped shear key for precast concrete segmental bridges. The FE model managed to predict the shear strength value with a deviation of only 9% and similar crack propagation obtained from experimental study. It is clear that with proper adoption of material properties, interaction setting and boundary condition, FE model is able to provide the strength performance prediction and optimisation of roughness tooth, as well as in time, cost and material saving prior conducting a physical experimental work.

Although several studies have been conducted to identify the shear behaviour and shear performance of various type and shape of groove and roughness tooth for new-old concrete interface, but there is a lack of investigation on geometry variation for rectangular roughness tooth. Therefore, this study aims to investigate the effect of various rectangular roughness' depth to the shear behaviour of the concrete interface via numerical FE analysis.

Method

The Numerical Specimens

For better prediction on the shear performance of a rectangular roughness tooth at the concrete interface, the setting up of numerical model and value of specific parameters reported by Wu et al. (2023) are adopted. Nine numerical specimens with two parts of 150 mm (width) × 150 mm (height) × 150 mm (length) for old concrete that having lower characteristic compressive strength, and one part of 150 mm (width) × 150 mm (height) × 250 mm (length) for new concrete that having high characteristic compressive strength, are modelled in ABAQUS FE software. Figure 1 illustrates the typical detailing of the numerical specimens. Various thicknesses of rectangular roughness tooth, ranging from 30 mm until 70 mm with 5 mm interval, are investigated in this study. The protrusion of the roughness tooth across all the specimens is fixed at 10 mm. Hence, each new concrete part consists of a rectangular roughness tooth at the mid height and both sides of the concrete component. The numerical specimen identification scheme used in this study was referred to as "Ti". The symbol "T" stands for test specimens, and "i" denotes to the roughness tooth thickness in millimetre unit. Table 1 lists the designated name for each numerical specimen involved in this study.
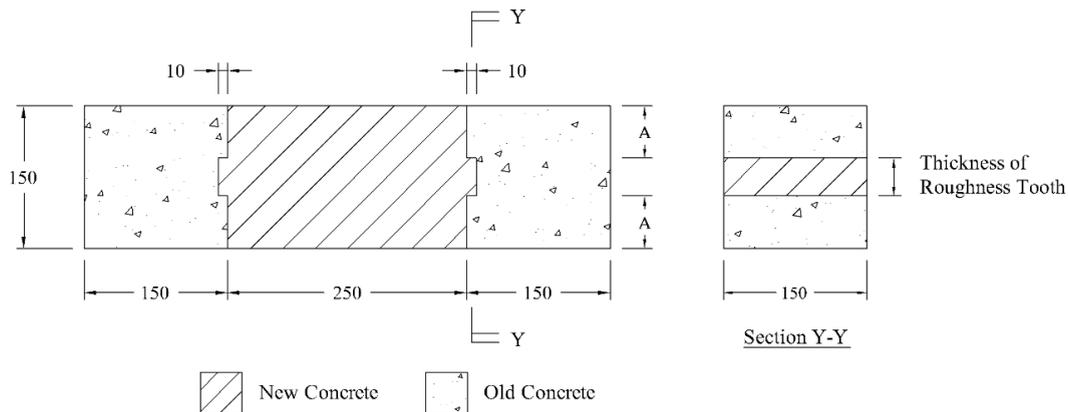

Figure 1. Typical Detailing of Numerical Specimens

Table 1. Designated Name of Numerical Specimen

Numerical Specimen	Thickness of Roughness Tooth (mm)	Dimension A (mm)
T30	30	60
T35	35	57.5
T40	40	55
T45	45	52.5
T50	50	50
T55	55	47.5
T60	60	45
T65	65	42.5
T70	70	40

The numerical specimens were simulated under the double shear test condition, as illustrated in Figure 2. Half of the numerical specimen was simulated in this study due to symmetry of the specimen. Therefore, an x-symmetry boundary condition was applied at Y-Z plan of the mid-cut of new concrete. The reference point of the support was constrained

against all translational and rotational degrees of freedom to ensure that the shear loading condition was not interrupted by the rotation and translation of the support. Meanwhile, the reference point of the loader was used to define the displacement-control loading that applied as the shear load to the numerical specimen.
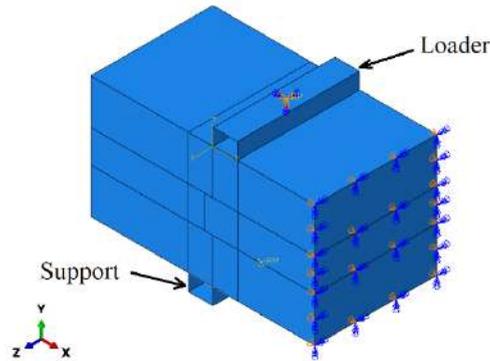

Figure 2. Numerical Specimen Testing Setup

Concrete Material Properties

Concrete Damage Plasticity (CDP) model was adopted to simulate the behavior of concrete. Table 2 lists the value of parameters used in this study based on values recommended by Wu et al. (2023) and Demir, Ozturk, Edip, Stojmanovska and Bogdanovic (2018). The mean compressive strength of concrete, f_{cm} used for the old concrete and new concrete are 28 MPa and 43 MPa respectively. Lower concrete compressive strength was chosen due to the consideration of early batch of concrete casting time or old concrete that had gone through years of strength's deterioration. Equations 1 – 3 obtained from EN 1992-1-1 (2004) were used to determine the non-linear concrete stress-strain relationship, where σ_c denotes to concrete's compressive stress, E_{cm} is modulus of elasticity of concrete and ε_{c1} is concrete's strain under compression peak stress. Figure 3 illustrates the uniaxial stress-strain curves under compression for both concrete grades.

Table 2. CDP Model Parameters

Parameter	Symbol	Value
Dilation angle in degrees	ψ	38
Flow potential eccentricity	ε	0.1
The ratio of the initial equibiaxial compressive yield stress to the initial uniaxial compressive yield stress	f_{b0}/f_{c0}	1.16
Ratio of the second stress invariant on the tensile meridian to that on the compressive meridian (for maximum principal stress)	k_c	0.667
Viscosity parameter	μ	0.0005

$$\text{Equation 1. } \frac{\sigma_c}{f_{cm}} = \frac{k\eta - \eta^2}{1 + (k-2)\eta}$$

Equation 2. $\eta = \frac{\varepsilon_c}{\varepsilon_{c1}}$

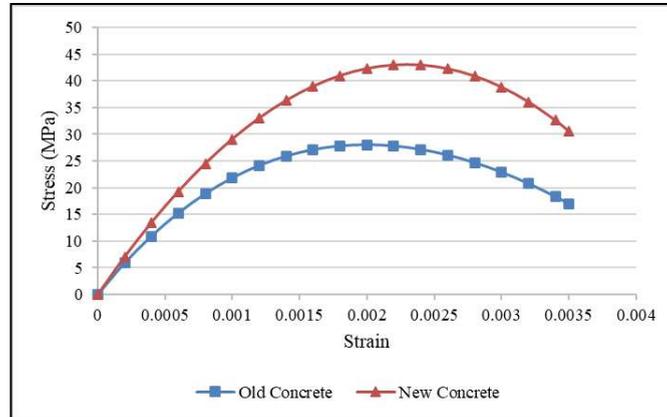Equation 3. $k = 1.05 E_{cm} \times \frac{|\varepsilon_{c1}|}{f_{cm}}$

Figure 3. Uniaxial Stress-Strain Curves under Compression

According to Shamass et al. (2015), the inelastic strain of concrete, $\widetilde{\varepsilon_c^{in}}$ can be calculated by substracting the concrete's elastic compressive strain, ε_{oc}^{el} from the concrete's total compressive strain, ε_c, as shown in Equations 4 and 5. Figure 4 plots the relationship between the concrete compressive stress and the inelastic strain used in the compressive behavior of the CDP model, for old and new concrete.

Equation 4. $\varepsilon_{oc}^{el} = \frac{\sigma_{c0}}{E_{cm}}$

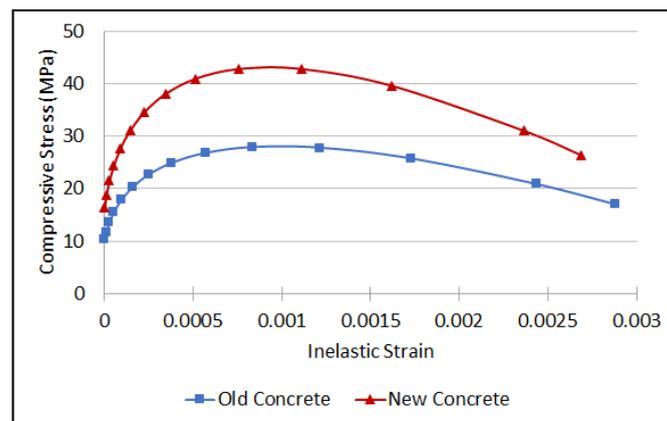Equation 5. $\widetilde{\varepsilon_c^{in}} = \varepsilon_c - \varepsilon_{oc}^{el}$

Figure 4. Concrete Compressive Stress versus Inelastic Strain Graph

Meanwhile, compressive damage parameter, d_c, was obtained for the descending part after the peak stress of the of the concrete's compressive stress-strain curve It ranges from 0, for an undamaged material, to 1, for fully damaged material. Equation 6 was used to calculate the corresponding damage parameters for each of the compressive stresses experienced by the concrete. Figure 5 shows the relationship between the compressive damage parameter and the inelastic strain used for old and new concrete in this study.

$$\text{Equation 6. } d_c = \begin{cases} 0 & , \ \varepsilon_c < \varepsilon_{c1} \\ \frac{f_{cm} - \sigma_c}{f_{cm}} & , \ \varepsilon_c \geq \varepsilon_{c1} \end{cases}$$
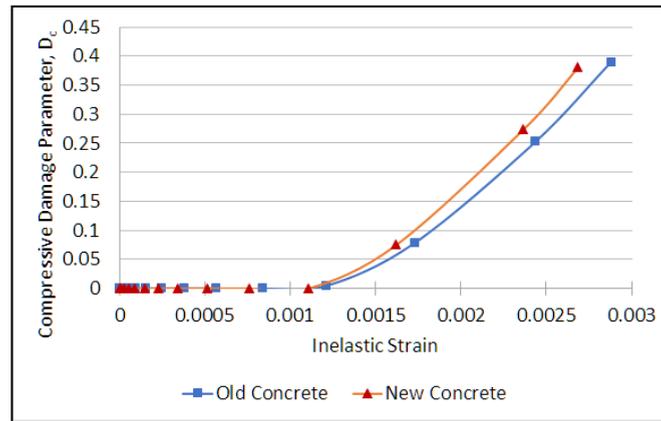

Figure 5. Concrete Compressive Damage Parameter against Inelastic Strain Graph

The concrete's tensile stress, σ_{ct} was simulated using Equations 7 and 8 that based on bilinear approach for the stress-crack opening relation (Model Code, 2010).

$$\text{Equation 7. } \quad \sigma_{ct} = f_{ctm} \cdot \left(1.0 - 0.82 \frac{w}{w_1}\right) \qquad \text{for } w \leq w_1$$

$$\text{Equation 8. } \quad \sigma_{ct} = f_{ctm} \cdot \left(0.25 - 0.05 \frac{w}{w_1}\right) \qquad \text{for } w_1 < w \leq w_c$$

Where, f_{tcm} denotes to mean tensile strength of concrete, w is the crack opening, $w_1 = G_F/f_{ctm}$ when concrete's tensile stress at $0.2f_{ctm}$, w_c equals to $5G_F/f_{ctm}$ when concrete's tensile stress equal to zero, and G_F is the facture energy for normal weight concrete that can be calculated as follow:

$$\text{Equation 9. } G_F = 73 \cdot f_{cm}^{0.18}$$

Figure 6 depicts the concrete tensile stress against crack opening for old and new concrete used in CDP model. The tensile damage parameter, d_t was calculated using Equation 10 and the values are plotted in Figure 7.

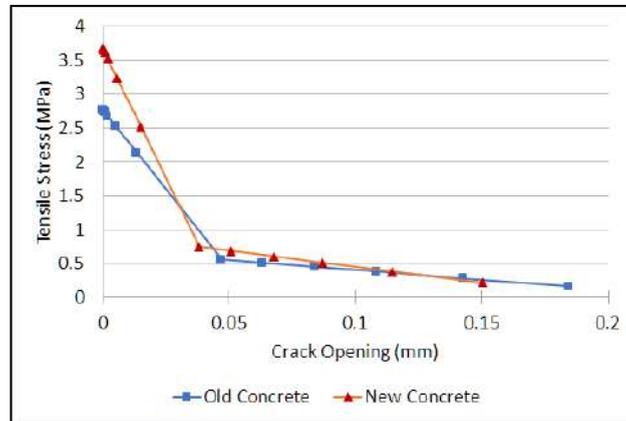$$\text{Equation 10. } \quad d_t = \frac{f_{ctm} - \sigma_{ct}}{f_{ctm}}$$

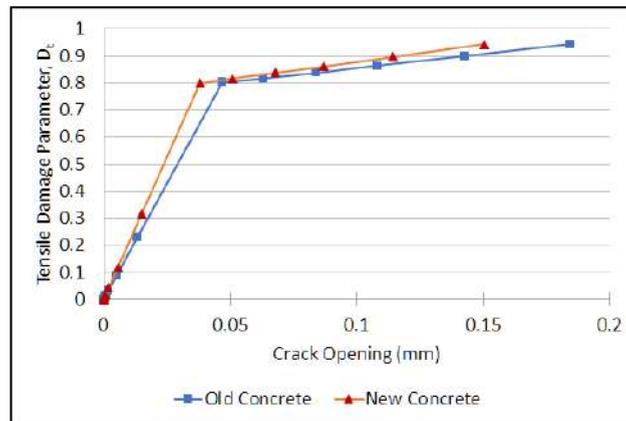Figure 6. Concrete Tensile Stress versus Crack Opening Graph

Figure 7. Concrete Tensile Damage Parameter against Crack Opening Graph

Interaction Properties

The interaction of the interface between the analytical rigid support and loader with the old and new concrete was defined as a "Hard" contact and assigned with a 0.2 friction coefficient. A part of that, in order to define the surface-based cohesive interface property between the old and new concrete, some of the specific parameters were characterised to define the complete interface model. The required parameter was the stiffness, K; damage initiation, δ_c; and damage evolution based on total/plastic displacement, δ_m (Dassault Systèmes, 2015). For the normal and tangential contact behaviour, "Hard" contact was used. Meanwhile, the friction model with penalty friction formulation was used to define tangential behaviour. The residual stress was used to determine the friction coefficient, μ. Therefore, trial-and-error method had been used to identify the appropriate value of μ with a reference value of 0.56 suggested by Wu et al. (2023). Table 3 shows the summary of the new-old concrete interface parameters used in this study.

Table 3. Concrete Interface Parameters

Stiffness, K	Damage Initiation, δ_c	Damage Evolution, δ_m	Friction Coefficient, μ
1.17	0.73	0.73	0.5

Boundary Conditions, Mesh Element Type and Sizes

The old and new concrete parts for the numerical specimen were modelled as C3D8R. In order to reduce the analysis time, the mesh distribution was ensured to be varied throughout the specimen, where fine meshes were assigned at and near the interface region in order to obtain accurate interface behaviour and stresses. Therefore, 15 mm mesh size was assigned for the overall specimen, except that 3 mm mesh size was used at and near the interface and rectangular roughness tooth regions. In this study, the loader and support components were unable to be meshed because they were modelled as 3D analytical rigid shell. Figure 8 shows the meshing outcome for one of the specimens in this numerical simulation.
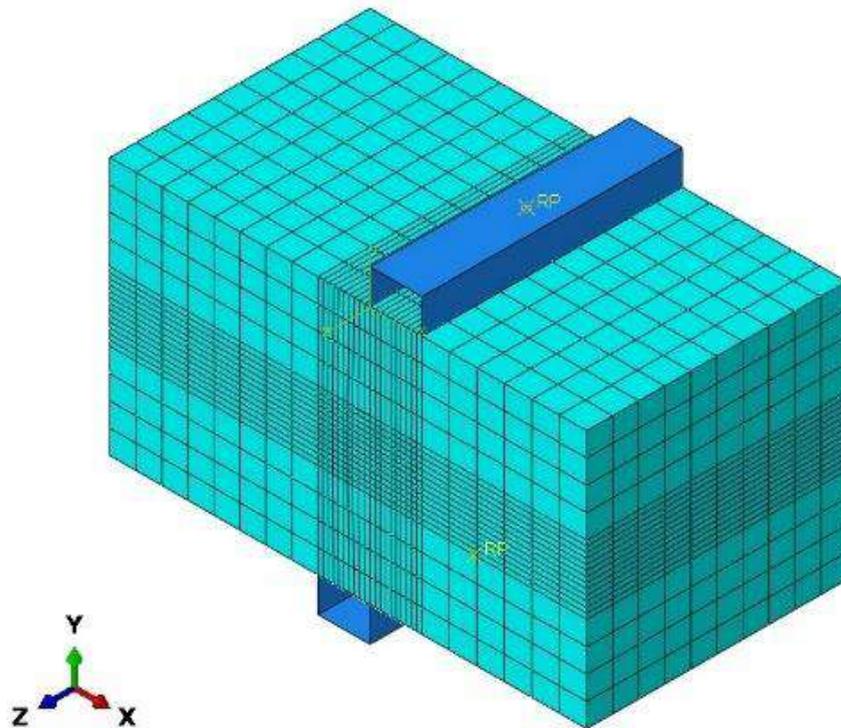

Figure 8. Meshing of Model

Results and Discussion

Nine numerical specimens with a rectangular roughness tooth varying from 30 mm to 70 mm thicknesses, with 5 mm thickness variation among each other, were simulated and numerically analyzed.

Normalized Shear Stress-Slip Curves

The shear force results obtained from the numerical simulation was normalized using Equation 11 so that the effect of the concrete strength variation at the new-old concrete interface are taken into consideration.

$$\tau = \frac{P}{2A\sqrt{f_c'}}$$

Equation 11.

Where,

τ = normalised shear strength (MPa).

P = total shear load distributed over two loading plates (N).

f_c' = cylindrical compressive strength of old concrete ($f_c' = 0.8f_{cu}$) in MPa.

f_{cu} = cubic compressive strength

The normalised shear stress-slip curve for all the specimens is shown in Figure 9. Figure 10 shows the ultimate normalized shear stress attained by each specimen with the linear regression analysis performed on those data points. Referring to Figure 9, the initial elastic stiffness across all the specimens is almost similar. In overall, a gradual increase in the rectangular roughness tooth thickness from 30 mm to 70 mm results in 15.81% of increment in ultimate normalised shear capacity. This finding also supported by 0.9206 coefficient of determination (R^2) as being reported in Figure 10. Besides, the adoption of rectangular roughness tooth produced hinge-like behavior between the new-old concrete interface. The rectangular roughness tooth found to be still engaging and providing the shear resistance up to a slip of 3.2 mm when load increases. This suggests a mechanical locking mechanism provided by the rectangular roughness tooth, which persists even after the concrete interfacial bonding failure.
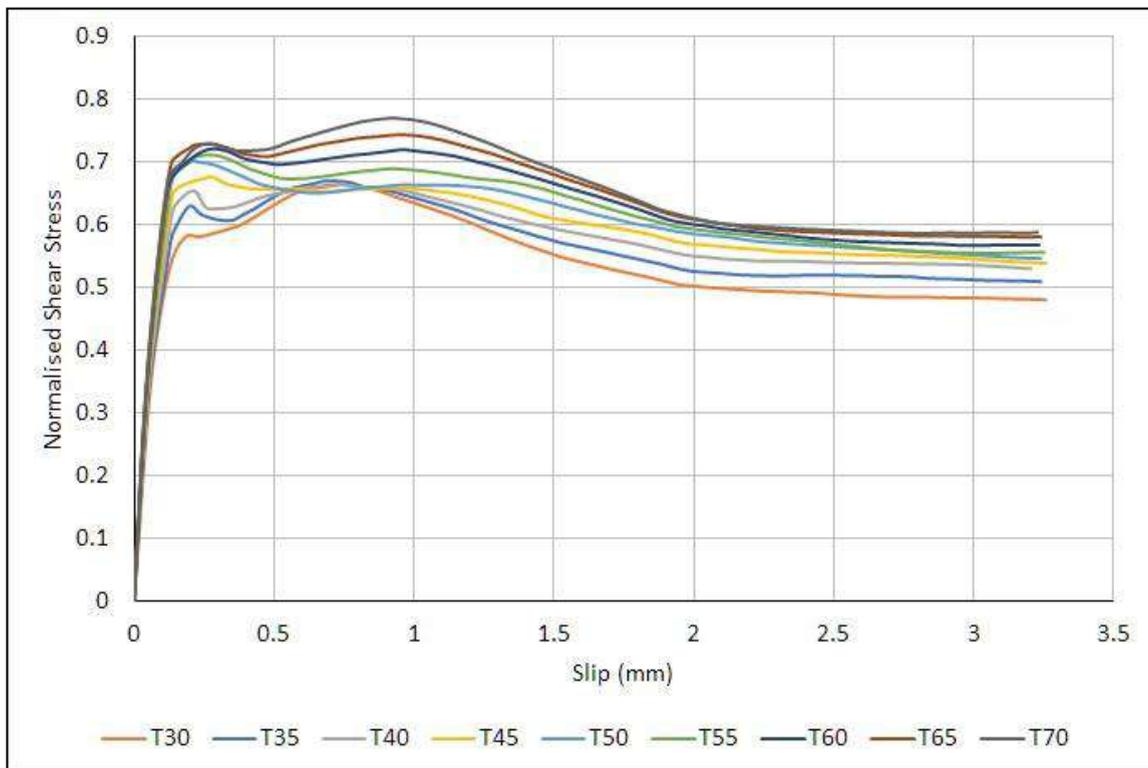

Figure 9. Normalised Shear Stress-Slip Curves for All Numerical Specimens

In addition, each specimen consistently exhibited two distinct peak points in the normalised shear stress-slip curves. Specimens T30 to T40 showed a lower primary peak compared to the secondary peak. This trend was reversed for

specimen T45 to T55, where their primary peak is higher than the secondary peak. Interestingly, specimen T60 showed an almost equal value for both peaks, suggesting a potential turning point in this behaviour. Then, specimen T65 and T70 returned to the stage with a higher secondary peak than its primary peak.
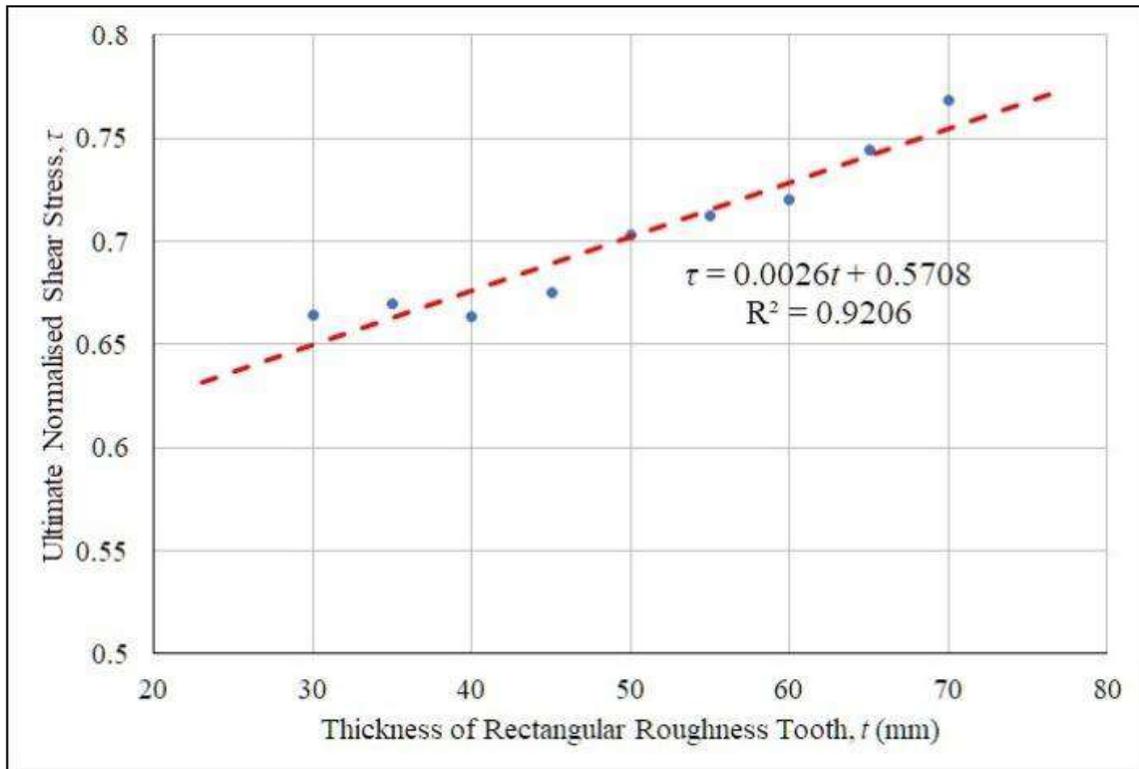

Figure 10. Correlation between Ultimate Normalised Shear Stress with Tooth Thickness

This analysis suggests that specimens with any thickness of concrete protrusion as a result of having the rectangular roughness tooth lesser than 45 mm thickness, either at the male or female concrete part, have encountered the first shear-slip failure at the early stage of testing. However, such geometry arrangement still enables those specimens continue to deform with higher shear force and resulted higher secondary peak. In contrast, specimens with any thickness of concrete protrusion at the male and female concrete parts greater than 45 mm, enable them to resist high shear force at the early stage and delayed the first shear-slip failure. But, the first shear-slip failure for this category of specimens may cause significant damage on the rectangular roughness tooth and prevented them to attain higher secondary peak. Nonetheless, further physical experimental test and investigation are required to validate these findings in order to determine the reason of shifting in peak behaviour between the specimens.

Maximum Principal Stress Contour

Maximum principal stress contours were used to analyse the internal tensile stress distribution in the specimens. Figure 11 shows a visualization obtained from the simulation results at the frame corresponding to the maximum normalised shear stress for the numerical specimens. By comparing the maximum principal stress contours across each specimen, it shows that the tensile stress was mainly concentrated at the interface in all specimens. Interestingly,

there was a compressive zone at the top of the rectangular roughness tooth in the new concrete part of specimen T30. However, this zone gradually disappeared when the thickness of roughness tooth. In contrast, the compression zone at the root of the rectangular roughness tooth in old concrete parts remained present in all specimens. In addition, the location of the maximum tensile stress was consistently noticed within the new concrete part that close to the roughness tooth. For specimens T30, T35 and T40, it appeared as a single concentrated zone. However, for specimens T45 onwards, this zone split into two separate regions. With increasing tooth thickness until 70 mm, this fragmentation of the high stress zone became more pronounced. This suggests that the tensile stress contour was influenced by the thickness of the rectangular roughness tooth.
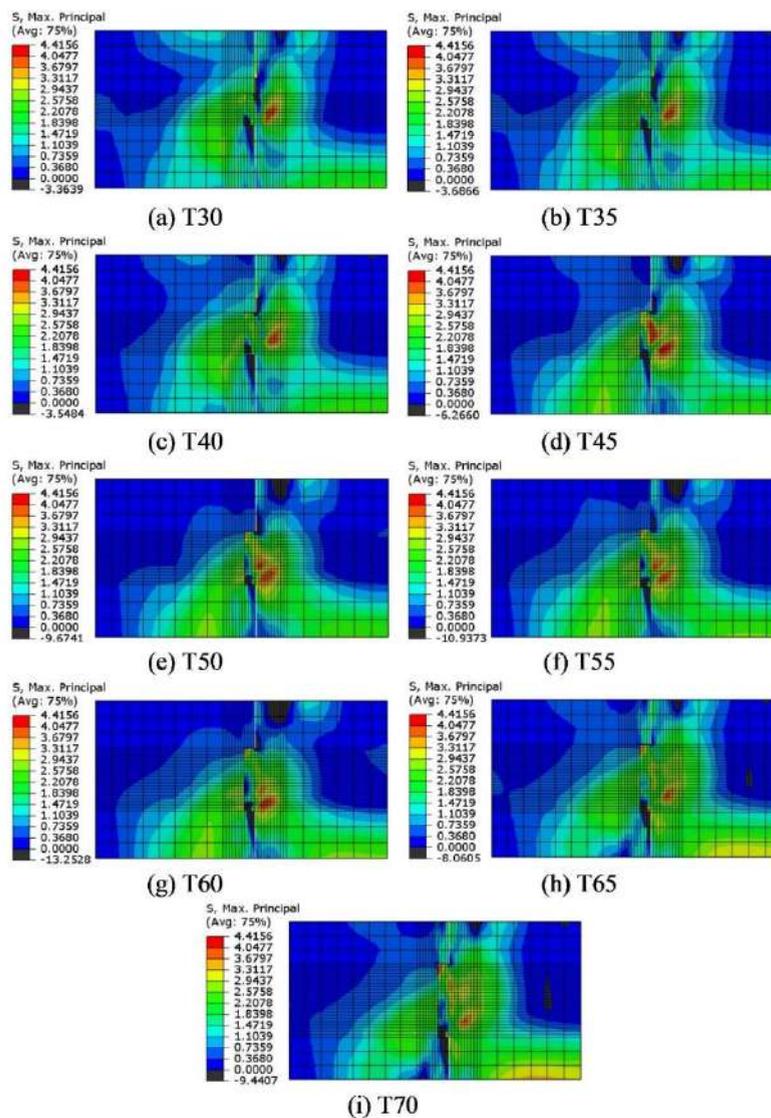

Figure 11. Maximum Principal Stress Contours for All Numerical Specimens

Damaged Contour

The DAMAGET contour was used as a visualisation approach to indicate the tensile crack that occurred within the numerical specimen. Figure 12 shows the DAMAGET contour extracted at a slip of 3.2 mm. Across all the numerical

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specimens, large interface opening at the bottom was noticed. This indicates that all specimens also exhibited cohesive failure other than adhesive failure at the old-new concrete interface. Besides, further analysis of these contours revealed a consistent pattern of tensile failure at the base of the rectangular roughness tooth in the new concrete part for each specimen. This failure was propagating towards the top part of the roughness tooth, indicated shear failure at this zone due to the shear load. This pattern is consistent with the ideal scenario observed in the shear tests by Niwa et al. (2016) and Shamass et al. (2015). Furthermore, a comparison of the DAMAGET contours with the maximum principal stress contours confirmed the following findings. The outer root of the roughness tooth did not fail in tension, while the crack was progressed from the inner root to the central region below the loader where the highest tensile stress zone was located. This reinforces the successful transfer of shear load to the rectangular roughness tooth and not just through the interface, resulting in a greater shear capacity as previously discussed in the normalised shear stress-slip curve.
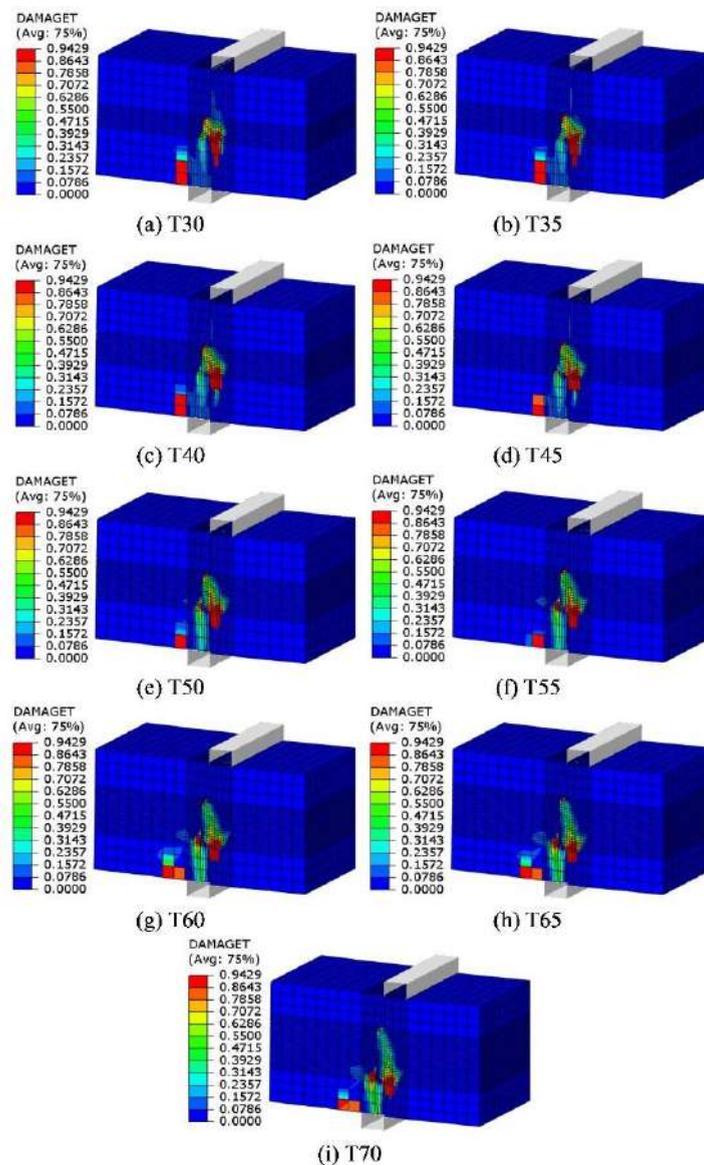

Figure 12. Damaget Contours for All Numerical Specimens

Conclusion

Total 9 numerical specimens with different thicknesses of rectangular roughness tooth were numerically modelled and analysed under double shear test. In conclusion, thicker rectangular roughness tooth's results higher normalised shear stress capacity. Besides, the normalised shear stress-strain curves for the specimens showed a shift in the first and second peak points, indicating hinge-like behavior with different failure mode happen in it. Regardless the thickness variation of rectangular roughness tooth, the tensile stress was found to be consistently located within the roughness tooth area of the new concrete part, highlighting the importance of the rectangular roughness tooth in this shear load transfer. The failure mode of all numerical specimens is the same, which is a combination of adhesive and cohesive failures. This means that the shear load is successfully transferred from the top loading plate and through the roughness tooth to the bottom support plate. In addition, the shear crack of the roughness tooth always started from the root and propagated diagonally.

Recommendations

Physical experiment testing on the shear performance of various thicknesses of rectangular roughness tooth is suggested for the future work. It is necessary to confirm the numerical findings. Particularly, on the male joint at the new concrete with higher concrete strength plays more dominant role in influencing the overall shear strength when load increases, instead of the interface bond strength. Hence, further detail observation and test data collection from the physical experimental work shall be conducted in order to confirm this phenomenon.

Acknowledgements

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Off-Axis Electric and Potential Fields of Uniform Ring of Charge

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Abstract: The electrostatic field of a uniformly charged ring is a classical problem in Electrostatics, often used to highlight the role of symmetry in field calculations. While the axial electric field and potential are straightforward to evaluate, the general off-axis field requires more advanced treatment involving complete elliptic integrals. In this work, we derive closed-form expressions for the electric potential and electric field due to a uniformly charged ring at arbitrary points in space. Beginning with Coulomb's law in cylindrical coordinates, we establish the field components by exploiting azimuthal symmetry: the radial and axial components are expressed in terms of complete elliptic integrals of the first and second kind, while the azimuthal component vanishes. An alternative derivation is then presented, in which the field is obtained from the gradient of the potential, providing mutual confirmation of both methods. Limiting cases are analyzed, including the axial field, in-plane behavior, and far-field approximations. Numerical simulations further illustrate the dependence of the field on radial position, and practical approximations in terms of elementary functions are proposed. This dual analytical–computational approach offers both clarity and accessibility, with applications in teaching, research, and engineering design.

Keywords: Uniformly charged ring, electric field, Coulomb's law, electric potential, elliptic integrals.

Introduction

Many modern textbooks on electrostatics start by introducing discrete charge distributions because they are conceptually simple. Continuous charge distributions are introduced later because they often require more complex calculations involving special functions. These calculations are typically illustrated using symmetric continuous distributions, such as uniformly charged wires, rings, disks, annuli, planes, cylinders and spheres, as well as their corresponding shells. These examples are widely discussed in standard textbooks (e.g., Serway & Jewett, 2014; Young & Freedman, 2012) and allow students to compute electric fields at general points using either Coulomb's law or Gauss's theorem relatively easily. However, calculating the electric field of rings or disks at arbitrary points is more challenging: simple analytical expressions only exist along their symmetry axis, while off-axis points require more advanced methods.

The study of the off-axis field of a uniformly charged ring has received increasing attention over the past two decades. Early contributions include those of Zypman (2006), who investigated the field outside the symmetry axis, and

Mandre (2007), who expressed the radial and axial components in terms of complete elliptic integrals. Ciftja et al. (2009) computed the potential at arbitrary off-axis points via direct integration. Meanwhile, Wissner-Gross (2012) and Escalante (2021) presented pedagogical approaches for undergraduate instruction and non-centred rings, respectively. More recent studies have examined applications in scanning force microscopy and associated experiments (Eisenberg & Zypman, 2019; Gordon et al., 2024; Lazarev & Zypman, 2017), demonstrating the practical importance of these calculations. Off-axis fields for disks and annuli have also been studied (Bochko & Silagadze, 2020; Martín-Luna et al., 2023; Sagaydak & Silagadze, 2024; Ciftja, 2023), but remain comparatively underdeveloped due to their computational complexity.

This study presents a unified treatment of the problem using two complementary approaches. First, symmetry and invariance considerations are applied to establish the implicit form of the field, showing that only radial and axial components are present. Explicit evaluation with Coulomb's law in cylindrical coordinates then yields integral expressions that reduce to compact forms involving complete elliptic integrals.

A second approach is developed through the scalar potential, which provides a more efficient route to the off-axis field. By first computing the potential and then taking its negative gradient, exact closed-form expressions for the radial and axial components are obtained in terms of the complete elliptic integrals of the first and second kind, $K(k)$ and $E(k)$. These results are validated by their reduction to the standard on-axis and far-field limits, and further illustrated by numerical simulations and special cases such as the in-plane field. The framework not only clarifies the mathematical structure of the problem but also highlights the pedagogical value of introducing higher transcendental functions in electrostatics, with potential applications in both research and engineering.

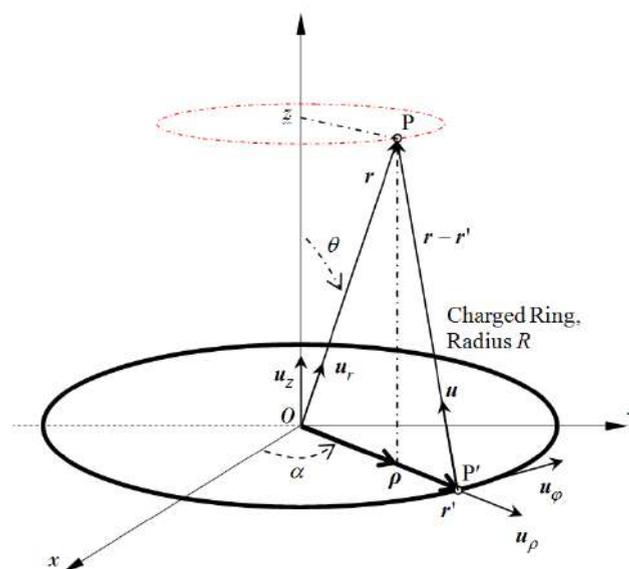## Implicit Electric Field of the Ring from Symmetry and Invariance

Figure 1. A ring of radius R lies on the xy plane. The field point P has cylindrical coordinates (ρ, z).

A filamentary ring of radius R carries a total charge Q, algebraic, uniformly distributed around it. Its linear charge density is $\lambda = Q/(2\pi R)$. Let $\boldsymbol{r}$ be the position vector of a point P in three-dimensional space. Consider an infinitesimal charge segment dq located at the point P' on the ring by the position vector $\boldsymbol{r'}$, with vector position r' forming an angle α with the x axis, as shown in Figure 1.

The goal is to determine the electric field vector $\mathbf{E}$ at a point P located a distance r from the center of a uniformly charged ring. The main aim of the symmetry and invariance analysis is to identify the non-zero components of the field $\mathbf{E}$ and the coordinates on which they depend. The implicit form obtained is useful for predicting expected results when applying Coulomb's law.

We begin with the symmetry analysis. The z axis is the ring's symmetry axis, and the xy plane is its plane of symmetry. Indeed, the ring possesses an infinite number of planes of symmetry perpendicular to the xy plane and intersecting the z axis. The electric field vector $\mathbf{E}$ at any point P in space can be expressed in cylindrical coordinates (ρ, φ, z) as:

$$\mathbf{E}(\rho, \varphi, z) = E_\rho(\rho, \varphi, z)\,\boldsymbol{u}_\rho + E_\varphi(\rho, \varphi, z)\,\boldsymbol{u}_\varphi + E_z(\rho, \varphi, z)\,\boldsymbol{u}_z \tag{1}$$

By symmetry, any plane that contains point P and is perpendicular to the xy plane and passes through the z axis is a plane of symmetry of the ring. As the electric field is a *true vector*, it lies entirely within this plane, implying that the component perpendicular to it vanishes. Equation (1) reduces to

$$\mathbf{E}(\rho, \varphi, z) = E_\rho(\rho, \varphi, z)\,\boldsymbol{u}_\rho + E_z(\rho, \varphi, z)\,\boldsymbol{u}_z \tag{2}$$

Next, the invariance study shows that, for a fixed Etiket and z, the magnitude of $\mathbf{E}$ does not depend on the azimuthal angle φ. In other words, rotating point P around the z axis (or, equivalently, rotating the ring around the z axis while keeping point P fixed) leaves the field unchanged. Consequently, $\mathbf{E}$ depends only on ρ and z, and the field expression is further simplified to:

$$\mathbf{E}(\rho, z) = E_\rho(\rho, z)\,\boldsymbol{u}_\rho + E_z(\rho, z)\,\boldsymbol{u}_z \tag{3}$$

This is the implicit form of the electric field vector for a uniformly charged ring. It depends only on the cylindrical coordinates ρ and z, and is independent of the azimuthal angle φ.

Calculation of Electric Field Components Using Coulomb's Law

An infinitesimal charge segment dq located at position vector $\boldsymbol{r'}$ on the ring produces an electric field infinitesimal contribution $d\mathbf{E}$ to the electric field $\mathbf{E}$ at a point P in space, specified by the position vector $\boldsymbol{r}(\rho, z)$. According to Coulomb's law, this contribution is given by

$$d\mathbf{E} = k_e \frac{dq}{\left\lVert \boldsymbol{r} - \boldsymbol{r'} \right\rVert^2}\,\boldsymbol{u} = k_e \frac{\boldsymbol{r} - \boldsymbol{r'}}{\left\lVert \boldsymbol{r} - \boldsymbol{r'} \right\rVert^3}\,dq \tag{4}$$

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where $k_e = 1/(4\pi\varepsilon_0)$ is Coulomb's constant, $\varepsilon_0 = 8.845 \times 10^{-12}$ F.m^{-1} is the vacuum permittivity, and $\boldsymbol{u}$ is a unit vector pointing from point P′ on the ring toward the observation point P, as shown in Fig. 1.

The infinitesimal charge element dq located at point P' on the ring is described by the position vector $\boldsymbol{r'}$, which forms an angle α with the x axis. Its Cartesian components are:

$$\boldsymbol{r'} = x'\boldsymbol{i} + y'\boldsymbol{j} = R\cos\alpha\,\boldsymbol{i} + R\sin\alpha\,\boldsymbol{j} \tag{5}$$

In cylindrical coordinates, however, the position vector of the observation point P lying in the xz plane as

$$\begin{aligned}\boldsymbol{r} &= r\boldsymbol{u}_r \\ &= \rho\,\boldsymbol{u}_\rho + z\,\boldsymbol{u}_z\end{aligned} \tag{6a}$$

With

$$\cos\theta = \frac{\boldsymbol{r}.\boldsymbol{k}}{r}\,, \text{ we get: } \rho = r\sin\theta\,, \text{ and } z = r\cos\theta \tag{6b}$$

The calculation may be carried out in any plane containing both the observation point P and the z axis. By symmetry and invariance of the ring system, no generality is lost by restricting the analysis to the xz plane, where the position vector of P is $\boldsymbol{r}(\rho, z)$, *i.e.* at $\varphi = 0$. In this case, the electric field takes the following form

$$\mathbf{E}(\rho, z) = E_x(\rho, z)\,\boldsymbol{i} + E_z(\rho, z)\,\boldsymbol{k} \tag{7}$$

Thus, the calculation can, without loss of generality, be carried out in the xz plane. This corresponds to expressing the position vector in Cartesian unit vectors by replacing $\boldsymbol{u}_\rho$ and $\boldsymbol{u}_z$ in Eq. (6a) with $\boldsymbol{i}$ and $\boldsymbol{k}$, respectively, yielding to

$$\boldsymbol{r} = \rho\,\boldsymbol{i} + z\,\boldsymbol{k} \tag{8}$$

The displacement vector from P' to P is obtained by subtracting their position vectors:

$$\boldsymbol{r} - \boldsymbol{r'} = (\rho - R\cos\alpha)\boldsymbol{i} - R\sin\alpha\,\boldsymbol{j} + z\,\boldsymbol{k} \tag{9}$$

Then, the distance between P and P′ is:

$$\|\boldsymbol{r} - \boldsymbol{r'}\| = (R^2 + \rho^2 + z^2 - 2R\rho\cos\alpha)^{1/2} \tag{10}$$

Substituting Eqs. (9) and (10) into Coulomb's law in Eq. (4) yields

$$d\mathbf{E}(\rho, z) = k_e \frac{(\rho - R\cos\alpha)\,\boldsymbol{i} - R\sin\alpha\,\boldsymbol{j} + z\,\boldsymbol{k}}{(R^2 + \rho^2 + z^2 - 2R\rho\cos\alpha)^{3/2}}\,dq \tag{11}$$

Henceforth, it is no longer necessary to restrict the calculation to the xz plane; by symmetry, the analysis may be

carried out in any ρz plane. The total charge Q is uniformly distributed along the ring's circumference, so an infinitesimal element is

$$dq = \lambda \, d\ell = \lambda R d\alpha = \frac{Q}{2\pi} d\alpha$$

Consequently, the integration can be performed over the full circumference of the ring. Thus, the electric field at an arbitrary point P is given by

$$\mathbf{E}(\rho, z) = k_e \frac{Q}{2\pi} \int_0^{2\pi} \frac{(\rho - R \cos\alpha)\, \boldsymbol{u}_\rho - R \sin\alpha\, \boldsymbol{u}_\varphi + z\, \boldsymbol{u}_z}{(R^2 + \rho^2 + z^2 - 2R\rho \cos\alpha)^{3/2}} d\alpha \tag{12}$$

Nonetheless, the component of the electric field along the azimuthal unit vector $\boldsymbol{u}_\varphi$ is zero, as anticipated from the symmetry and invariance analysis. This can be demonstrated as follows.

Let

$$f(\alpha) = (R^2 + \rho^2 + z^2 - 2R\rho \cos\alpha)^{-1/2} \quad \Rightarrow \quad \frac{df}{d\alpha} = \frac{-R\rho \sin(\alpha)}{(R^2 + \rho^2 + z^2 - 2R\rho \cos\alpha)^{3/2}}$$

$$E_\varphi(\rho, z) = k_e \frac{Q}{2\pi} \int_0^{2\pi} \frac{-R \sin\alpha}{(R^2 + \rho^2 + z^2 - 2R\rho \cos\alpha)^{3/2}} d\alpha$$

$$= k_e \frac{Q}{2\pi} \frac{1}{\rho} \int_0^{2\pi} \frac{-R\rho \sin\alpha}{(R^2 + \rho^2 + z^2 - 2R\rho \cos\alpha)^{3/2}} d\alpha$$

$$= k_e \frac{Q}{2\pi} \frac{1}{\rho} \left[-\frac{1}{(R^2 + \rho^2 + z^2 - 2R\rho \cos\alpha)^{1/2}} \right]_0^{2\pi}$$

$$= k_e \frac{Q}{2\pi} \frac{1}{\rho} \left[\frac{1}{(R^2 + \rho^2 + z^2 - 2R\rho)^{1/2}} - \frac{1}{(R^2 + \rho^2 + z^2 - 2R\rho)^{1/2}} \right]_0^{2\pi}$$

$$= 0$$

Thus, $E_\varphi(\rho, z) = 0$ because $\cos(2\pi) = \cos(0) = 1$. Consequently, Eq. (12) simplifies to

$$\mathbf{E}(\rho, z) = k_e \frac{Q}{2\pi} \int_0^{2\pi} \frac{(\rho - R \cos\alpha)\, \boldsymbol{u}_\rho + z\, \boldsymbol{u}_z}{(R^2 + \rho^2 + z^2 - 2R\rho \cos\alpha)^{3/2}} d\alpha \tag{13}$$

These are elliptic integral functions, which do not have closed-form analytic expressions.

This expression accurately describes the electric field of a uniformly charged ring. Numerical values can be readily obtained by evaluating the integrals in Eq. (13) using a computer, or by expressing them in terms of standard elliptic integrals. Rewriting the formulas for the E_ρ and E_z components yields further expressions involving elliptic integrals. Nevertheless, Eq. (13) is sufficient for calculating the electric field vector of a uniformly charged ring at any point in space. It also confirms that the field has only two non-zero components, E_ρ and E_z, which is in agreement with Eq.

(3), while $E_\varphi = 0$. It is, however, possible to carry the calculation further and obtain explicit expressions in terms of the elliptic integrals of the first and second kinds. Apart from the angle α, which specifies the position of the source point on the ring, the integrals appearing in the formulas for E_ρ and E_z depend only on the variables ρ and z. Since $\cos(\alpha)$ is a periodic function and the integrals are additive, the evaluation of Eq. (13) can be restricted to the interval $[0,\pi]$:

$$\mathbf{E}(\rho, z) = k_e \frac{Q}{2\pi} \int_0^\pi \frac{(\rho - R\cos\alpha)\,\mathbf{u}_\rho + z\,\mathbf{u}_z}{(R^2 + \rho^2 + z^2 - 2R\rho\cos\alpha)^{3/2}} \, d\alpha \tag{14}$$

The next step is to evaluate these integrals by substitution, changing the integration variable according to the formula:

$$\beta = \frac{\pi - \alpha}{2}, \text{ such that } \alpha = \pi - 2\beta, \ d\alpha = -2d\beta \tag{15}$$

$$\alpha = 0 \rightarrow \beta = \frac{\pi}{2}, \ \alpha = \pi \rightarrow \beta = 0, \ \cos(\alpha) = \cos(\pi - 2\beta) = -\cos(2\beta) = 2\sin^2(\beta) - 1 \tag{16}$$

By substitution, Eq. (14) can be rewritten as :

$$\mathbf{E}(\rho, z) = k_e \frac{Q}{\pi} 2 \int_0^{\pi/2} \frac{(\rho + R - 2R\sin^2(\beta))\,\mathbf{u}_\rho + z\,\mathbf{u}_z}{(R^2 + \rho^2 + z^2 + 2R\rho - 4R\rho\sin^2(\beta))^{3/2}} \, d\beta \tag{17}$$

Then, by introducing

$$\mu = k^2 = \frac{4\rho R}{q} \text{ where } q = R^2 + \rho^2 + z^2 + 2\rho R \tag{18}$$

Here, the quantity $k = \sqrt{\mu}$ represents the modulus of the Jacobian elliptic functions (Abramowitz & Stegun, 1964).

Decomposing Eq. (17) then yields the radial and axial components of the field vector:

$$E_\rho(\rho, z) = k_e \frac{Q}{\pi} \frac{2}{q^{3/2}} \left\{ \rho \int_0^{\pi/2} \frac{1}{(1 - k^2\sin^2\beta)^{3/2}} \, d\beta + R \int_0^{\pi/2} \frac{1 - 2\sin^2\beta}{(1 - k^2\sin^2\beta)^{3/2}} \, d\beta \right\} \tag{19a}$$

$$E_z(\rho, z) = k_e \frac{Q}{\pi} \frac{2}{q^{3/2}} \left\{ z \int_0^{\pi/2} \frac{1}{(1 - k^2\sin^2\beta)^{3/2}} \, d\beta \right\} \tag{19b}$$

Axial Electric Field Component: As is well known, the complete elliptic integral of the third kind is defined as (Good, 2001; Noh, 2017):

$$\Pi\left(n\middle|m\right) = \int_0^{\pi/2} \frac{1}{1 - n\sin^2\beta} \frac{d\beta}{\sqrt{1 - m\sin^2\beta}} \qquad (20)$$

where n is the elliptic characteristic and m is the elliptic modulus (Weisstein, 2025). For real values of m, the parameter can always be chosen such that $0 \leq m \leq 1$ (Abramowitz & Stegun, 1964).

A noteworthy special case arises within this class of integral equations when both the characteristic n and the parameter m are equal to the modulus k squared. Specifically, for $n = m = k^2$, the integral in Eq. (20) yields

$$\Pi\left(k^2\middle|k^2\right) = \int_0^{\pi/2} \frac{d\beta}{(1 - k^2\sin^2\beta)^{3/2}} \qquad (21)$$

According to Arfken & Weber (2005) and Weisstein (2025), the function diverges when $k^2 = 1$. For $0 \leq k^2 < 1$, it remains finite but increases as k^2 approaches unity. Thus, $\Pi(k^2|k^2)$ diverges at for $k^2 = 1$ and remains finite for $0 \leq k^2 < 1$. For $k^2 = 0$, $\Pi(0|0) = \pi/2$, as shown in Fig. 2.

Inspection of Eq. (19b) reveals that it includes the special case of the complete elliptic integral of the third kind with $n = k^2$ and $m = k^2$. Consequently, the axial component of the field can be written as

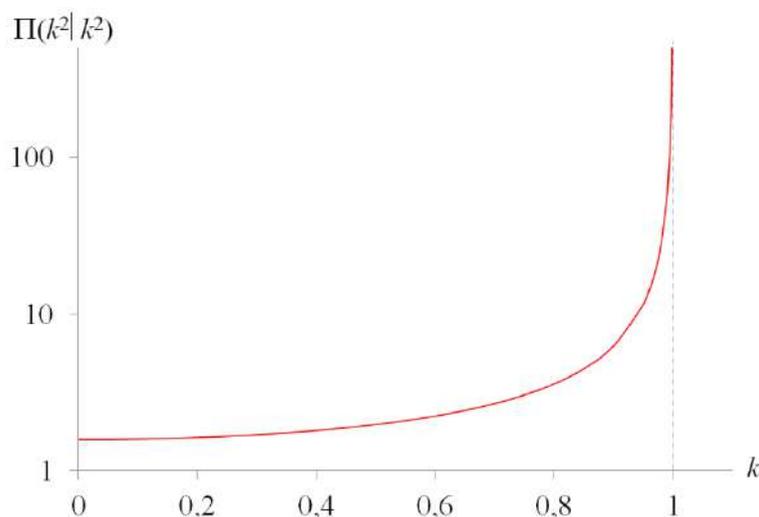$$E_z(\rho, z) = k_e \frac{Q}{\pi} \frac{2}{q^{3/2}} z \Pi\left(k^2\middle|k^2\right) \qquad (22)$$

Figure 2. Complete elliptic integral of the third kind $\Pi(k^2|k^2)$ vs. modulus k.

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Furthermore, the relation between $\Pi(k^2|k^2)$ and the complete elliptic integral of the second kind is given by (Abramowitz & Stegun, 1964; Gradshteyn & Ryzhik, 2007; Weisstein, 2025):

$$\Pi\left(k^2 \middle| k^2\right) = \frac{E(k^2)}{1-k^2} \tag{23}$$

where

$$E(k^2) = \int\limits_0^{\pi/2} \sqrt{1 - k^2 \sin^2\beta} \, d\beta \tag{24}$$

For $k^2 = 0$, $E(0) = \pi/2$. The curve of $E(k^2)$ as a function of k is shown in Fig. 3.

For $k^2 = 1$, the denominator $(1-k^2)$ in Eq. (23) vanishes, causing the integral to diverge, which indicates a singularity. Nevertheless, this relation remains valid and provides a means to compute $\Pi(k^2|k^2)$ in terms of $E(k^2)$. Substituting this expression for $\Pi(k^2|k^2)$ from Eq. (23) into Eq. (22) allows the axial component of the field vector to be written in a more compact form as:

$$E_z(\rho, z) = k_e \frac{Q}{\pi} \frac{2}{(1-k^2)q^{3/2}} z \, E(k^2) \tag{25}$$

Radial Electric Field Component: Similarly, the radial component E_ρ can be expressed in terms of standard elliptic integrals. Eq. (19a) shows that it involves two integral functions. The first is analogous to the complete elliptic integral of the third kind with $n = k^2$ and $m = k^2$, while the second contains an additional factor in the numerator, making it more complex. To simplify this expression, it is convenient to decompose it as:

$$E_\rho(\rho, z) = k_e \frac{Q}{\pi} \frac{2}{q^{3/2}} \left\{ \rho \int\limits_0^{\pi/2} \frac{d\beta}{(1-k^2\sin^2\beta)^{3/2}} + R \int\limits_0^{\pi/2} \frac{d\beta}{(1-k^2\sin^2\beta)^{3/2}} + \int\limits_0^{\pi/2} \frac{-2R\sin^2\beta}{(1-k^2\sin^2\beta)^{3/2}} d\beta \right\} \tag{26}$$

By multiplying both the numerator and denominator by ρ and rearranging, the third integral in Eq. (26) can be rewritten as:

$$E_\rho(\rho, z) = k_e \frac{Q}{\pi} \frac{2}{q^{3/2}} \left\{ (\rho + R) \int\limits_0^{\pi/2} \frac{d\beta}{(1-k^2\sin^2\beta)^{3/2}} + \frac{1}{\rho} \int\limits_0^{\pi/2} \frac{-2R\rho\sin^2\beta}{(1-k^2\sin^2\beta)^{3/2}} d\beta \right\} \tag{27}$$

At this stage, it is necessary to add and subtract certain terms to facilitate the evaluation of the integral, as follows:

$$E_\rho(\rho, z) = k_e \frac{Q}{\pi} \frac{2}{q^{3/2}} \left\{ \begin{array}{l} (\rho + R) \int\limits_0^{\pi/2} \frac{d\beta}{(1-k^2\sin^2\beta)^{3/2}} \\[2em] + \frac{1}{\rho} \int\limits_0^{\pi/2} \frac{\frac{R^2}{2} - \frac{R^2}{2} - 2R\rho\sin^2\beta + \frac{\rho^2}{2} - \frac{\rho^2}{2} + \frac{z^2}{2} - \frac{z^2}{2}}{(1-k^2\sin^2\beta)^{3/2}} d\beta \end{array} \right\} \tag{28}$$

After rearrangement, the radial component becomes:

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$$E_\rho(\rho,z) = k_e \frac{Q}{\pi} \frac{2}{q^{3/2}} \left\{ \begin{array}{l} (\rho + R) \int_0^{\pi/2} \frac{d\beta}{(1 - k^2 \sin^2 \beta)^{3/2}} \\ \\ + \frac{1}{\rho} \int_0^{\pi/2} \frac{\frac{1}{2}((R+\rho)^2 + z^2) - 2R\rho \sin^2 \beta - \frac{1}{2}(R^2 + \rho^2 + z^2 + 2R\rho)}{(1 - k^2 \sin^2 \beta)^{3/2}} d\beta \end{array} \right\}$$

(29)

By replacing $q = (\rho + R)^2 + z^2$ by $q = 4\rho R / k^2$ (see relations (18)), we obtain:

$$E_\rho(\rho,z) = k_e \frac{Q}{\pi} \frac{2}{q^{3/2}} \left\{ \begin{array}{l} (\rho + R) \int_0^{\pi/2} \frac{d\beta}{(1 - k^2 \sin^2 \beta)^{3/2}} \\ \\ + \frac{1}{\rho} \int_0^{\pi/2} \frac{\frac{2\rho R}{k^2}(1 - k^2 \sin^2 \beta)}{(1 - k^2 \sin^2 \beta)^{3/2}} d\beta - \frac{1}{\rho} \int_0^{\pi/2} \frac{\frac{1}{2}\frac{4\rho R}{k^2}}{(1 - k^2 \sin^2 \beta)^{3/2}} d\beta \end{array} \right\}$$

(30)

A more convenient form is obtained after appropriate simplifications.

$$E_\rho(\rho,z) = k_e \frac{Q}{\pi} \frac{2}{q^{3/2}} \left\{ \begin{array}{l} (\rho + R) \int_0^{\pi/2} \frac{d\beta}{(1 - k^2 \sin^2 \beta)^{3/2}} \\ \\ + \frac{2R}{k^2} \int_0^{\pi/2} \frac{d\beta}{(1 - k^2 \sin^2 \beta)^{1/2}} - \frac{2R}{k^2} \int_0^{\pi/2} \frac{d\beta}{(1 - k^2 \sin^2 \beta)^{3/2}} \end{array} \right\}$$

(31)

Among these integrals, one can identify the complete elliptic integral of the first kind, denoted $K(k)$, which is commonly defined as

$$K(k^2) = \int_0^{\pi/2} \frac{d\beta}{\sqrt{1 - k^2 \sin^2 \beta}}$$

(32)

Some notable values of the complete elliptic integral of the first kind are $K(0) = \pi/2$ for $k^2 = 0$, and $K(k) \to \infty$ as $k^2 \to 1$ (Arfken & Weber, 2005), as illustrated in Fig. 3.

In Eq. (31), the first and third integrals correspond to the complete elliptic integral of the third kind, $\Pi(n|m)$, with $n = k^2$ and $m = k^2$, while the middle integral is the complete elliptic integral of the first kind, $K(k)$. Consequently, the radial component of the electric field can be expressed as:

$$E_\rho(\rho,z) = k_e \frac{Q}{\pi} \frac{2}{q^{3/2}} \left\{ (\rho + R)\Pi\left(k^2 \middle| k^2\right) + \frac{2R}{k^2} K(k^2) - \frac{2R}{k^2}\Pi\left(k^2 \middle| k^2\right) \right\}$$

(33)

Then, applying Eq. (23) again,

$$E_\rho(\rho,z) = k_e \frac{Q}{\pi} \frac{2}{q^{3/2}} \left\{ (\rho + R)\frac{E(k^2)}{1 - k^2} + \frac{2R}{k^2} K(k^2) - \frac{2R}{k^2}\frac{E(k^2)}{1 - k^2} \right\}$$

(34)

At this stage, the expressions have been simplified as much as possible. The final step is to reorder them as follows:

$$E_\rho(\rho,z) = k_e \frac{Q}{\pi} \frac{2}{q^{3/2}} \frac{1}{k^2} \frac{1}{(1-k^2)} \left\{ 2R(1-k^2)K(k^2) - (2R - k^2(\rho+R))E(k^2) \right\} \qquad (35)$$

As a result, the expressions for the radial and axial components of the electric field vector of a uniformly charged ring at an arbitrary point in space are:

$$E_\rho(\rho,z) = k_e \frac{Q}{\pi} \frac{2}{q^{3/2}} \frac{1}{\mu} \frac{1}{(1-\mu)} \left\{ 2R(1-\mu)K(\mu) - (2R - \mu(\rho+R))\, E(\mu) \right\} \qquad (36a)$$

$$E_z(\rho,z) = k_e \frac{Q}{\pi} \frac{2}{(1-\mu)q^{3/2}} z\, E(\mu) \qquad (36b)$$

Here, q and μ ($\mu = k^2$) are defined in Eq. (18), and the functions $K(\mu)$ and $E(\mu)$ denote the complete elliptic integrals of the first and second kinds, given in Eqs. (24) and (32), respectively.
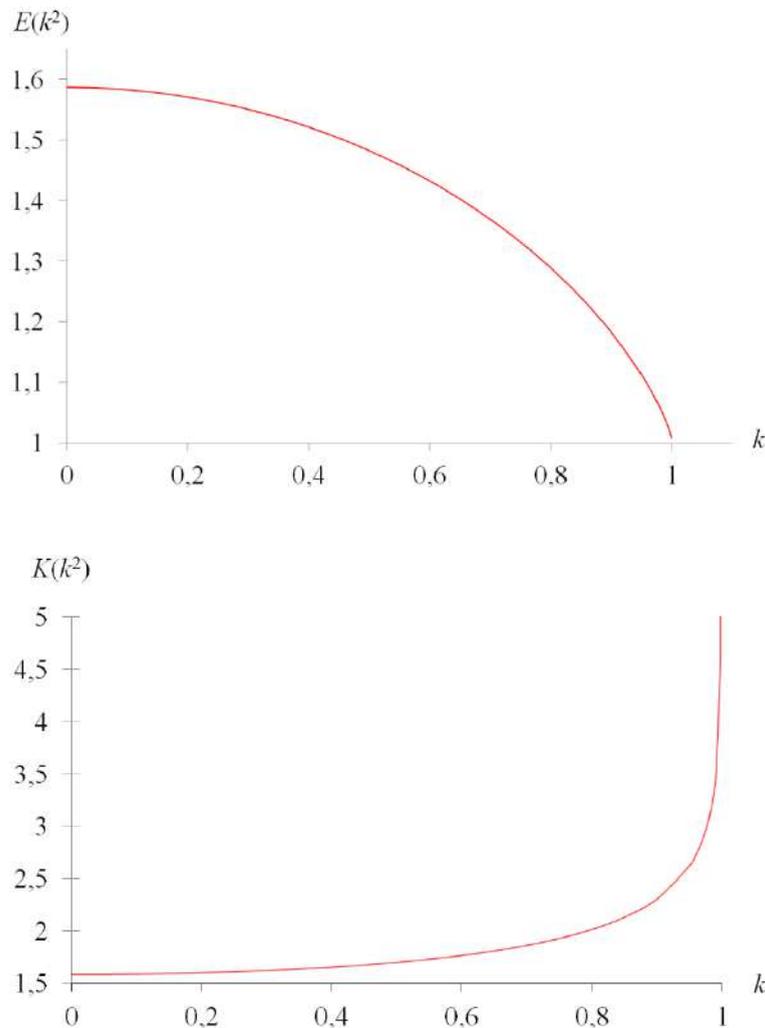

Figure 3. Complete elliptic integrals of the first and second kinds as functions of the Modulus k.
As shown, $K(k^2)$ diverges as $k \to 1$, i.e., $K(k^2) \to \infty$.

Electric Potential at an Arbitrary Point

The geometry of the problem is shown in Fig. 1. The electric potential *dV(r)* at a point P in space due to a small single segment of charge *dq* of an arc of the ring is given by Coulomb's law as:

$$dV(r) = k_e \frac{dq}{\|r - r'\|} \tag{37}$$

Substituting expression (10) in Eq. (37) results in:

$$dV(r) = k_e \frac{dq}{(R^2 + \rho^2 + z^2 - 2R\rho \cos\alpha)^{1/2}} \tag{38}$$

Substituting *dq* by *Q/(2π)dα*, the electric potential becomes:

$$V(\rho, z) = k_e \frac{Q}{2\pi} \int_0^{2\pi} \frac{d\alpha}{(R^2 + \rho^2 + z^2 - 2R\rho \cos\alpha)^{1/2}} \tag{39}$$

Since cos(α) is a periodic function, (39) can be calculated as:

$$V(\rho, z) = k_e \frac{Q}{\pi} \int_0^{\pi} \frac{d\alpha}{(R^2 + \rho^2 + z^2 - 2R\rho \cos\alpha)^{1/2}} \tag{40}$$

Integration by substitution is to be used, and the integration variable must be changed according to the following change of variables:

$$\beta = \frac{\pi - \alpha}{2}, \text{ such that } \alpha = \pi - 2\beta, \ d\alpha = -2d\beta \tag{41a}$$

$$\alpha = 0 \rightarrow \beta = \frac{\pi}{2}, \ \alpha = \pi \rightarrow \beta = 0, \ \cos(\alpha) = \cos(\pi - 2\beta) = -\cos(2\beta) = 2\sin^2(\beta) - 1 \tag{41b}$$

By substituting, Eq. (40) can be rewritten as:

$$V(\rho, z) = k_e Q \frac{2}{\pi} \int_0^{\pi/2} \frac{d\beta}{(\rho^2 + R^2 + z^2 + 2\rho R - 4\rho R sin^2\beta)^{1/2}} \tag{42}$$

Then, by substituting relations (18) into Eq. (42), the potential leads to the following form:

$$V(q,k^2) = k_e \frac{2}{\pi} \frac{Q}{\sqrt{q}} \int_0^{\pi/2} \frac{d\beta}{\sqrt{1 - k^2 \sin^2 \beta}} \tag{43}$$

In this expression, we can recognize the form of the complete elliptic integral of the first kind $K(k^2)$ given by (32). From (43), the most compact form of the electric potential is (Ciftja et al., 2009; Ciftajo at al., 2025):

$$V(q,k^2) = k_e \frac{2}{\pi} \frac{Q}{\sqrt{q}} K(k^2) \tag{44}$$

Electric Field from the Potential Created by the Ring at Any Point

The electric field is given by E = −☐grad$V$. Mathematically,

$$\mathbf{E} = -\nabla V \tag{45}$$

In cylindrical coordinates, the gradient operator vector in the differential Eq. (45) applied to the scalar function of the potential results in:

$$\mathbf{E}(\rho, z) = -\nabla V(\rho, z) = -\left(\frac{\partial}{\partial \rho} \boldsymbol{u}_\rho + \frac{1}{\rho} \frac{\partial}{\partial \varphi} \boldsymbol{u}_\varphi + \frac{\partial}{\partial z} \boldsymbol{u}_z \right) V(\rho, z) \tag{46}$$

Due to azimuthal symmetry, $\partial V(\rho, z)/\partial\varphi = 0$, so the field has no φ–component, see Eq. (3). Thus,

$$\mathbf{E}(\rho, z) = -\nabla V(\rho, z) = -\left(\frac{\partial}{\partial \rho} \boldsymbol{u}_\rho + \frac{\partial}{\partial z} \boldsymbol{u}_z \right) V(\rho, z) \tag{47}$$

To compute these derivatives, we must use Eq. (44) and the chain rule. After differentiation and simplification (**Saâd, 2025**), the components of the electric field are found to be:

$$E_\rho(q,\mu) = k_e Q \frac{2}{\pi \mu(1-\mu)q^{3/2}} \left(2R(1-\mu)K(\mu) - (2R - \mu(\rho + R))E(\mu) \right) \tag{36a}$$

$$E_z(q,\mu) = k_e \frac{Q}{\pi} \frac{2}{(1-\mu)q^{3/2}} z E(\mu) \tag{36b}$$

where

$$q = \rho^2 + R^2 + z^2 + 2\rho R ,$$

$$\mu = k^2 = \frac{4\rho R}{q} \ ,$$

and $K(\mu)$ and $E(\mu)$ are the complete elliptic integrals of the first and second kinds.

In-Plane and On-Axis Electric Field Vector

Electric Field in the Plane of the Ring

The electric field in the plane of the ring of charge can be calculated using two approaches: first, by applying Eq. (13), and second, by using the elliptic integrals in Eqs. (36a) and (36b) (**Saâd**, **2025**). To simplify the calculation, we introduce the dimensionless parameters $a = \rho/R$ and $b = z/R$, where ρ and z are defined in Eq. (6b). Substituting these parameters, Eq. (13) can be rewritten as:

$$\mathbf{E}(\rho, z) = k_e \frac{Q}{2\pi} \frac{1}{R^2} \int_0^{2\pi} \frac{(a - \cos\alpha)\, \boldsymbol{u}_\rho + b\, \boldsymbol{u}_z}{(1 + a^2 + b^2 - 2a\cos\alpha)^{3/2}} d\alpha \tag{48}$$

The condition $z = 0$ ($\Box = \Box/2$) places the point P in the xy plane, which is the plane of the ring (P$\in z = 0$ plane). In this case, $\cos(\theta) = 0$ and $\sin(\theta) = 1$, yielding $a = \rho/R = r/R$ and $b = 0$. This result implies that the axial component E_z vanishes, confirming that the field is purely radial, in agreement with Eq. (3) due to symmetry. Substituting $\lambda = Q/(2\pi R)$ into Eq. (48) produces the simplified form presented by Wissner-Gross (2012).

$$E_r(r, 0) = k_e \frac{\lambda}{R} \int_0^{2\pi} \frac{a - \cos\alpha}{(1 + a^2 - 2a\cos\alpha)^{3/2}} d\alpha \tag{49}$$

Alternatively, the field can be expressed in terms of standard elliptic integrals using Eq. (36a), while Eq. (36b) vanishes because $z = 0$. Consequently,

$$E_r(r, 0) = k_e \frac{Q}{\pi} \frac{2}{q^{3/2}} \frac{1}{\mu} \frac{1}{(1 - \mu)} \left\{ 2R(1 - \mu)K(\mu) - \left(2R - \mu(r + R)\right)E(\mu) \right\} \tag{50}$$

where

$$q = R^2 + r^2 + 2rR = R^2(1 + 2a + a^2) = R^2(1 + a)^2 \tag{51a}$$

and

$$\mu = k^2 = \frac{4rR}{q} = \frac{4rR}{(R + r)^2} = \frac{4a}{1 + 2a + a^2} \tag{51b}$$

As $Q = 2\pi R\lambda$, function (50) simplifies to

$$E_r(r,0) = k_e \frac{\lambda}{R} \frac{(1+a)}{a} \frac{1}{(1-a)^2} \left\{ 2(1-\mu)K(\mu) - (2-\mu(1+a))E(\mu) \right\} \tag{52}$$

Comparing Eqs. (49) and (52), we obtain:

$$\int_0^{2\pi} \frac{a - \cos\alpha}{(1+a^2 - 2a\cos\alpha)^{3/2}} d\alpha = \frac{1+a}{a} \frac{1}{(1-a)^2} \left\{ 2(1-\mu)K(\mu) - (2-\mu(1+a))E(\mu) \right\} \tag{53}$$

This equation can be evaluated numerically using a computer. Microsoft Excel may be employed for this purpose. To implement the integral in Excel, the following discretization method is suggested:

$$E_r(r,0) = k_e \frac{\lambda}{R} \sum_{i=1}^{N} \frac{a - \cos(\alpha_i)}{(1+a^2 - 2a\cos(\alpha_i))^{3/2}} \Delta\alpha_i \tag{54}$$

where

$$\alpha_i = \frac{\alpha_{n+1} + \alpha_n}{2} \tag{55a}$$

$$\Delta\alpha_i = (\alpha_{n+1} - \alpha_n) = \frac{\pi}{N} \tag{55b}$$

The accuracy of the calculated value increases with the number of steps N. For example, using N = 1000 yields a result closer to the exact value than N = 100. For the present calculation, we choose N = 200, giving $\Delta\alpha_i = (a_{n+1} - a_n)$ = 2π/200, $a_0 = 0$, $a_1 = 2\pi/200$, $a_2 = a_1 + 2\pi/200$, $a_3 = a_2 + 2\pi/200$, …, $a_{200} = a_{199} + 2\pi/200 = 2\pi$.

Function (43) depends on two variables: the angle α and the parameter $a = r/R$, over which the integration is performed. Excel was programmed to execute the necessary iterative calculations for a series of a values.

As presented in Table 1, the field values, expressed as $k_e\lambda/R$ in IS units, are given for various concentric circles with relative radii $a \in [0, 1[\cup]1, 4]$. The field in the plane of the ring diverges at $r/R = 1$, indicating a singularity.

Values in Table 1 can be interpreted as follows: for a circle with relative radius $r/R = 0.5$, the electric field vector is approximately :

$$\mathbf{E} \cong -2{,}167 \frac{k_e\lambda}{R} \mathbf{u}_r \tag{56}$$

The minus sign (−) in this expression indicates that the vector points in the opposite direction to the unit vector $\mathbf{u}_r$, since λ > 0. Outside the ring, the vector aligns with $\mathbf{u}_r$. On a given field line, the orientation of the electric field vector is opposite inside the ring and along the same direction outside it, see Zypman (2006).

Figure 4 shows the electric field as a function of the ratio r/R. The field vanishes at the center of the ring and diverges at $a = 1$, corresponding to a singular point at the ring's edge. As point P approaches this edge, the field tends to

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infinity, reflecting the behavior of the elliptic integrals in Eq. (53). Nevertheless, for a real conductor with finite volume, the field inside the ring would be zero, since the ring's surface is closed and any excess charge resides on the surface.

Table 1. In-plane Field of a Uniformly Charged Ring as a Function of Relative Radius.

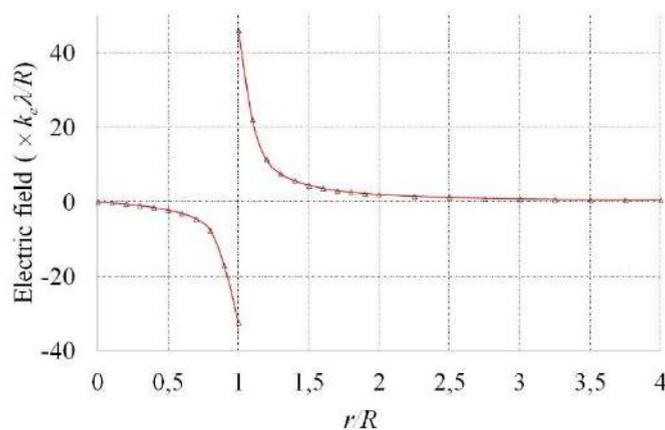| $a = r/R$	$E_r (\times k_e\lambda/R)$	$a = r/R$	$E_r (\times k_e\lambda/R)$
0	0,000	1,001	46,188
0,1	-0,318	1,1	22,005
0,2	-0,658	1,2	11,310
0,3	-1,048	1,3	7,551
0,4	-1,528	1,4	5,606
0,5	-2,167	1,5	4,410
0,6	-3,100	1,6	3,599
0,7	-4,641	1,7	3,015
0,8	-7,744	1,8	2,574
0,9	-17,184	1,9	2,231
0,999	-32,368	2	1,957
		2,25	1,47
		2,5	1,15
		2,75	0,92
		3	0,76
		3,25	0,64
		3,5	0,55
		3,75	0,47
		4	0,41

Figure 4. Electric field amplitude in the plane of a uniformly charged ring as a function of the relative radius $a=r/R$. The field vanishes at the center ($a=0$) and diverges as $a \to 1$.

Electric Field Along the Axis of the Ring

Due to the symmetry, only the axial component of the field remains. Therefore, Eq. (48) reduces to

$$\mathbf{E} = k_e \frac{Q}{2\pi R^2} \boldsymbol{u}_z \int_0^{2\pi} \frac{b}{\left(1 + a^2 + b^2 - 2a\cos\alpha\right)^{3/2}} d\alpha \qquad (57)$$

The field along the z axis of the ring corresponds to $\theta = 0$, as shown in Fig. 1, which places the point P on the z axis, i.e., $r = z$ and $b = z/R$. Since $P \in z$ axis, if $\theta = 0 \Rightarrow \cos(\theta) = 1$, we obtain $b = z/R = r/R$. In this case, the r coordinate coincides with z coordinate, and $\sin(\theta) = 0 \Rightarrow a = \rho/R = 0$. Under this condition, the electric field vector at point P, which lies on the z axis of the ring, can be calculated by integrating the contributions from each infinitesimal charge segment distributed around the ring. Therefore, Eq. (57) is further simplified to

$$\mathbf{E} = k_e \frac{Qz}{(R^2 + z^2)^{3/2}} \boldsymbol{u}_z \qquad (58)$$

Here, the coordinate z represents the distance from the center O of the ring to the point P on the z axis.

It should be noted that expression (58) can also be derived from the components (36a) and (36b) of the field vector (**Saâd**, **2025**). To obtain this result, one must substitute the parameters ρ, z, q and k with their corresponding values for $\theta = 0$: $\rho = 0$, $q = (R^2 + z^2)$ where $z \equiv r$, $k = 0$ into expressions (36a) and (36b). After simplification, the resulting expression exactly takes the form of (58).

It is worth mentioning that this special case is the one most frequently presented in textbooks and online resources on Electrostatics; hence, it is already familiar to many undergraduate students. However, when the point P is located at the center ($z = 0$), the electric field vanishes ($\mathbf{E} = \mathbf{0}$). In contrast, for $z \gg R$, expression (58) reduces to the following approximation:

$$\mathbf{E} = k_e \frac{Qz}{(R^2 + z^2)^{3/2}} \boldsymbol{u}_z \approx k_e \frac{Q}{z^2} \boldsymbol{u}_z = k_e \frac{Q}{r^2} \boldsymbol{u}_z \qquad (59)$$

If $z \gg r$, the uniformly charged ring of total charge Q behaves like a point charge located at the origin for points far from the ring. Now, consider placing a test charge q_t at the center of the ring and displacing it slightly by a distance $z \ll R$ along the z axis. The expression for the restoring force acting on q_t is given by

$$\mathbf{F} = q_t \mathbf{E} = k_e \frac{Q q_t z}{R^3} \boldsymbol{u}_z \qquad (60)$$

Accordingly, when the charge q_t is released, it undergoes small oscillations with a frequency

$$f = \frac{1}{2\pi} \sqrt{k_e \frac{q_t Q}{mR^3}} \qquad (61)$$

This restoring force has the same mathematical form as Hooke's law (**Serway & Jewett**, **2014**), analogous to the force exerted by a spring.

Conclusion

The electric field of a uniformly charged ring has been analyzed through symmetry arguments, Coulomb's law, and the gradient of the electrostatic potential. A preliminary symmetry-based assessment established the structure of the field: only radial and axial components are present, while the azimuthal component vanishes. This implicit characterization serves as a predictive guide for identifying the relevant field variables prior to explicit evaluation.

Direct computation with Coulomb's law leads to integral expressions involving elliptic functions. While these are suitable for numerical evaluation, further manipulation yields compact closed forms in terms of complete elliptic integrals of the first and second kind. By first determining the electrostatic potential, exact off-axis field expressions were derived in simplified form Eqs. (36a) and (36b), demonstrating the efficiency of the scalar-potential method in problems with high symmetry. The resulting formulas reduce to the well-known on-axis and far-field limits, providing a consistent validation of the approach.

In the plane of the ring, the axial component vanishes and the field becomes purely radial. Numerical results corroborate the theoretical predictions, reproducing the expected divergence at the ring's edge and correcting the common misconception that the field inside the ring is everywhere zero. The classical on-axis expression is recovered as a limiting case, further confirming the analysis. Beyond its pedagogical value—illustrating the interplay between electrostatics and higher transcendental functions—this framework offers practical utility. It can be readily extended, via superposition, to rings of finite thickness or non-uniform charge distribution, with applications across physics and engineering.

Acknowledgment

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The Influence of Religious Motivation, Family Environment, and Religious Education Learning on Character Development

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Abstract: Character development is a critical aspect of individual growth, shaped by various intrinsic and extrinsic factors. This study aims to examine the influence of religious motivation, family environment, and religious education on character development. The research is based on the premise that these three variables play a fundamental role in shaping students' ethical and moral values. Given the increasing challenges in fostering character development in the contemporary era, understanding the interaction between religious motivation, familial influence, and structured religious education is essential. This study employs a quantitative research approach, utilizing a structured questionnaire as the primary data collection instrument. Data were analyzed using IBM SPSS Statistics to assess the degree of influence exerted by each independent variable on character development. Through comprehensive and partial hypothesis testing, it was found that Ho was rejected and Ha was accepted. Therefore, the results of this study conclude that religious motivation, family environment, and religious education influence the character development of Bina Nusantara students in Tangerang and Jakarta. This research contributes to the ongoing academic discourse on character education and serves as a valuable reference for educational institutions and parents in collaboratively fostering students' character. The implications of this study highlight the necessity of an integrated approach, where educational institutions and families work in synergy to reinforce character development. These findings offer practical insights for policymakers, educators, and parents in designing strategies that enhance moral and ethical cultivation among students, ensuring a holistic educational experience that extends beyond the classroom.

Keywords: Religious Motivation, Family Environment, Education, Character Development

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Introduction

Character formation is a multidimensional process that encompasses cognitive, affective, and behavioral dimensions, which continuously develop throughout an individual's life. Character not only reflects the moral values a person upholds, but also serves as an indicator of integrity, honesty, empathy, responsibility, and respect for others (Lickona, 1991). The term "character" originates from the Greek word karasso, meaning "to mark" or "to engrave," emphasizing the application of moral values through concrete actions or behavior. Consequently, an individual who acts dishonestly, cruelly, or greedily is often regarded as having poor character, whereas a person who demonstrates honesty and helpfulness is perceived as having noble character. Character is closely associated with virtues, grounded in a belief in a higher moral law, and is ultimately judged as either good or bad (David F. Wells, 2005).

According to Berkowitz and Bier, character formation in higher education requires a systematic, comprehensive, and contextual approach. Character education cannot rely solely on the transmission of normative content; it must also engage students in active participation through reflective and applicative learning experiences. Value-based character education that is grounded in the actual life contexts of students has been proven effective in shaping resilient moral character (Berkowitz, M. W., & Bier, 2005).

Furthermore, Nucci, Narvaez, and Krettenauer assert that character develops within complex social and cultural contexts. Therefore, effective character education must take into account the social environments surrounding students, including family, academic settings, and religious communities (Nucci, L., Narvaez, D., & Krettenauer, 2014).

Religious motivation is one of the key factors in the development of religious and moral character. This motivation can be intrinsic—where individuals practice their faith based on personal conviction and commitment—or extrinsic, where religious adherence is driven by social pressure or perceived social benefits (Allport, G. W., & Ross, 1967). Religion serves as a guiding framework that governs all aspects of human life, directing individuals toward salvation. It becomes a foundational reference point in shaping one's personality through the internalization of spiritual values, theological beliefs, and religious practices, thereby fostering individuals who are devout and diligent in living out their faith. Obedience and adherence to religious values not only shape personal character but also contribute to the organization of one's lifestyle, enabling individuals to live in peace, order, and discipline. As social beings, humans require religion not only for spiritual fulfillment but also for physical well-being, as it offers guidance and foundational principles for achieving a life of peace and well-being (Fauzan, 2019).

In the context of higher education, strong religious motivation is associated with increased empathy, prosocial behavior, and a decreased tendency toward deviant behavior (Saroglou, 2011). Ryan also emphasize that intrinsic

religious motivation plays a significant role in the development of moral autonomy and emotional stability among university students (Ryan, R. M., Rigby, C. S., & King, 1993).

According to research by King and Boyatzis, students with strong religious motivation tend to exhibit higher levels of self-control and more tolerant social attitudes (King, P. E., & Boyatzis, 2015). The dimensions of religiosity as outlined by Glock and Stark—which include ideological, ritualistic, experiential, intellectual, and consequential dimensions—offer a comprehensive framework for understanding the influence of religious motivation on behavior and character formation (Glock, C. Y., & Stark, 1965).

The family environment serves as the primary and most fundamental setting for the socialization of values and the formation of character. The quality of interactions within the family, particularly between parents and children, plays a critical role in shaping the direction of an individual's personality and moral development (Jeje Haryono, 2018). The family is a central factor in character building and personality formation in children. Parents play a vital role in this process by introducing character education from an early age, guiding children to behave in accordance with prevailing social norms. Establishing effective two-way communication between parents and children is essential to fostering a harmonious relationship. Furthermore, in the digital era, it is increasingly important to instill religious values as a foundational guide for behavior (Cony Khoirina, 2022).

We can understand the critical importance of a supportive family environment in the character formation of university students. Emotional attachment within the family is closely linked to the internalization of religious and moral values during young adulthood.

Religious education plays a central role in character formation, particularly in instilling spiritual values, ethics, and morality. At the higher education level, religious education must be able to respond to contemporary challenges through a transformative and contextual pedagogical approach (Muhammad Aufa Muis, 2024).

According to a study conducted by Biesta, effective religious education not only focuses on the transfer of knowledge but also on the formation of moral identity and the reflective abilities of students (Biesta, 2015). An integrative and dialogical religious education curriculum has been shown to strengthen value orientation and deepen students' spiritual experiences (Indah Nur Bella Sari, 2024).

The importance of a learning methodology that involves critical reflection and personal experience as an effective means to strengthen the understanding and internalization of religious values is evident. This aligns with the experiential learning approach, which encourages students to internalize religious teachings within the context of real-life experiences (Anwar, 2023).

At Bina Nusantara University (BINUS), the Religion course is uniquely structured to be inclusive of students from all religious backgrounds. Rather than focusing on the doctrines of a single religion, this course emphasizes universal religious values that are shared across faiths. These include values such as compassion, honesty, responsibility, respect, peace, integrity, and empathy—principles that are essential not only for spiritual life but also for the holistic

development of character. The objective of this course is to foster a deeper understanding of how religion contributes to personal ethics and social harmony in a pluralistic society. By engaging in discussions, reflections, and collaborative projects, students are encouraged to appreciate religious diversity while finding common ground in shared human values. The course serves as a platform for interreligious dialogue, promoting tolerance, mutual respect, and unity among students from different belief systems. Furthermore, the Religion course at BINUS plays a significant role in character education. It helps students connect ethical teachings from various religions to real-life situations, thereby guiding them in making moral decisions and acting with integrity in both personal and professional contexts. In this way, religious education is not limited to spiritual insight, but becomes a practical tool for shaping responsible and ethical future leaders (Bina Nusantara University, 2022).

The three variables in this study—religious motivation, family environment, and religious education—work synergistically to support the character formation of university students. Research conducted by Hardy found that the integration of family values, religious beliefs, and religious learning experiences in higher education significantly contributes to the development of moral and religious character in students (Hardy, S. A., Dollahite, D. C., Johnson, N., & Call, 2010). Furthermore, empirical studies by Hill and Pargament highlight that the combination of high religious motivation, family support, and quality religious education acts as a protective factor against deviant behavior and strengthens students' moral resilience in the face of social pressures (Hill, P. C., & Pargament, 2002).

Research Methods and Hypothesis

Research Methods

This research employs quantitative methods with a descriptive approach, utilizing a Multiple linear Regression Test. The goal of this approach is to outline the current phenomena or issues by examining numerical or statistical data (R. Kurniawan, 2016). Jan Malte asserts that simple regression models are particularly useful for making predictions within the regression context, especially when contrasted with more intricate statistical models applied to large and diverse real-world datasets. Regression analysis is a statistical method used to determine the strength of the relationship between four variables. In this analysis, the variables that exert influence are known as independent variables, whereas those that are influenced are termed dependent variables. Multiple linear regression method is used to explore how the Religious Motivation, Family Environment, and Religious Education Learning affects the Character Development.

The data utilized in this research is primary data, meaning it is gathered firsthand by the researchers from the original source. This type of data is also known as original or current data. To gather this primary data, researchers distribute questionnaires directly to students in the classroom. The data is then processed and analyzed using IBM SPSS Statistics.

Hypothesis

H_o1 = Religious Motivation has no a significant influence on Character Development

H_a1 = Religious Motivation has a significant influence on Character Development

H$_o$2 = Family Environment has no a significant influence on Character Development

H$_a$2 = Family Environment has a significant influence on Character Development

H$_o$3 = Religious Education Learning has no a significant influence on Character Development

H$_a$3 = Religious Education Learning has a significant influence on Character Development

H$_o$4 = Religious Motivation, Family Environment, Religious Education Learning have no significant influence on Character Development

H$_a$4 = Religious Motivation, Family Environment, Religious Education Learning have no significant influence on Character Development

Population and Sample

A total of 253 students participated in completing the questionnaire for this study. These respondents were drawn from the population of students enrolled in the CB Religion class at Bina Nusantara University, located in Tangerang, Jakarta. The selection of this particular group of students was based on their relevance to the research topic, providing a targeted sample from the broader academic community at the university. The data collected from these students will offer valuable insights into the subject matter being investigated, reflecting the perspectives and experiences of those engaged in religious studies at this institution.

Results

Validity Test

The results of the validity test indicate that all statement items have a calculated r value greater than the r table value or a significance level (sig) less than 0.05, thus it can be concluded that all statement items are valid.

Table 1. Validity test results

Variable	Indicator	r Calculate	r Table	Sig.	Sig. Level	Description
X1	X1.1	0,668	0,1036	0,000	0,05	Valid
	X1.2	0,663	0,1036	0,000	0,05	Valid
	X1.3	0,713	0,1036	0,000	0,05	Valid
	X1.4	0,705	0,1036	0,000	0,05	Valid
	X1.5	0,747	0,1036	0,000	0,05	Valid
X2	X2.1	0,590	0,1036	0,000	0,05	Valid
	X2.2	0,723	0,1036	0,000	0,05	Valid
	X2.3	0,744	0,1036	0,000	0,05	Valid
	X2.4	0,833	0,1036	0,000	0,05	Valid
	X2.5	0,757	0,1036	0,000	0,05	Valid
X3	X3.1	0,860	0,1036	0,000	0,05	Valid
	X3.2	0,827	0,1036	0,000	0,05	Valid
	X3.3	0,826	0,1036	0,000	0,05	Valid
	X3.4	0,853	0,1036	0,000	0,05	Valid
	X3.5	0,850	0,1036	0,000	0,05	Valid
Y	Y1	0,719	0,1036	0,000	0,05	Valid

Y2	0,710	0,1036	0,000	0,05	Valid
Y3	0,768	0,1036	0,000	0,05	Valid
Y4	0,685	0,1036	0,000	0,05	Valid
Y5	0,758	0,1036	0,000	0,05	Valid

Reliability Test

The results of the reliability test show that all variables have a Cronbach's Alpha value greater than 0.60, indicating that all variables are reliable.

Table 2. Reliability Test Result

Variable	Cronbach's Alpha	Standard	Description
X1	0,705	0,60	Reliable
X2	0,762	0,60	Reliable
X3	0,897	0,60	Reliable
Y	0,757	0,60	Reliable

Normality Test

The results of the Kolmogorov-Smirnov normality test show a significance value of 0.200, which is greater than 0.05, indicating that the data are normally distributed.

Table 3. Normality Test Result

One-Sample Kolmogorov-Smirnov Test

		Unstandardized Residual
N		253
Normal Parameters[a,b]	Mean	.0000000
	Std. Deviation	182.491.713
Most Extreme Differences	Absolute	.051
	Positive	.027
	Negative	-.051
Test Statistic		.051
Asymp. Sig. (2-tailed)		.200[c,d]

Multicollinearity Test

The results of the multicollinearity test show that all variables have tolerance values greater than 0.10 or VIF values less than 10, indicating the absence of multicollinearity symptoms or that the data pass the multicollinearity test.

Table 4. Multicollinearity Test Result

Coefficientsᵃ

Model		Collinearity Statistics	
		Tolerance	VIF
1	X1	.700	1.429
	X2	.662	1.510
	X3	.718	1.393
a. Dependent Variable: Y			

Heteroscedasticity Test

The results of the heteroscedasticity test show that all variables have significance values greater than 0.05, indicating the absence of heteroscedasticity symptoms or that the data pass the heteroscedasticity test.

Table 5. Heteroscedasticity Test Result

Coefficientsᵃ

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.188	.691		4.617	.000
	X1	-.068	.033	-.150	-2.034	.053
	X2	.035	.033	.082	1.084	.279
	X3	-.051	.025	-.148	-2.025	.054
a. Dependent Variable: ABS_RES						

Multiple Linear Regression Equation

Table 6. Multiple Linear Regression

Coefficientsᵃ

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.824	1.171		4.974	.000
	X1	.359	.056	.362	6.387	.000
	X2	.189	.055	.200	3.432	.001
	X3	.197	.043	.257	4.602	.000
a. Dependent Variable: Y						

The linear regression model is expressed as: Y= 0.824 + 0,359 X1 + 0,189 X2 + 0,197 X3

The value of the constant coefficient is 0.824 and is positive, which indicates that with the presence of the independent variables X1, X2, and X3, the dependent variable Y will increase by 82.4%. The beta coefficient value for variable X1 is 0.359, meaning that if other variables remain constant and X1 increases by 1%, variable Y will increase by

35.9%, and vice versa. The beta coefficient value for variable X2 is 0.189, which means that if other variables remain constant and X2 increases by 1%, variable Y will increase by 18.8%, and vice versa. Finally, the beta coefficient value for variable X3 is 0.197, indicating that if other variables remain constant and X3 increases by 1%, variable Y will increase by 19.7%, and vice versa.

Hypothesis Test

R2 Determination Coefficient Test

The Adjusted R Square value is 0.440 or 44%. This coefficient of determination indicates that variables X1, X2, and X3 collectively explain 44% of the variance in variable Y, while the remaining 56% is explained by other variables not included in the model.

Table 7. Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.664[a]	.440	.434	1.836

a. Predictors: (Constant), X3, X1, X2

b. Dependent Variable: Y

F-Test

Table 8. F Test Result

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	660.656	3	220.219	65.338	.000[b]
	Residual	839.241	249	3.370		
	Total	1.499.897	252			

ANOVA[a]

The calculated F value is 65.338, which is greater than the F table value of 2.640, and the significance value is 0.000, which is less than 0.05. Therefore, the null hypothesis (H₀) is rejected and the alternative hypothesis (Hₐ) is accepted, indicating that variables X1, X2, and X3 have a significant effect on variable Y.

T-Test

Table 9. T-Test Result

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	824	1.171		4.974	.000
	X1	.359	.056	.362	6.387	.000
	X2	.189	.055	.200	3.432	.001
	X3	.197	.043	.257	4.602	.000

The partial influence of the independent variables on the dependent variable is as follows: First, the t-value for variable X1 is 6.387, which is greater than the t-table value of 1.969, with a significance value of 0.000 (< 0.05). Therefore, H_{01} is rejected and H_{a1} is accepted. Second, the t-value for variable X2 is 3.432, which is greater than the t-table value of 1.969, with a significance value of 0.001 (< 0.05). Thus, H_{02} is rejected and H_{a2} is accepted. Third, the t-value for variable X3 is 4.602, which is greater than the t-table value of 1.969, with a significance value of 0.000 (< 0.05). Consequently, H_{03} is rejected and H_{a3} is accepted.

Discussion

The findings of this study indicate that religious motivation, family environment, and religious education learning—both simultaneously and partially—have a significant influence on the character development of BINUS University students. These findings are consistent with previous studies and reinforce the theoretical foundations underpinning them.

First, religious motivation has been proven to be a powerful internal factor in shaping student character. In line with the theories proposed by Ryan et al. (1993) and King & Boyatzis, students with intrinsic religious motivation tend to possess moral autonomy, high levels of empathy, and strong self-control. This finding suggests that the internalization of religious values encourages students to behave in accordance with moral principles, regardless of social pressure or external circumstances.

Second, the family environment significantly influences character formation. This aligns with the assertions of Nucci, Narvaez, and Krettenauer, who emphasize that social context—including the family—is a crucial element in moral and character development. Students from supportive, communicative, and religious families are more likely to internalize ethical and moral values from an early age.

Third, the religious education program at BINUS, which emphasizes universal, interfaith values, has been shown to provide students with reflective and practical spaces to apply religious teachings in real life. This approach resonates with Biesta's perspective and the experiential learning model, wherein religious education is not merely the transmission of knowledge but also the formation of moral identity.

Together, these three factors, religious motivation, family environment, and religious education—complement each other and create an effective synergy in shaping resilient, empathetic, tolerant, and responsible student character. In

the pluralistic and modern context of BINUS University, the integration of these three aspects is increasingly relevant and essential.

Conclusion

Based on both simultaneous and partial hypothesis testing, this study concludes that religious motivation, family environment, and religious education significantly influence the character development of Bina Nusantara (BINUS) University students in Tangerang and Jakarta. The adjusted R^2 value of 0.440 indicates that these three variables together explain 44% of the variance in student character formation. Meanwhile, the remaining 56% is influenced by other variables not examined in this study, such as peer interactions, campus culture, media exposure, or personal life experiences. This finding reinforces the importance of internal (religious motivation), social (family environment), and institutional (religious education) factors in shaping students' moral and spiritual identity. At the same time, it also suggests the need for a broader investigation into additional contributing factors in future research to fully understand the complexity of character development in higher education settings.

Recommendations

Based on the findings and discussions presented above, the following theoretical and practical recommendations are proposed: First, Integration of Contextual and Reflective Religious Education, referring to Biesta's theory and the experiential learning approach, religious education should continue to be developed through reflective and contextual pedagogies. BINUS University could expand its interfaith dialogue practices, modern ethical case studies, and collaborative interreligious projects to help students internalize spiritual values in their daily lives. Second, enhancement of family-based character development programs. In line with Nucci et al.'s theoretical framework and the findings of this study, the university may collaborate with parents/guardians through parenting seminars, online discussions, and family-values campaigns. These initiatives aim to strengthen parental awareness of their ongoing role in character formation, even at the university level. Third, holistic strengthening of student spirituality. Aligned with Glock & Stark's model and the research of King & Boyatzis, the university can facilitate the development of intrinsically motivated religious programs, such as interfaith spiritual communities, moral retreats, character mentoring, and mindfulness training. These efforts aim to reinforce the ideological and experiential dimensions of students' spirituality as the foundation for character building. fourth, curriculum development that embeds character values. It is important for the university to review its curriculum across all subjects—not limited to religious studies— to ensure that character values such as integrity, responsibility, and empathy are embedded across disciplines. This reflects the systemic and comprehensive approach to character education emphasized by Berkowitz & Bier.

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viewform?usp=sharing&ouid=106993880888497321751

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- Formulating the research problem and objectives.

- Developing the theoretical framework and conducting the literature review.

- Determining the quantitative method to be used in the research, including designing the questionnaire.

- Overseeing data collection from Bina Nusantara University student respondents.

- Analyzing the data using IBM SPSS and compiling the analysis results for the final report.

- Systematically collecting and summarizing the questionnaire results.

- Entering data into the IBM SPSS application for analysis.

- Assisting in data processing by conducting the required statistical tests.

- Preparing tables, charts, and data visualizations based on the SPSS results.

- Writing the introduction, literature review, methodology, and main discussion sections.

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- Reviewing the findings and linking them to existing literature.

- Writing the discussion section of the research findings, especially on the influence of religious motivation, family, and religious education on character development.

- Responsible for drawing conclusions and formulating recommendations from the research.

- Editing and proofreading the entire research document to ensure consistency in content, language style, and structure.

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The Influence of Clergy's Financial Well-Being on the Quality of Church Ministry

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Abstract: In the corporate and industrial sectors, financial well-being is widely recognized as a significant determinant of employee performance, compelling management to ensure appropriate financial support and improvement. However, the context differs in churches as nonprofit and spiritual institutions, where clergy serve based on their divine calling rather than financial incentives. This study employs a quantitative research methodology using IBM SPSS Statistics to examine whether financial well-being influences the quality of clergy service in the church. By analyzing empirical data, this research seeks to determine the extent to which financial security impacts ministerial effectiveness, despite the intrinsic motivation that drives religious service. The results of this study indicate that clergy financial well-being has a positive and significant influence of 42.2% on the quality of church ministry, while the remaining 57.8% is influenced by other factors. The findings of this study will provide valuable insights for future research and contribute to church human resource management by offering considerations for enhancing the quality of ecclesiastical service. This research underscores the importance of a balanced approach that acknowledges both spiritual devotion and practical financial support in sustaining high-quality pastoral ministry.

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Introduction

Financial well-being is a condition in which an individual feels secure and sufficient in managing their personal finances, both in the short term and the long term. According to Joo, financial well-being is an essential component of overall psychological well-being and comprises both objective aspects (e.g., income, savings, debt burden) and subjective aspects (such as feelings of financial security and satisfaction with one's financial situation) (Joo, 2008).

Research conducted by Zaid indicates that financial factors—including salary, benefits, and incentives—play a significant role in influencing employee performance (M Zaid Abdurrakhman, 2019). A decent salary is crucial in enhancing worker productivity. When employees receive sufficient compensation to meet their own and their families' basic needs, they tend to feel more at ease and less burdened by financial concerns, allowing them to focus and perform their tasks more effectively. Moreover, a fair salary that is commensurate with similar types of work fosters a sense of satisfaction and appreciation, which in turn motivates employees to work more diligently, accurately, and responsibly. On the other hand, providing appropriate compensation also helps organizations maintain harmonious labor relations by reducing the potential for conflict arising from dissatisfaction with the wage system.

In the context of clergy, financial well-being possesses a unique dimension, as their ministerial duties are often driven by devotion rather than commercial interests. The church, as a non-profit institution, is not profit-oriented but rather serves the interests of the community and does not seek material gain. Its income is primarily derived from donations rather than profits. The church aims to provide benefits to society, not to pursue financial profit (Dyah N.A. Janie, n.d.). As a non-profit organization, the church focuses on creating social value and delivering services, rather than generating financial returns. While this approach fosters a work environment grounded in dedication to service, it also leads to limited attention being given to the financial well-being of clergy. Moreover, various challenges—such as dependence on key stakeholders, high public expectations, and limited commitment from volunteers and workers— further exacerbate the clergy's welfare conditions. Therefore, the church must adopt an adaptive and sustainable strategic management approach to effectively address the holistic needs of its clergy and to support their well-being in a more optimal manner (Kgaugelo Sammy Boya, 2022).

Ecclesiastical ministry refers to activities carried out by clergy to guide, nurture, and serve the spiritual needs of the congregation. The quality of church ministry is not solely measured by liturgical routines, but also by the extent to which it has spiritual, emotional, and social impact on the lives of the believers. Church ministry is broad and complex. Gidion explains that the quality of ecclesiastical ministry can be enhanced through several aspects, such as a service structure oriented toward the needs of the congregation, the effective deployment of human resources, an understanding of the importance of church management, servant leadership, the empowerment of congregants to become ministers themselves, and the effective use of small groups (cells) as a space for mutual service and spiritual growt (Gidion, 2017).

A church minister must possess the ability to translate both theological and practical knowledge, as well as the skills required for effective service, in order to enhance the quality and scope of church stewardship. Church workers must also be capable of responding to and resolving challenges within ecclesiastical ministry, as well as of guiding or influencing individuals toward the achievement of shared objectives. Furthermore, they should be adept at establishing and nurturing both internal and external relationships that support the church's ministry (Welikinsi, 2020).

Thus, it can be concluded that a successful church minister is one who works diligently and perseveres even when results are not yet visible, relying on God's command to serve. Such a minister focuses on cultivating the purity and spiritual growth of the congregation, rather than merely pursuing numerical growth. They possess a sincere and unwavering spirit, unaffected by failure or reluctance to serve. Moreover, they demonstrate balanced attention in training and nurturing all members of the congregation (Charles A. Stillman, 2003).

This research is relevant to the context of church clergy, as they often serve under significant economic constraints. Within a theological framework, the quality of ministry is not solely determined by preaching skills or theological competence, but also by the minister's ability to be a role model and a shepherd who is fully present in the lives of the congregation. Such holistic presence is unlikely to be realized if the minister is constantly struggling with financial hardship.

The quality of ministry is highly dependent on the personal condition of the minister, including life satisfaction, social support, and available spiritual resources. Meaningful ministry arises from church leaders who are emotionally stable and financially secure, as they are better equipped to empathize, listen, and be authentically present in the lives of their congregation (Grant R. Bickerton, Maureen H. Miner, Martin Dowson, 2015). In general, workplace spirituality plays a significant role in enhancing the quality of ministry (I Ketut Setia Sapta, Ni Wayan Rustiarini, 2021).

Alsemgeest conducted research on the relationship between financial well-being and job satisfaction among pastors in South Africa. He found that financial instability has a direct impact on work-related stress and burnout, and can diminish ministry effectiveness. Financial well-being significantly influences job satisfaction and mental health among near-retirement pastors (Alsemgeest, 2019). Blea also discovered that financial pressure can lead to feelings of shame, emotional stress, and even spiritual struggles among young clergy, particularly seminary students. The interplay of financial stress, shame, and mental health in seminary students highlights a significant vulnerability in future clergy (Blea, J. E., 2021). Thus, financial well-being is not merely a matter of material needs but serves as a foundation for building spiritual, emotional, and social resilience in a church minister. Furthermore, Makalew and Pangemanan state that financial accountability and pastoral spirituality have a direct influence on ministry outcomes. When clergy feel trusted in financial management and receive both moral and financial support, they tend to demonstrate higher work enthusiasm and more impactful ministry (Makalew, M. M., & Pangemanan, 2025). Park, in his study conducted in South Korea, found that church leaders who are financially satisfied exhibit higher levels of job satisfaction, which directly affects the sincerity and dedication of their ministry. Financial satisfaction predicts overall job satisfaction among church leaders (Park, D., Kim, C., & Paeng, 2022).

Similarly, Mudge highlights that financial instability is one of the primary causes of clergy turnover, spiritual

exhaustion, and the decline in ministry quality. In the context of long-term ministry, financial well-being serves as a foundation for cultivating faithfulness and consistency in service (Mudge, 2021).

These various studies demonstrate a positive correlation between financial well-being and the quality of ministry within the context of spiritual leadership. Clergy who experience economic stability tend to be more focused on their ministerial duties, as they are free from external pressures such as debt, unmet household needs, or uncertainty about the future.

Based on the aforementioned theories and empirical findings, it can be concluded that financial well-being has the potential to influence the quality of church ministry, both directly and indirectly. The research area was chosen because churches in the Greater Jakarta (Jabodetabek) region represent a diverse and dynamic context in which clergy face both spiritual responsibilities and practical financial challenges. As an urban area with churches of varying sizes and economic conditions, Jabodetabek provides a relevant setting for exploring how financial well-being impacts the quality of ministry across different church environments.

Research Methods and Hypotheses

Research Methods

This study utilizes quantitative methods with a descriptive approach through a Simple Regression Test. The aim of this quantitative method is to describe existing phenomena or symptoms by analyzing numerical or statistical data (S. Arikunto, 2002). According to Jan Malte, simple regression models are effective in making predictions within a regression framework, especially when compared to more complex statistical models on large and varied real-world data sets. Regression analysis is a statistical technique used to assess the strength of the relationship between two variables. In regression analysis, the influencing variables are referred to as independent variables, while the affected variables are called dependent variables (R. Kurniawan, 2016). A simple linear regression technique is applied to examine the impact of the financial well-being of clergy on the quality of church ministry.

The data used in this study is primary data, which is information collected directly by researchers from the original source. This data is also referred to as original or up-to-date data. To collect primary data, researchers distribute questionnaires directly to students in the classroom. Data processing and analysis are carried out using IBM SPSS Statistics.

Hypothesis

H_o = The Clergy's Financial Well-Being has no a significant influence on the Quality of Church Ministry. H_a = The Clergy's Financial Well-Being has a significant influence on the Quality of Church Ministry.

Population and Sample

The respondent population consists of God's servants, church pastors, ministers, and clergy from churches scattered

across the Greater Jakarta area (Jabodetabek), with various denominations and synods, totaling 52 respondents.

Results

Data Normality Test

The purpose of the normality test is to determine whether the residuals in the regression model are normally distributed. Using the Kolmogorov-Smirnov method, the test produced an Asymp. Sig. value of 0.170. Since the probability value exceeds 0.05, it indicates that the residuals follow a normal distribution.

Table 1. Kolmogorov-Smirnov Test

		Unstandardized Residual
N		52
Normal Parametersa,b	Mean	.0000000
	Std. Deviation	4.62962483
Most Extreme Differences	Absolute	.110
	Positive	.056
	Negative	-.110
Test Statistic		.110
Asymp. Sig. (2-tailed)		.170c

a. Test distribution is Normal.
b. Calculated from data.
c. Lilliefors Significance Correction.

Heteroscedasticity Test (Spearman's Rho)

If the Sig. (2-tailed) value is greater than 0.05, it can be concluded that there is no indication of heteroscedasticity. If the Sig. (2-tailed) value is less than 0.05, it indicates the presence of heteroscedasticity. SPSS Output Analysis, Sig. (2-tailed) value for X: 0.872 (> 0.05), which means there is no indication of heteroscedasticity.

Table 2. Heteroscedasticity Test

			Clergy's Financial Well-Being	Unstandardized Residual
Spearman's rho	Clergy's Financial Well-Being	Correlation Coefficient	1.000	-.023
		Sig. (2-tailed)	.	.872
		N	52	52
	Unstandardized Residual	Correlation Coefficient	-.023	1.000
		Sig. (2-tailed)	.872	.
		N	52	52

Linear Regression Equation Model

The linear regression model is expressed as: Y = 21,799 (α) + 0,520 (X) + e

The linear regression model indicates that the constant (α) is 21.799, which implies that if the financial well-being of

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clergy remains unchanged, the quality of church services is predicted to be 21.799. Furthermore, the regression coefficient (β) for the financial well-being variable is 0.520, showing a positive relationship. This means that for every one-unit increase in the financial well-being of clergy, the quality of church services is expected to increase by 0.520 units, assuming other factors remain constant.

Table 3. Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	21.799	3.275		6.656	.000
	Clergy's Financial Well-Being	.520	.086	.650	6.048	.000

a. Dependent Variable: Quality of Church Ministry

Hypothesis (t-Test)

Based on the hypothesis testing results, the significance value is 0.000, which is less than 0.05, and the t-calculated value is greater than the t-table value (6.048 > 1.67469). This indicates that the financial well-being of clergy has a positive and significant effect on the quality of church services. In other words, the higher the level of financial well-being of clergy, the better the quality of church services will be.

Table 4. Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
1 (Constant)	21.799	3.275		6.656	.000
Clergy's Financial Well-Being	.520	.086	.650	6.048	.000

a. Dependent Variable: Quality of Church Ministry

Based on the R Square value of 0.422, it can be concluded that the financial well-being of clergy influences the quality of church services by 42.2%, while the remaining 57.8% is influenced by other factors not included in the model.

Table 5. Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.650[a]	.422	.411	4.676

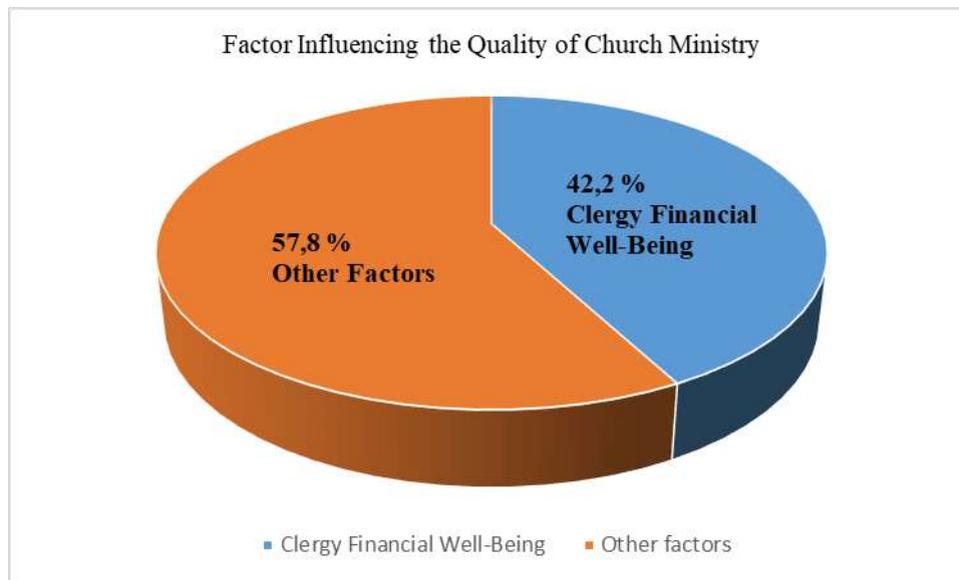a. Predictors: (Constant), Clergy's Financial Well-Being

Figure 1. Pie Chart of Factors Influencing the Quality of Church Ministry

Discussion

This study reveals that the financial well-being of clergy has a positive and significant influence of 42.2% on the quality of church ministry, while the remaining 57.8% is influenced by other factors. These findings reinforce the assumption that although spiritual ministry is primarily driven by a divine calling, financial aspects still play a crucial role in supporting the effectiveness and sustainability of church services.

The results are consistent with previous research, such as that conducted by Alsemgeest (2020), which demonstrated that financial instability directly affects work-related stress, job satisfaction, and burnout among pastors in South Africa. Mudge (2021) further noted that economic pressure is one of the main causes of spiritual exhaustion and reduced quality of ministry. In this context, Blea (2019) also highlighted the importance of economic stability for seminary students as future ministers, as financial pressure can lead to shame, emotional distress, and spiritual crises.

Theoretically, this study supports Joo's (2008) assertion that financial well-being is an integral part of psychological well-being, which ultimately influences individual performance. In the context of clergy, both objective aspects such as income and debt burden, and subjective aspects such as financial security and satisfaction with one's economic condition, contribute to the readiness and sincerity in ministry.

The diverse church environment in the Jabodetabek region ranging from small churches with limited funding to large churches with professional management systems also illustrates that economic factors are a critical dimension in the management of church human resources. While churches, as non-profit institutions, are not profit-oriented, quality ministry requires strategic approaches that include meeting the basic needs of church workers, including financial well-being.

Thus, these findings convey an important message: excellent church ministry is not only shaped by spiritual and theological quality but is also supported by practical factors including adequate financial well-being.

Conclusion

Through hypothesis testing, the study concluded that the null hypothesis (Ho) was rejected while the alternative hypothesis (Ha) was accepted. This indicates that there is a statistically significant relationship between clergy financial well-being and the quality of church ministry. The findings reveal that financial well-being of clergy contributes positively and significantly to 42.2% of the variance in church ministry quality, suggesting that nearly half of the effectiveness in ministry can be explained by the financial stability and support of church leaders. The remaining 57.8% is attributed to other variables not examined in this study, which could include factors such as leadership style, congregational engagement, spiritual maturity, organizational structure, and community support.

These findings offer meaningful implications for both academic research and practical application within the field of church management and pastoral care. For future researchers, this study opens avenues for exploring additional factors influencing ministry effectiveness and encourages more comprehensive models of analysis. From a practical standpoint, the study contributes to the discourse on human resource development within ecclesiastical institutions by emphasizing the necessity of financial well-being as a foundational element of sustainable and impactful ministry.

Ultimately, this research highlights the importance of a holistic and balanced approach to pastoral leadership one that integrates spiritual commitment with adequate financial support. It reinforces the idea that while spiritual devotion remains central to ministry, practical considerations such as financial security must not be overlooked if churches are to maintain and enhance the quality of their services and the well-being of their leaders.

Recommendations

The findings of this study indicate that churches must balance both spiritual and managerial approaches in managing their human resources, particularly clergy. Adequate financial support functions not merely as a means of meeting material needs but also as a reinforcement of the spiritual, emotional, and psychological capacity of ministers in serving the congregation.

Referring to the findings of Zaid, Park, and Makalew & Pangemanan, churches are encouraged to develop a compensation and benefits system that is fair, transparent, and proportional to the burden of ministry. Such policies serve not only as a form of appreciation but also as a long-term investment in improving the quality of church ministry.

Financial well-being should be understood as part of the church's pastoral responsibility towards its ministers—not solely a matter of material welfare, but also as a strategy for building the spiritual and psychological resilience of clergy. Churches in urban areas such as Greater Jakarta (Jabodetabek) are advised to implement locally responsive compensation policies, taking into account urban living costs and the complexity of ministerial duties.

Furthermore, churches should develop financial mentoring programs for clergy, particularly for younger ministers, to equip them with financial literacy skills and the ability to manage personal finances wisely and responsibly.

Lastly, it is essential to establish a healthy system of accountability and foster an organizational culture in the church that does not marginalize financial issues, but instead views them as an integral part of ethical pastoral practice and sustainable ministry. Addressing financial matters openly and responsibly can support the long-term effectiveness of authentic and impactful church leadership.

This study is limited in terms of geographical scope and methodological approach. Conducted only in the Greater Jakarta (Jabodetabek) area and using a quantitative method, the research was not able to fully capture the emotional and spiritual dimensions experienced by clergy.

Therefore, future studies are encouraged to adopt a qualitative or mixed-methods approach to gain deeper insights into the subjective experiences of clergy, particularly in coping with financial stress and its impact on motivation, integrity, and authenticity in ministry. Additionally, expanding the geographical scope of future research would offer a more comprehensive understanding of clergy financial well-being in various cultural and social contexts.

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Our research data can be found at the following link:

https://docs.google.com/forms/d/e/1FAIpQLScgXl0qCPPNk57z_6d-ydIGJuDlhh2nUOcM1Y8YDEsM57grhQ/viewform?usp=sharing&ouid=106993880888497321751

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   • **Main Role:** Responsible for the overall research process, from planning to publication.

   • **Duties:**

- Formulating the research problem and objectives.
- Developing the theoretical framework and literature review.
- Determining the quantitative method to be used in the study, including questionnaire design.
- Overseeing data collection from Bina Nusantara University student respondents.
- Analyzing data using IBM SPSS and preparing the results for the final report.
- Systematically compiling and summarizing the questionnaire results.
- Entering data into IBM SPSS for analysis.
- Assisting in data processing by running the required statistical tests.
- Creating tables, charts, and data visualizations based on SPSS results.
- Writing the introduction, literature review, methodology, and main discussion sections.
- Coordinating with other team members to ensure the smooth progress of the research process.

2. **Second to Fifth Authors (Collaborative Analysts and Editors)**

   • **Main Role:** Serve as supporting analysts and editors of the research report.

• **Duties:**

- Assisting in analyzing the research results, particularly interpreting the obtained quantitative data.

- Reviewing the findings and relating them to the existing literature.

- Writing the discussion section of the findings.

- Responsible for drawing conclusions and making recommendations based on the study.

- Editing and proofreading the entire research document to ensure consistency in content, language style, and structure.

- Managing formatting and publication in accordance with the standards required by journals or academic institutions.

Ball Distribution Strategies and Their Impact on Match Outcomes in The Mitsubishi Electric Cup 2024

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Abstract: Southeast Asian football has grown significantly in recent decades, with regional teams enhancing their tactical sophistication and competitive performance. The Mitsubishi Electric Cup 2024 was a key tournament to assess the impact of passing accuracy and crossing efficiency on team success. This study analysed the relationship between passing accuracy, total accurate passes, and crossing efficiency in determining team rankings and goal-scoring opportunities. A quantitative research design was employed, utilising correlation analysis, multiple linear regression, and Principal Component Analysis (PCA). The dataset included match statistics from all participating teams, with key performance indicators such as Accurate Passes, Pass Success Percentage, and Accurate Crosses examined. Results indicated a strong positive correlation between Accurate Passes and Pass Success Percentage ($r = 0.743$), highlighting the importance of structured ball control. Regression analysis further confirmed that Accurate Passes ($\beta = -0.0020$, $p = 0.020$) significantly influenced team ranking, while Pass Success Percentage ($\beta = -0.1328$, $p = 0.052$) was a near-significant predictor. Conversely, Accurate Crosses ($\beta = -0.0283$, $p = 0.346$) had a limited impact on overall rankings. PCA identified possession-based play as the dominant tactical factor (80.9% variance explained), with crossing-based strategies playing a secondary role (14.3%). Findings suggest that ASEAN teams should prioritise structured passing sequences, ball retention, and controlled possession over excessive reliance on crossing. Tactical recommendations include refining passing drills, improving positional play, and integrating crossing within a broader offensive framework. Future research should explore advanced predictive models and defensive adaptations to optimise ASEAN football strategies.

Keywords: Football, Passing Accuracy, Crossing Efficiency, Match Outcomes, Ball Possession Strategies.

Introduction

Southeast Asian football has experienced significant growth over the past few decades, with regional teams making remarkable progress in both domestic and international competitions. The ASEAN Football Federation (AFF) has played a crucial role in fostering football development across the region, organizing tournaments, and providing a competitive platform for national teams. Countries such as Thailand, Vietnam, and Indonesia have established themselves as dominant forces in ASEAN football, consistently performing well in regional tournaments and making strides on the international stage.

A blend of technical skill, quick attacking transitions, and an increasing emphasis on tactical discipline characterises football in ASEAN countries. While teams in the region historically relied on individual brilliance and attacking flair, modern ASEAN football has evolved to incorporate structured defensive play and more sophisticated tactical approaches. The rise of professional football leagues, such as Thailand's Thai League 1, Indonesia's Liga 1, and Vietnam's V.League 1, has significantly contributed to improving football infrastructure, player development, and coaching standards. These leagues provide a steady pipeline of talented players who transition into national team setups, enhancing the overall quality of competition in the region.

Moreover, ASEAN teams have become more competitive in Asian-level tournaments, with nations such as Vietnam and Thailand making notable appearances in the AFC Asian Cup and even advancing to later stages. Vietnam's impressive performance in the 2018 AFC Asian Cup, where they reached the quarter-finals, and Thailand's consistent showings in the competition have demonstrated that ASEAN teams can challenge traditionally stronger Asian nations. However, despite these achievements, ASEAN football still faces challenges such as inconsistency in performance, limited financial resources, and the need for further advancements in youth development and infrastructure. The Mitsubishi Electric Cup 2024 was one of Southeast Asia's most anticipated football events, featuring fierce rivalries, high-stakes matches, and emerging footballing talents. The competition maintained its round-robin group stage, followed by knockout rounds, ensuring that teams had ample opportunities to prove their capabilities. Hosted across multiple ASEAN countries, the 2024 edition saw increased fan engagement, heightened media coverage, and improved technological advancements in football analytics.

Research Gaps

Despite the growing body of research on football analytics and performance metrics, several critical gaps in the literature concerning ASEAN football and the Mitsubishi Electric Cup remain. While extensive studies have been conducted on European and South American leagues, relatively little research has been dedicated to understanding football's tactical and statistical dimensions in Southeast Asia. As the region continues to develop its footballing infrastructure and tactical sophistication, there is a pressing need for more comprehensive research that addresses the unique aspects of ASEAN football.

Limited Studies on Tactical Analysis in ASEAN Football

One of the primary gaps in the literature is the lack of in-depth tactical analysis specific to ASEAN football. Most research on passing accuracy, crossing efficiency, and ball possession strategies has been centered on elite European leagues such as the English Premier League, La Liga, and the Bundesliga. These studies provide valuable insights into football dynamics but fail to account for the distinct playing styles, developmental structures, and competitive conditions in ASEAN football. The absence of region-specific analysis makes it difficult to determine how passing accuracy and crossing efficiency impact team success in Southeast Asia. Given the tactical differences between European and ASEAN teams, such as variations in defensive structures, player physicality, and coaching methodologies, there is a need for dedicated research that explores how these metrics influence performance within the unique context of ASEAN football.

Lack of Predictive Models for Team Performance

While previous studies have examined passing and crossing trends in elite football, few have attempted to develop predictive models that forecast team performance based on statistical data. Most research remains descriptive, identifying correlations between passing efficiency and match outcomes without applying advanced modelling techniques. Statistical tools such as multiple linear regression and Principal Component Analysis (PCA) have been widely adopted in European football studies but remain underutilised in ASEAN football research. A robust predictive framework could offer valuable insights for coaches, analysts, and team managers, enabling them to refine strategies based on data-driven decision-making. Without such models, teams may rely on traditional scouting and subjective assessments rather than leveraging the full potential of performance analytics to optimize their tactical approaches.

Insufficient Analysis of Modern Tactical Evolution

Another critical research gap is the limited examination of how ASEAN teams have evolved tactically in response to the increasing influence of foreign coaches, sports technology, and globalisation. Many ASEAN teams have benefited from the influx of experienced international coaches who bring new tactical philosophies and training methodologies. However, little research has assessed how these influences have shaped playing styles, defensive structures, and attacking strategies. Additionally, with the introduction of advanced sports technology such as video analysis, GPS tracking, and data-driven match preparation, teams can access more significant insights into player performance and tactical efficiency. Despite these advancements, there remains a lack of empirical studies examining the extent to which these innovations have impacted ASEAN football. Understanding how modern tactics and technology reshape team dynamics could provide essential guidance for further developing regional competitive strategies.

Addressing these research gaps is essential for advancing the understanding of ASEAN football and ensuring that teams can compete more effectively at the regional and international levels. By conducting targeted research on tactical analysis, predictive modelling, and the evolution of modern football strategies in ASEAN, scholars and analysts can contribute to the region's footballing development. Future studies should prioritise region-specific data collection, employ advanced statistical methodologies, and assess the long-term impact of tactical innovations on

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team success. As ASEAN football continues to grow, filling these knowledge gaps will be crucial in enhancing team performance, optimising player development, and elevating the overall competitiveness of the region's football landscape.

Problem Statement

Football analytics has revolutionised performance evaluation in major leagues worldwide, yet its application to ASEAN football remains underexplored. While passing accuracy and crossing efficiency are well-documented indicators of success in elite football, their role in determining team performance in the Mitsubishi Electric Cup has not been systematically analysed. This study aims to bridge this gap by investigating how passing accuracy, total accurate passes, and crossing efficiency influence team rankings and goal-scoring opportunities in the tournament. By employing advanced statistical analyses, this research seeks to provide valuable insights into the tactical trends shaping ASEAN football, offering data-driven recommendations for teams and coaches to optimise their strategies.

This study examines the role of passing accuracy and crossing efficiency in determining team success in the Mitsubishi Electric Cup 2024. The analysis focuses on:
a.   Investigating whether teams with higher pass accuracy and total accurate passes tend to perform better.
b.   Exploring the influence of crossing accuracy on goal-scoring opportunities.
c.   Identifying key tactical trends in ball distribution among top-performing teams.

Method

This study employs a quantitative research design to investigate the impact of passing accuracy and crossing efficiency on team performance in the Mitsubishi Electric Cup 2024. By utilizing statistical analyses, the study examines how passing and crossing metrics contribute to team rankings and overall tactical effectiveness. The design integrates descriptive and inferential statistical approaches to explore relationships between key performance indicators and their influence on match outcomes.

The study adopts a data-driven analytical approach, focusing on performance statistics to determine how passing accuracy and crossing efficiency correlate with team success. This approach enables an objective team performance assessment based on measurable variables rather than subjective evaluation. The research is structured around three core objectives: (1) investigating whether teams with higher pass accuracy and total accurate passes tend to perform better, (2) exploring the influence of crossing accuracy on goal-scoring opportunities, and (3) identifying key tactical trends in ball distribution among top-performing teams.

The dataset consists of match statistics from the Mitsubishi Electric Cup 2024, sourced from official tournament records and performance analytics databases provided by Wyscout (https://wyscout.hudl.com). The sample includes passing and crossing data from all participating teams, allowing for a comprehensive evaluation of playing styles and tactical efficiency. The study measures three primary performance indicators: independent variables (accurate passes, pass success percentage, and accurate crosses) and dependent variables (team ranking, which is calculated as final

tournament standing). By analysing these metrics, the study seeks to establish the extent to which passing and crossing accuracy contribute to overall team performance. The study employs three key statistical techniques to achieve its objectives: Correlation Analysis, Multiple Linear Regression, and Principal Component Analysis (PCA). Table 1 summarises the statistical analysis methods used for each research objective.

Table 1. Statistical Method Used

Objective	Statistical Method Used	Key Metrics Analysed
Investigating whether teams with higher pass accuracy and total accurate passes tend to perform better	Correlation Analysis, Multiple Linear Regression	Accurate Passes, Pass Success Percentage, Team Ranking
Exploring the influence of crossing accuracy on goal-scoring opportunities	Correlation Analysis, Multiple Linear Regression	Pass Success Percentage, Accurate Crosses, Goal-Scoring Opportunities
Identifying key tactical trends in ball distribution among top-performing teams	Principal Component Analysis (PCA)	Accurate Passes, Accurate Crosses, Pass Success Percentage

Results

Rank Team, Accurate Passes Success (%) and Accurate Crosses

Based on Figure 1, passing accuracy and efficiency are crucial in determining a football team's ability to control possession and execute successful plays. The graph illustrates the passing performance of ten teams based on Accurate Passes, Pass Success Percentage, and Accurate Crosses, providing insights into each team's effectiveness in ball distribution. At the top of the ranking, Thailand emerges as the most dominant team in passing, recording an impressive 3,373 accurate passes with a pass success rate of 85%. This high accuracy suggests a well-structured and technically skilled team capable of maintaining possession and executing precise ball movements. Vietnam, ranking second, follows closely with 2,484 accurate passes and a pass success rate of 79%. Despite having fewer accurate passes than Thailand, Vietnam stands out in accurate crosses, leading with 60, indicating their strategic focus on effectively delivering the ball into attacking areas.

The Philippines and Singapore also demonstrate solid passing abilities, with 2,210 and 1,856 accurate passes, respectively. The Philippines achieved % pass success rate of 82%, placing them just behind Thailand's passing efficiency. Despite having a slightly lower pass success rate of 79%, Singapore shows consistency in their overall passing game. Malaysia and Cambodia, with 1,245 and 1,233 accurate passes, respectively, maintain a similar level of performance, achieving pass success rates of 80% and 78%. Their slightly lower number of passes may be attributed to playing fewer games than the top-ranking teams.

Further down the ranking, Indonesia and Myanmar exhibit moderate passing performance, with 1,150 and 967 accurate passes, respectively. Indonesia's pass success rate of 81% places them in a competitive position, but Myanmar struggles with a pass success rate of 73%, suggesting difficulties in maintaining precise ball movement. Timor-Leste and Laos, at the bottom of the ranking, face significant challenges in passing efficiency. Timor-Leste registers only 763 accurate passes with a pass success rate of 68%, while Laos records the lowest performance with

571 accurate passes and a pass success rate of 61%. These statistics indicate weaker ball control and distribution, which could impact their overall game strategy.

Overall, the analysis of passing statistics highlights Thailand and Vietnam as the strongest teams in terms of ball distribution and accuracy, reinforcing their tactical superiority in maintaining possession and creating scoring opportunities. Malaysia, Indonesia, and Myanmar display competitive passing abilities but may need further consistency and ball retention improvements. Meanwhile, Timor-Leste and Laos lag significantly, emphasising the need for better passing strategies and technical refinement to improve their overall game performance.
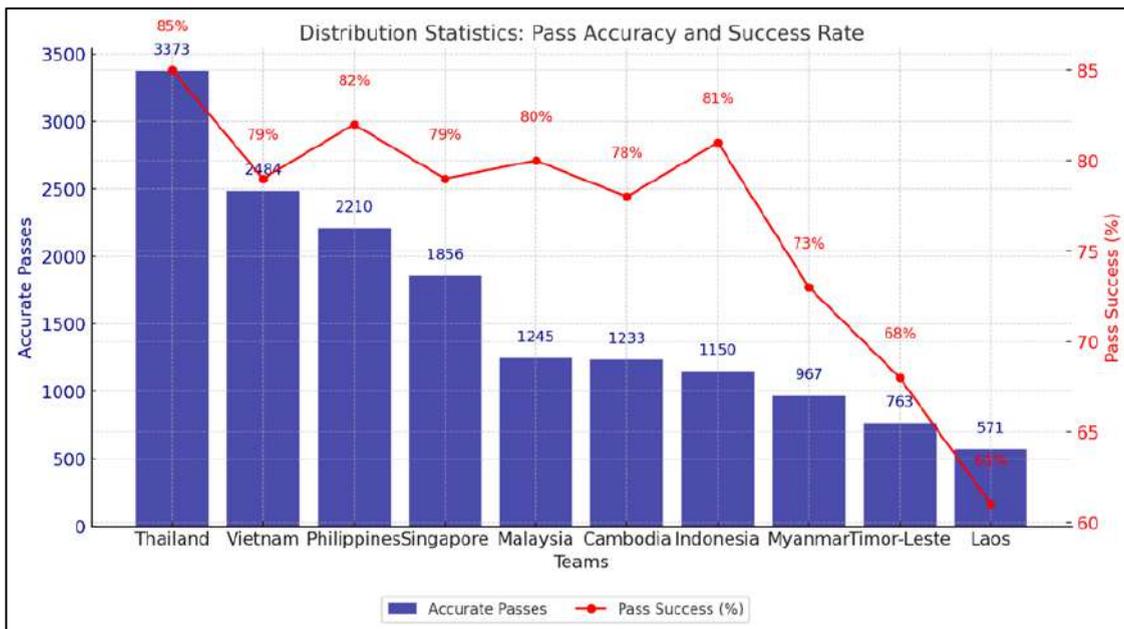

Figure 1. Rank Team, Accurate Passes Pass Success (%) and Accurate Crosses

Correlation Analysis: Relationship Between Passing and Crossing Metrics

In analysing the impact of passing accuracy and crossing efficiency on team success, a correlation matrix was generated to examine the relationships between Accurate Passes, Pass Success Percentage, and Accurate Crosses. This statistical analysis provides valuable insights into how different aspects of passing and crossing contribute to a team's overall performance in the Mitsubishi Electric Cup 2024.

Table 2. Correlation Analysis

Correlation Type	Variables	Correlation Coefficient (r)	Interpretation
Strong Positive Correlation	Accurate Passes & Pass Success Percentage	0.743	Teams with more completed passes tend to achieve greater passing accuracy. This highlights the importance of technical proficiency and structured passing sequences in maintaining possession and dictating play.
Moderate Correlation	Pass Success Percentage &	0.578	Teams with higher pass accuracy are more likely to deliver effective crosses. However, crossing efficiency is

| | Accurate Crosses | | influenced by additional factors such as tactical approach, team positioning, and opponent defensive structures. |
| Weaker Correlation | Accurate Passes & Accurate Crosses | 0.815 | While accurate passes contribute to overall ball control, they do not necessarily translate directly into frequent or effective crosses. Some teams emphasize possession-based play rather than relying on wide deliveries to create goal-scoring opportunities. |

Strong Positive Correlation Between Accurate Passes and Pass Success Percentage

The results indicate a strong positive correlation between Accurate Passes and Pass Success Percentage (r = 0.743), suggesting that teams with a higher volume of completed passes tend to achieve greater passing accuracy. This underscores the importance of structured passing sequences in maintaining possession and controlling the tempo of the game (Lago-Ballesteros & Lago-Peñas, 2010). Teams that execute precise passes with high efficiency can dictate play, reduce turnovers, and establish dominance in possession. This aligns with modern football tactics, where ball retention is crucial for breaking defensive structures and creating goal-scoring opportunities (Tenga et al., 2010). Maintaining possession through effective passing sequences allows teams to control the tempo of play, minimise defensive risks, and create structured attacking opportunities. The significance of this relationship highlights the importance of technical proficiency in executing short, precise passes that contribute to smoother ball progression and retention.

Moderate Correlation Between Pass Success Percentage and Accurate Crosses

A moderate correlation between Pass Success Percentage and Accurate Crosses (r = 0.578) indicates that teams with higher pass accuracy tend to deliver more effective crosses. However, the correlation is not as strong as the previous relationship, highlighting the influence of additional factors such as team positioning, tactical setup, and opposition defensive strategies (Hughes & Franks, 2005). While accurate passing can facilitate the transition into broad areas, successful crossing also depends on factors like player movement, timing of runs, and aerial presence in the box (Rampinini et al., 2009). This suggests that teams should integrate passing accuracy with strategic crossing approaches tailored to their squad's strengths. Crossing efficiency depends on multiple external factors beyond just passing accuracy. For instance, crossing success is often influenced by team tactics, player positioning, and opponent defensive structures. Some teams prefer a possession-based build-up strategy with minimal reliance on crosses, whereas others focus on wide play and aerial deliveries into the penalty area. Additionally, strong target players in the box can impact a team's ability to convert accurate crosses into goal-scoring opportunities. This finding suggests that while passing accuracy contributes to crossing effectiveness, it is not the sole determinant of success in delivering quality balls into the attacking zone.

Weaker Correlation Between Accurate Passes and Accurate Crosses

The weaker correlation between Accurate Passes and Accurate Crosses (r = 0.815) suggests that teams emphasising high passing accuracy do not necessarily rely on crossing as a primary offensive tool. This aligns with the tactical evolution of football, where many successful teams prioritise short passing sequences and central penetration over

wide deliveries (Collet, 2013). Possession-based teams, such as those employing a tiki-taka or positional play strategy, often focus on intricate build-up rather than frequent crossing. In contrast, teams with a more direct attacking style may prioritise early crosses into the penalty area regardless of their overall passing efficiency. This highlights the importance of aligning passing strategies with broader tactical goals to optimise scoring opportunities. While accurate passing plays a role in controlling possession, it does not necessarily translate into frequent or effective crossing opportunities. This implies that specific teams emphasise a more structured, possession-based approach rather than relying heavily on wide deliveries. Crossing may not be a primary offensive tool for teams favouring short, intricate passing sequences to penetrate the opponent's defence. On the other hand, teams that adopt a direct attacking style may prioritise early crosses into the box, regardless of their overall passing accuracy. The weaker correlation suggests that crossing success depends more on tactical preferences, offensive positioning, and match situations than on the number of accurate passes completed.

Regression Analysis: Predicting Team Ranking

A multiple linear regression model was developed to understand how passing and crossing metrics impact team ranking in the Mitsubishi Electric Cup 2024. The analysis incorporated Accurate Passes, Pass Success Percentage, and Accurate Crosses as predictor variables to determine their influence on team performance. The resulting regression equation is as follows:

$$\text{Rank} = 19.56 - 0.0020 \times \text{Accurate Passes} - 0.1328 \times \text{Pass Success \%} - 0.0283 \times \text{Accurate Crosses}$$

This equation provides a quantitative framework for understanding how these variables contribute to a team's final ranking in the tournament.

Overall Model Accuracy

The regression model achieved an R² value of 0.954, signifying that 95.4% of the variation in team rankings can be attributed to Accurate Passes, Pass Success Percentage, and Accurate Crosses. This high explanatory power underscores the critical role of passing efficiency and ball distribution patterns in determining team success in competitive football tournaments. Given the strong relationship between these passing metrics and final rankings, it is evident that teams with structured and precise passing strategies tend to perform better than those relying on inconsistent ball movement.

Impact of Accurate Passes on Team Ranking

The regression analysis revealed a significant negative correlation between Accurate Passes and team ranking (β = -0.0020, p = 0.020), indicating that teams with higher accurate passing numbers tend to achieve better rankings. This finding aligns with ball control and strategic build-up play research, emphasising the advantages of possession-based football (Lago-Peñas & Dellal, 2010). Higher passing efficiency facilitates ball retention, minimises turnovers, and

allows teams to dictate play tempo, all contributing to improved performance in competitive tournaments (Tenga et al., 2010). Teams that maintain high passing efficiency tend to perform better in tournaments, as precise passing enhances ball control, strategic build-up play, and reduces turnover risks. The negative coefficient suggests that increased accurate passes lead to a better team ranking, reinforcing the importance of possession-based strategies and controlled ball circulation. These aspects are crucial in securing higher rankings and maintaining dominance over opponents. Ultimately, successful teams prioritise structured passing sequences over random ball movement, leading to more effective offensive and defensive stability.

Influence of Pass Success Percentage on Team Ranking

Although Pass Success Percentage (β = -0.1328, p = 0.052) did not reach strict statistical significance (p < 0.05), it remains a crucial predictor of team success. A 1% improvement in pass success percentage is associated with an increase of 0.1328 ranking positions, reinforcing the impact of ball control in competitive football (Hughes & Franks, 2005). Teams with higher passing accuracy are better equipped to control the game's tempo, sustain structured attacks, and minimise defensive exposure. The near-significant p-value suggests that refining overall pass accuracy through targeted training, positional awareness, and coordinated team movements is a key area for improvement. This supports tactical approaches prioritising patient, controlled possession over high-risk, direct attacking play. While Accurate Passes had a stronger impact, Pass Success Percentage remains a valuable predictor of team success, particularly in high-pressure situations where maintaining possession is critical.

Effect of Accurate Crosses on Team Ranking

The regression model revealed that Accurate Crosses (β = -0.0283, p = 0.346) were not a statistically significant predictor of team ranking. While crossing remains a viable offensive tool, the statistical analysis suggests that crossing alone does not directly determine a team's success in high-level competition (Collet, 2013). Instead, accurate passes and pass success percentage are far stronger predictors of team ranking than crossing efficiency. This implies that teams relying solely on crossing strategies without a structured passing approach may struggle to succeed in competitive tournaments consistently. Modern football has shifted towards intricate passing play and positional control rather than relying heavily on wide deliveries. Many top-performing teams emphasise ball circulation, quick transitions, and precise short passing to break down defensive structures, rather than depending on frequent crosses into the penalty area (Rampinini et al., 2009). The analysis indicates that teams focusing excessively on crossing strategies without a well-structured passing approach may struggle to convert opportunities into goals and secure higher rankings.

However, crossing can still be effective when combined with strong tactical execution. Crossing strategies must be well-integrated within an attacking framework to translate into goal-scoring opportunities. Precise timing, intelligent attacking runs, and efficient finishing ability are essential components of a successful crossing approach. Without these complementary elements, crosses may result in lost possession, ineffective goal attempts, or easy clearances by opposing defenders. While crossing remains a valuable component of attacking play, its effectiveness depends on how well it is incorporated into a team's broader tactical setup. Teams aiming to maximize their crossing efficiency

must focus on enhancing player movement in the final third, improving finishing capabilities, and ensuring that crossing opportunities are created under optimal conditions rather than as a default attacking strategy. By refining these aspects, teams can ensure that crossing is a productive asset rather than a low-percentage attacking approach. These findings indicate that crossing efficiency should not be treated as an isolated metric for success but as a supporting tactical element within a broader game strategy. Teams that rely excessively on crossing without well-structured passing sequences or attacking coordination may struggle to convert these opportunities into meaningful goal-scoring chances.

Principal Component Analysis (PCA)

Principal Component 1 (PC1): Dominance of Possession-Based Play

PC1 emerged as the dominant factor, explaining 80.9% of the variance in the dataset. This substantial variance indicates that passing efficiency and structured ball distribution are primary determinants of team performance. Teams that scored highly in PC1 excelled in maintaining possession, executing accurate passes, and controlling the game tempo. These findings align with modern football trends, where teams prioritise precise ball circulation and methodical build-up play rather than direct, high-risk passing strategies (Lago-Peñas & Dellal, 2010). The prominence of PC1 underscores the tactical importance of refining passing drills, midfield coordination, and technical execution. Teams that emphasise structured ball retention can dictate match tempo, minimise defensive vulnerabilities, and create high-quality offensive opportunities (Tenga et al., 2010). As a result, investing in structured passing and positional discipline significantly enhances team performance at the international level.

Principal Component 2 (PC2): Tactical Diversity in Offensive Strategies

While PC1 captured the majority of tactical variability, PC2 accounted for 14.3% of the variance, highlighting variations in crossing efficiency and secondary attacking strategies. Unlike PC1, which emphasises structured ball movement, PC2 represents how much teams rely on crossing as a primary offensive method. Teams with higher PC2 values prioritise wide play and crossing efficiency, leveraging frequent deliveries into the box to generate goal-scoring opportunities (Collet, 2013). However, the relatively lower variance explained by PC2 suggests that crossing efficiency, while valuable, plays a supplementary role in determining team success. This aligns with contemporary football tactics, where elite teams integrate crossing into a broader attacking framework rather than relying on it as an isolated strategy. Successful crossing-based teams optimise their approach by ensuring well-coordinated attacking movement, precise deliveries, and efficient finishing ability (Rampinini et al., 2009).

Total Variance Explained

The combination of PC1 and PC2 explains 95.2% of the variance in ball distribution patterns, making PCA a highly effective method for classifying team playing styles. This high explanatory power reinforces the significance of passing efficiency and crossing strategy as the primary factors influencing how teams distribute the ball during matches. By understanding these two principal components, coaches, analysts, and teams can refine their tactical

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approaches. PC1's strong dominance suggests that structured possession and accurate passing should remain the foundation of a successful football strategy. At the same time, crossing tactics should be strategically integrated based on team strengths and attacking personnel. These findings highlight the importance of a balanced, data-driven approach to football tactics, ensuring that teams optimize their possession play while enhancing their attacking efficiency to achieve higher competitive success.

Patterns Identified from PCA Analysis

Top-Ranked Teams: Structured Possession and Tactical Precision

The PCA scatter plot revealed a distinct cluster comprising top-performing teams such as Thailand, Vietnam, and the Philippines. These teams exhibited high scores in PC1, emphasising structured possession, controlled ball circulation, and precise attacking transitions. Their ability to maintain possession and execute well-coordinated passing sequences allowed them to dominate matches while minimizing defensive risks. These findings reinforce previous research linking structured play with superior team performance in competitive tournaments (Hughes & Franks, 2005).

Lower-Ranked Teams: Tactical Weaknesses and Possession Instability

Conversely, Timor-Leste and Laos were positioned as outliers in the PCA analysis, highlighting tactical inefficiencies in passing accuracy and crossing effectiveness. Their struggle to maintain possession and execute structured attacking plays resulted in frequent turnovers and defensive instability. This inefficiency aligns with studies indicating that teams with weaker technical execution face greater challenges in controlling the game and competing effectively at higher levels (Lago-Ballesteros & Lago-Peñas, 2010).

Transitional Teams: Mixed Playing Styles and Inconsistent Execution

Cambodia, Indonesia, and Myanmar formed a transitional group, exhibiting a blend of possession-based and direct attacking strategies. While these teams displayed moments of structured play, their inconsistency in passing execution and ball distribution prevented them from fully capitalising on offensive opportunities. The fluctuating nature of their playing style suggests the need for improved tactical discipline and strategic adaptability to compete more effectively with higher-ranked teams.

Table 3. PCA Tactical Trends

Tactical Group	Teams in Cluster	Key Characteristics	Tactical Implications
Top-Ranked Teams	Thailand, Vietnam, Philippines	High passing accuracy, structured possession-based play, effective attacking crosses.	Demonstrates superior control of possession, better attacking efficiency, and dominance in playmaking.
Lower-Ranked Teams	Timor-Leste, Laos	Low passing accuracy, ineffective crossing, lack of structured ball distribution.	Struggles to maintain possession, lacks offensive threat, and is vulnerable defensively.

| Transitional Teams | Cambodia, Indonesia, Myanmar | Mixed playing style, inconsistent execution, moderate passing accuracy. | Displays potential for structured play but needs consistency in execution to compete at a higher level. |

Discussion

Investigating Whether Teams with Higher Pass Accuracy and Total Accurate Passes Tend to Perform Better

The findings strongly support the notion that teams with higher pass accuracy and a greater number of accurate passes achieve better performance outcomes. Correlation analysis demonstrated a strong positive relationship between Accurate Passes and Pass Success Percentage (r = 0.743), indicating that teams completing more passes also maintain higher passing accuracy. Additionally, regression analysis confirmed that Accurate Passes (β = -0.0020, p = 0.020) and Pass Success Percentage (β = -0.1328, p = 0.052) significantly influence team ranking, reinforcing the critical role of precise passing in competitive success. Teams that emphasise structured passing sequences are more likely to maintain possession, control the game tempo, and minimise turnovers. Principal Component Analysis (PCA) further highlighted that possession-based play (PC1: 80.9% variance explained) is the most influential tactical trend, underscoring the importance of passing accuracy and structured ball movement in top-performing teams. These findings indicate that passing efficiency is key to success in high-level football tournaments.

Exploring the Influence of Crossing Accuracy on Goal-Scoring Opportunities

While crossing accuracy contributes to goal-scoring opportunities, its overall impact on team performance is less significant than passing accuracy. Correlation analysis revealed a moderate relationship between Pass Success Percentage and Accurate Crosses (r = 0.578), suggesting that teams with higher passing accuracy tend to execute more effective crosses. However, regression analysis indicated that Accurate Crosses (β = -0.0283, p = 0.346) were not a statistically significant predictor of team ranking. These findings suggest that while crossing can be an effective attacking tool, its success depends on additional tactical factors, such as player movement, finishing ability, and opponent defensive structures. PCA findings confirmed that crossing-based play (PC2: 14.3% variance explained) plays a secondary role compared to possession-oriented football.

Consequently, teams should integrate crossing within a broader tactical framework rather than relying on it as their primary method of goal creation. For instance, Vietnam led in accurate crosses (60) but finished second to Thailand, which delivered fewer crosses (45) yet demonstrated superior overall gameplay. Conversely, lower-ranked teams such as Timor-Leste and Laos struggled with crossing efficiency (1 and 11 accurate crosses, respectively), reflecting their overall attacking inefficiencies. These insights highlight the necessity of optimizing crossing strategies to complement an effective attacking system.

Identifying Key Tactical Trends in Ball Distribution Among Top-Performing Teams

PCA analysis revealed two key tactical trends in ball distribution among top-performing teams. The first and most

influential trend (PC1: 80.9% variance explained) reflects structured possession-based play, characterized by high passing accuracy, controlled ball circulation, and methodical build-up strategies. The second trend (PC2: 14.3% variance explained) represents crossing-based attacking strategies, which, while valuable, play a supplementary role in overall team success. The top-performing teams (Thailand, Vietnam, and the Philippines) clustered around PC1, emphasising structured possession, efficient passing, and controlled attacking transitions. In contrast, lower-ranked teams (Timor-Leste and Laos) were identified as tactical outliers, struggling with passing and crossing efficiency. Transitional teams (Cambodia, Indonesia, and Myanmar) exhibited a blend of possession-based and direct attacking approaches but lacked the consistency required to compete with the top-tier teams. For example, Thailand (85% pass success) and Vietnam (79%) demonstrated exceptional ball retention and structured build-up play, securing the top two positions. Conversely, Timor-Leste (68%) and Laos (61%) struggled with passing accuracy, leading to weak ball retention, frequent turnovers, and ineffective attacking transitions. These findings emphasise the critical role of passing proficiency in determining team success.

This study confirms that passing accuracy and structured ball movement are key to team success. Teams that execute precise passing sequences, maintain possession, and integrate crossing effectively within their attacking strategies tend to achieve higher competitive performance. By focusing on these tactical elements, teams can optimise their game plans and improve their rankings in elite football tournaments. The findings further suggest that while crossing can contribute to goal-scoring opportunities, teams should prioritise passing accuracy and structured possession as their core tactical approach. Adopting a data-driven football strategy that enhances ball retention and efficient attacking movement will significantly improve team success in high-level competitions.

Conclusion

This study confirms that passing accuracy and structured ball movement determine team success in high-level football tournaments. Teams that emphasise accurate passing and maintain strong ball possession tend to perform better, controlling the game's tempo and reducing the likelihood of turnovers. Possession-based play emerged as the dominant tactical approach among top-performing teams, highlighting the importance of methodical build-up strategies and effective ball retention. Although crossing can create goal-scoring opportunities, its influence on overall team success is less significant than passing accuracy. Successful teams do not rely solely on crossing but rather integrate it within a broader, possession-oriented tactical framework. Effective crossing depends heavily on complementary factors such as player positioning, movement, and finishing ability.

Analysis of ball distribution patterns revealed that teams focusing on structured passing sequences and controlled offensive transitions consistently outperformed those relying on direct or crossing-heavy strategies. Teams with superior passing efficiency maintained consistent attacking pressure and defensive stability, while teams struggling with passing accuracy faced ball retention and goal creation difficulties. In conclusion, teams aiming to enhance their competitive performance should prioritise developing precise passing networks, structured ball possession, and intelligent integration of crossing into their overall tactical plans. By focusing on these key elements, teams can strengthen their game strategies, dominate possession, and achieve higher success in elite football tournaments.

Recommendations

1. Enhancing Passing Accuracy for Competitive Success

a. Teams should prioritise intensive passing drills to improve accuracy and execution.

b. Training should focus on positional awareness and tactical build-up strategies to maintain possession in high-stakes matches.

c. Implement structured possession-based play to control tempo and minimise defensive vulnerabilities.

2. Optimising Crossing Strategies for Maximum Effectiveness

a. Instead of increasing crossing frequency, teams should focus on delivering high-quality, targeted crosses to maximise goal-scoring potential.

b. Tactical training should emphasize movement coordination, precision delivery, and efficient positioning in the attacking third.

c. Crosses should be integrated as a supplementary tool within a broader, structured offensive framework.

3. Refining Tactical Approaches Based on Team Profiles

a. Lower-ranked teams should adopt structured passing patterns to enhance ball retention and reduce unforced errors.

b. Teams must improve positional play and decision-making in the final third to create higher-quality goal-scoring opportunities.

c. Coaching strategies should focus on reinforcing technical execution and fostering adaptable game plans based on opposition analysis.

By implementing these recommendations, teams can enhance their competitive performance, optimize their tactical efficiency, and improve their chances of success in high-level tournaments. These findings provide valuable insights into modern football trends and underscore the importance of data-driven approaches in refining strategic gameplay. Recent advancements in football analytics have significantly enhanced our understanding of how passing and crossing metrics influence team performance. Two notable studies exemplify this progress:

1. Machine Learning Models for Predicting Match Outcomes Based on Passing Metrics

A study by Wang et al. (2024) developed a machine learning-based system to predict English Premier League match outcomes, focusing on passing metrics. The researchers employed models such as Principal Component Analysis (PCA), K-Nearest Neighbors (KNN), Random Forests, and Support Vector Machines (SVM) to analyse a large dataset of matches. Their findings revealed that the Random Forest model demonstrated robust performance in forecasting wins and losses, particularly when emphasizing accurate passing sequences. However, the models faced challenges predicting draws, indicating areas for further refinement. This study underscores the potential of machine learning techniques in capturing the complexities of match dynamics through detailed passing data.

2. Impact of Defensive Schemes on Passing Efficiency

NFL Operations (2024) article examined how evolving defensive schemes shape the passing game. The analysis highlighted that defences are adapting to counter aerial attacks, resulting in observable impacts such as fewer passing

yards, shorter throws, and a reduction in deep passes. This evolution in defensive strategies underscores the dynamic interplay between offensive passing tactics and defensive adaptations, influencing overall game outcomes. These studies collectively highlight the importance of integrating advanced analytical methods and considering defensive contexts when evaluating the role of passing and crossing metrics in football performance.

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Biomedical Engineering Possibilities in The Modern Method of Differential Diagnosis of Biological Tissues of The Colon in Inflammatory and Tumor Conditions

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Abstract: The proposed and developed modern method of mini-gamma-quantum differential diagnosis of pathological conditions of the colon *(Sulyma V., Gaponov V., Kravchenko V., 2001)* has significant advantages. Histological examination of tissue samples is usually sufficient to establish the presence or absence of tumor cell complexes and ulcerative changes. Since the zone of spread and invasion of tumor cells and ulcerative lesions can be invisible, the doctor usually relies on his own experience and intuition. Despite the fact that this method is the most reliable and widespread throughout the world, it has a long execution time - up to 6 days, therefore an alternative or additional method has been developed and proposed, which allows you to determine and differentiate the nature of the colon lesion, since the duration of the study is 60 seconds. This method is based on the difference in the concentration of intracellular trace elements in tumor, inflammatory and normal tissues of the colon wall. The authors use the well-known phenomenon of the photo effect. Irradiation of a tissue sample with a mini-γ-quantum causes the cells to lose their negative charge, thus creating a photoelectric effect (Stoletov effect), which will be strictly individual for tumor, inflammatory and normal tissues. To differentiate various pathological formations, the authors measure the intensity of absorption of γ-quanta by cells, as well as the characteristic emission of microelements present in the tissue. Thus, the key point of the presented method is to distinguish the concentration of trace elements in malignant, non-malignant, inflammatory and normal tissues. This circumstance can be explained by the complex and related function of the sodium pump in carcinogenesis. We recommend the use of the express method of mini-γ-quantum examination when taking biopsy material during colonoscopy and when performing surgical interventions for the differentiation of pathologically changed tissues.

Keywords: Biopsy, Mini-γ-Quantum, Differentiation

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Introduction

The novelty of the scientific and technical solution in the developed small-sized device for mini-gamma-quantum express diagnostics of tissues of the human body in the verification of oncological diseases is that the device is a portable medical device for non-invasive and non-contact differential express diagnostics of normal diseases and pathologically changed tissues of the human body based on the study of biopsies directly during surgical intervention. The main novelty of the development is that the construction of the proposed device is based on the gamma absorption method - a method of elemental analysis based on measuring the degree of attenuation of the gamma radiation flux passing through the biological tissue under investigation, or, in other words, the dependence of the degree of absorption on the biological tissue of a monochromatic beam of gamma quanta with a low energy value ranging from 5 to 17 keB, at which a sample of biological tissue with a thickness of 3 to 5 mm will intensively absorb gamma quanta. Irradiation of a tissue sample with a mini-gamma-quantum causes cells to lose their negative charge, thus creating a photoelectric effect (Stoletov effect), which will be strictly individual for tumor, inflammatory and normal tissues. To differentiate various pathological formations, the authors measure the intensity of absorption of gamma quanta by cells, as well as the characteristic emission of microelements present in the tissue.

A thallium-NaI (TL) activated sodium-iodine scintillation gamma spectrometric detector converts the energy of gamma quanta entering its sensitive area into flashes of visible light with a brightness proportional to the energy of the gamma quanta.The photomultiplier converts the visible light flashes of the scintillation detector installed opposite the photocathode into electrical pulses with an amplitude proportional to the brightness of the visible light flashes.

Functions provided by the desired device for mini-gamma diagnostics:

1. It is used in non-invasive, non-contact medical research.

2. Has a level of complexity such that personnel who have learned only the device's operating instructions are allowed to work with it.

3. Differentiate tissues that are examined according to the following criteria: normal biological tissue without pathological formations; biological tissue with benign neoplasms; biological tissue with malignant neoplasms, and records the obtained results in the form of physical (digital) values.

4. It has the functional ability to ensure the following actions for express diagnostics:

- calibration with the help of specialized equivalents included in the device package, for working with defined tissue biopsies of a specific area of a person, as well as re-calibration when switching to another type of biological tissue during operation and use of the device from the same equivalents that are included in the device package;

- insertion of the biopsy specimen into the cassette of the device's research unit and the formation of determined sizes of samples of the biological tissue being examined using the cassette, the cutting mechanism and the cassette holder;

- positioning of the cassette holder with the inserted cassette with the sample to be examined in the formed form in the examination unit of the device;

- formation of a low-energy monochromatic collimated gamma-ray beam with energy from 5 to 17 keV for research through the sample;

- measurement of the intensity of the gamma quanta flow after passing through the sample of biological tissue under investigation using a scintillation detector and a photoelectron multiplier;

- performing mathematical processing of the received information;

- display on the monitor of the information of the final result in the form of a physical (digital) value and the corresponding category of the state of the biological tissue;

- maintaining a database with the necessary amount of information: numbering of the research list, data, patient's first and last name, male/female, birth data, address, digital research result, conclusion based on the research results;

- necessary preservation of the amount of information;

- has communication (wired and wireless) with electronic data entry devices;

- transfer for system entry of the database and use with the service of information on a higher-level device; processing information from the database using artificial intelligence.

Method

The quality of the diagnosis of oncological diseases mostly depends on the accuracy of the results of studies that determine the type of neoplasm. The tactics of further examination and treatment of the patient are based on the results of these studies, with the selection of necessary programs of possible complex combined treatment (radiation therapy, chemotherapy, surgery).An inexpensive instrumental method of differential diagnosis of biological tissues developed by us and currently being implemented in medical practice, which will not only speed up the time of obtaining research results, but also significantly increase their objectivity and reliability on the basis of evidence and fixation of results in physical quantities in a computer program.

The developed device is a portable medical apparatus for noninvasive and non-contact differential express diagnostics of normal and pathologically changed tissues of the human body based on the study of biopsies directly during surgical intervention in patients with suspected cancer.

The proposed device allows differentiation of biological tissues according to 3 groups:

1. normal biological tissue without pathological formations;

2. biological tissue with non-malignant neoplasms;

3. biological tissue with malignant neoplasms.

Our biological tissue analyzer enables the doctor to establish the nature of the tumor, assess the local or regional spread of the process, determine the boundaries of neoplasms of different localization, assess the extent of surgical intervention and surgical tactics, ensure a negative result at the edges of the resection and reduce the risk of tumor recurrence after its removal.

The appearance of the device for mini-gamma-quantum differentiation of biological tissues, the arrangement of units (research unit and control unit), units (cassette holder, electronic units, etc.) and individual parts (cassette, etc.), as well as control panels (front and rear) have ergonomic indicators that ensure convenience use (preparation for operation – ease of installation of the device on the table, connection to the electrical network and grounding,

loading/unloading of biological tissue samples into/from the cassette, etc.); ease of use (ease of working with the control panel and the cassette with the cassette holder); the convenience of preventive maintenance work (cassette disinfection, etc.).

The control unit and the research unit are located in different housings of the device: a) control unit – in a high-strength plastic case; b) research unit – in a stainless-steel metal case. A measuring device in the form of a scintillation detector is located in the metal case of the research unit, consisting of: a case, a scintillator (crystal, plastic, liquid), a photoelectric multiplier, a power cell, a source of ionizing low-energy gamma radiation in a special protective case that ensures compliance with sanitary requirements and radiation safety standards, and a cassette for biological tissue to be examined (a sample of biological tissue is placed in the biopsies section of the cassette), which is installed in the cassette holder. The design of the cassette holder includes a knife for cutting excess biopsies.

The cassette holder is firmly fixed in the housing of the device's research unit. The control unit houses power elements, a microprocessor controller for processing information and maintaining a database, providing communication with peripheral electronic devices. The front panel of the device houses the information monitor and control points. On the back panel there is a device on/off switch, a fuse and places for connecting additional devices.

The device has the possibility of applying protective grounding. The industrial production of the developed device will ensure the availability of a tool in every medical organization, which makes it possible to detect cancer early, start quick and high-quality complex combined treatment, reduce the development of complications of the disease and save the lives of patients. Such a device should be in every hospital, every oncology care center, every scientific medical and clinical research center.

The novelty of the proposed solution in the developed small-sized device for express diagnosis of tissues of the human body in the verification of oncological diseases is that the device is a portable medical apparatus for noninvasive and non-contact differential express diagnosis of normal and pathologically changed tissues of the human body based on the examination of biopsies directly during execution surgical intervention.

The main novelty of the development is that the construction of the proposed device is based on the gamma absorption method - a method of elemental analysis based on measuring the degree of attenuation of the gamma radiation flux passing through the biological tissue under investigation, or, in other words, the dependence of the degree of absorption on the biological tissue of a monochromatic beam of gamma quanta with a low energy value ranging from 5 to 17 keB, at which a sample of biological tissue with a thickness of 3 to 5 mm will intensively absorb gamma quanta.

At the same time, the weakened flux of gamma quanta, which was not absorbed by the biological tissue and recorded by the device after its irradiation, will have a specific value for a biological tissue, characteristic separately for normal tissues, non-malignant tumors, and tissues affected by a malignant neoplasm. Irradiation of a tissue sample with a mini-gamma-quantum causes cells to lose their negative charge, thus creating a photoelectric effect (Stoletov effect), which will be strictly individual for tumor, inflammatory and normal tissues. To differentiate various pathological

formations, the authors measure the intensity of absorption of gamma quanta by cells, as well as the characteristic emission of microelements present in the tissue. A thallium-NaI (TL) activated sodium-iodine scintillation gamma spectrometric detector converts the energy of gamma quanta entering its sensitive area into flashes of visible light with a brightness proportional to the energy of the gamma quanta.

The current state of differentiation of pathological changes in tissues, and even more so in tumors, requires the use of not only the knowledge, skills and abilities of a pathologist, but also the use of much more informative molecular genetic methods *(Kopnyn, 2002)*. However, the terms of performance of both traditional and modern methods of studying pathologically changed tissues are very significant (from 1 to 7 days), which is especially undesirable in patients with malignant tumors when performing organ-preserving surgical interventions on the biological tissues, which must end with the formation of an any anastomosis.

Usually, the assessment of the state of the ends of the connecting intestine for the presence of parts of the tumor is carried out by the surgeon only visually and by palpation, and only after 5-7 days it is possible to obtain a histological conclusion about the state of the ends of the removed drug. Sometimes, unfortunately, the presence of cancer cells is possible, which leads to a high probability of tumor recurrence in the formed anastomosis (*Сулима et al., 2008*). It is important to develop and implement a new instrumental method of differentiation, which will not only speed up the time of obtaining results, but also increase their objectivity and reliability on the basis of evidence and fixation of physical units.

There must be a morphological basis for such a method. Normal tissue growth is characterized by two main features: constancy of the cell population (achieved by the balance between proliferation and cell death), and full maturation and differentiation of cells after proliferation. With sublethal damage to the genetic material of cells, both fundamental laws of normal tissue growth will be violated. The most frequent types of mutations are translocation, amplification, deletion and point mutations, as a result of which the expression of genes and their products can be excessive (hyperexpression) or suppressed (suppression). This unregulated growth ends with population expansion (cell expansion) and insufficient cell differentiation.

One of the main tasks of a surgeon is to determine the extent of surgical intervention in the treatment of colorectal cancer. The choice of the scope of the operation - intestinal resection without restoration of intestinal patency with the formation of a permanent colostomy or sphincter-preserving surgery with restoration of colonic anastomosis patency - depends on the degree of invasion and tumor dissemination. Since the determination of the borders of the tumor field and the degree of cancer dissemination with carcinoma of the lymphatic and blood vessels is beyond the intraoperative capabilities of the doctor, he relies exclusively on his own experience, intuition, operative findings and the results of preoperative studies.

For radical surgical treatment and to prevent postoperative complications and early recurrences, the surgeon must be sure that the line of bowel resection is not damaged by the neoplastic process. The most common and highly informative diagnostic method is intraoperative express biopsy of intestinal tissue taken from the resection line. When

tumor complexes are detected in the line of resection, the surgeon can expand or change the scope of the surgical intervention.

Unfortunately, in most hospitals, the method of intraoperative express biopsy is impossible, and even when it is used, the edges of the removed intestine are not completely studied by express examination, but only a few pieces of it, the analysis of which will not give answers about the condition of the ends of the drug. As a rule, the operative material is examined only after the operation, and the doctor receives a conclusion at least a day later, or even 5-7 days after the operation. A modern express method is proposed, which allows determining the extent of tumor spread to neighboring tissues and differentiating tumor and non-tumor processes by means of gamma radiation and residual measurement of samples removed during surgery *(Sulyma* et al.*, 2008)*. The positive achievements of the method consist in the expansion of the surgeon's intraoperative capabilities to determine the type and scope of the operation, which, in the end, is directly related to the improvement of the quality of life of the operated patient.

The method is based on the difference in concentrations of intracellular microelements in tumors and intact intestinal tissues using the phenomenon of the photoelectric effect. Irradiation of the specimens with mini-γ- quanta causes the cells to lose their negative charge, causing a photoelectric effect that is strictly individual for normal, reactively and non-plastically transformed tissues. To differentiate pathological processes of different quality, the intensity of mini-gamma quanta absorption by cells is measured and compared, as well as the characteristic emission of microelements contained in tissues, where the measurement results are represented by the formula.

Biochemical studies of tumors revealed that malignant cells have a different concentration of intracellular ions Na^+, K^+, and Cl^- compared to normal cells. Thus, the concentration of intracellular sodium is increased, while the level of potassium ions is decreased. The ratio of Na^+/K^+ ions in tumor cells is five times higher than in normal cells. One of the possible explanations for disturbed ion homeostasis of tumor cells is the abnormal activity of Na^+/K^+-ATP-ase and the altered functioning of the co-transport systems for Na^+, K^+, Cl^- ions, when a shift in the $Na^+/K^+/Ca$ ion ratio is not only observed in a malignant cell ++, but also their possible influence on the abnormality of the cell shape, its mobility and cellular interactions *(Latzkovits et al., 1983; Mtskhvetadze, et al., 1987)*.

Results

Research results indicate that the enzyme Na^+/K^+-ATPase (sodium pump), in addition to ion transport, is part of the protein complex that transmits growth signals from the extracellular environment to the intracellular pathway of the replicative signal. The sodium pump acts as a transmembrane receptor for growth factors and is involved in the mechanism of tissue growth, where Na^+/K^+-ATPase regulates intracellular calcium content *(Kaplan,2005)*.

Changes in metabolism and interactions with Na^+/K^+-ATPase may be associated with the development of malignant tumors. This is explained by the abnormal activity of Na^+/K^+-ATPase and its sensitivity in malignant cells, high concentration in the plasma of cancer patients. Na^+/K^+-ATPase α1-isoform expression is decreased and α3-isoform expression is increased in all colon cancer tissue samples compared with intact colonic mucosa, and poorly differentiated colon carcinomas have reduced Na^+/K^+-ATPase β1 subunit easy. These disturbances can explain

changes in the level of Na+ and K+ in the cytoplasm of precancerous and tumorous epithelial cells of the colon mucosa.

Determination and fixation of the difference in the concentration of microelements in the tissues of the colon allows to differentiate its states: from normal to damage by the tumor process. The difference in the composition of pulses for various pathological processes was 30%, which confirms the possibility of differentiating benign, malignant tumors and inflammatory processes of the rectum with the involvement of this energy at a measurement time of 60 seconds *(Сулима et al., 2008)*.

The photomultiplier converts the visible light flashes of the scintillation detector installed opposite the photocathode into electrical pulses with an amplitude proportional to the brightness of the visible light flashes. The pulse amplifier brings the value of the amplitude of electric pulses at the output of the gamma quanta detection unit to several volts, depending on the energy of the output gamma quanta. Thus, the possibility of diagnosing the quality of biological tissue by absorption follows from the fact that the absorption of the same type of radiation will be significantly different in biological tissues of different states. The attenuation of a narrow monoenergetic beam of gamma radiation when passing through biological tissue is described by an exponential law:

$I = I_0 e_{-\mu\pi d}$,

where:

I_0 – is the intensity of the gamma radiation beam falling on the biological tissue;

I – is the intensity of the gamma radiation beam that passed through a layer of biological tissue, with a thickness of d cm;

μ_π – is the linear absorption coefficient.

The device developed by us examines mini-samples of biological tissue (biopsies) selected and placed in a special cassette of the measuring part of the analyzer and visually reproduces physical values that are characteristic only for certain tissue states (normal, inflammatory, with non-malignant or malignant growth) with a measurement period from 1 to 6 minutes based on residual characteristic radiation results. The initial gamma quanta passing through the tissue sample under investigation can receive one of three types of interaction with the electrons of the carbon, nitrogen and oxygen atoms that make up, mainly, the deoxyribonucleic acid molecule, that is, the cell (at the same time, the probability of such a process will be the higher, the more important the density of the study sample will be):

- fluorescent absorption by the electrons of the K- or L-shell of the indicated atoms, while one of the electrons from a more distant orbit, having released excess energy at this time, will move to the vacancy created;
- characteristic radiation, which is cut off by the information processing unit;
- coherent scattering without energy change;
- incoherent scattering with energy change (Compton effect).

The development of a small-sized device for express diagnostics of human body tissues for verification in oncological diseases allowed us to substantiate, manufacture and test a sample of the analyzer, which implements the gamma

absorption measurement method using low-energy gamma quanta for differential express diagnostics of the state of normal and pathologically changed tissues of the human body, which are studied during a surgical operation on an oncological patient.

Discussion

The main technical parameters that determine the functional, quantitative (numerical) and qualitative characteristics of the developed device.

Functions provided by the proposed device:

1. The device is used in non-invasive, non-contact medical research.

2. The device has such a level of complexity that personnel who have learned only the device's operating instructions are allowed to work with it.

3. The device differentiates the tissues examined according to the following criteria:

   - normal biological tissue without pathological formations;

   - biological tissue with non-malignant neoplasms;

   - biological tissue with malignant neoplasms, and records the obtained results in the form of physical (digital) values.

4. The device has the functional ability to ensure the following actions for express diagnostics:

   - calibration with the help of specialized equivalents included in the device package, for working with defined tissue biopsies of a specific part of the human body, as well as re-calibration when switching to another type of biological tissue during operation and in the place of operation of the device using the same equivalents included to the configuration of the device;

   - insertion of the biopsy specimen into the cassette of the device's research unit and formation of the defined dimensions of the sample of biological tissue to be examined with the help of the cassette, the cutting mechanism and the cassette holder;

   - positioning of the cassette holder with the inserted cassette with the sample to be examined in a molded form in the device's examination unit;

   - formation of a low-energy monochromatic collimated stream of gamma radiation with energy from 5 to 17 keV to pass through the research sample;

   - measurement of the intensity of the gamma quanta flow after passing through the sample of biological tissue under investigation using a scintillation detector and a photoelectron multiplier;

   - perform mathematical processing of the received information;

   - display on the monitor the information of the final result in the form of a physical (digital) value and the corresponding category of the state of the biological tissue;

   - maintaining a database with the necessary amount of information: numbering of the sequence of research, date, first and last name of the patient, male/female, date of birth, address, digital research result, conclusions based on the research results;

   - preservation of the required amount of information;

- communication (wired and wireless) with various electronic devices for data entry;

- transfer of information to a higher-level device for system input of the database and use for official purposes;

- processing of information from the database using artificial intelligence.

Quantitative parameters that determine the device's performance of its functions.

The device must provide the following quantitative parameters:

- distribution of biological tissues, which are studied according to three categories:

a) normal biological tissue without pathological formations;

b) biological tissue with non-malignant neoplasms;

c) biological tissue with malignant neoplasms,

in the form of a physical quantity corresponding to a specific category;

- time of one measurement (exposure time) from 1 to 5 minutes;

- measurement error in comparison with morphological laboratory results studies from 2 to 3%;

- the weight and geometry of the biopsy being studied, which is formed with the help

cassette and cutting mechanism: a) weight — from 1.0 g; b) diameter — from 1 to 5 mm;

c) thickness — from 1 to 5 mm;

- the range of measuring the density of the investigated tissues from 1.00 to 1.20 g/cm3;

- use of a low-energy emitting isotope as a source of gamma quanta monochrome flux of

gamma radiation with energy from 5 to 17 keV;

- the average working time of the device before failure is not less than 12,000 hours;

- the term of use of the device is at least 10 years.

Conclusion

One of the main tasks of the surgeon while carrying out of the resection of colon due to cancer is as more as exact to determine the borders of the intestine resection. Because of the area of tumour spreading and invasion is invisible; the surgeon commonly trusts on self-experience and intuition. The histological examination of the frozen tissue samples obtained from the margins of the resection usually sufficient for establishing the presence or absence of complexes of tumour cells.

Although this method is the most reliable and commonly used throughout the world here there is an alternative or additional way that allows determining the precise margins of the resection of the affected colon and differentiation of malignant and nonmalignant lesions right during surgery. This method is based on the difference in the concentration of the intracellular microelements in tumour and non-affected colonic tissue.

The authors use the phenomenon of photoelectrical effect. Radiation of the tissue sample by the mini-γ-quantum induces loss of negative charge by cells thereby creating the photoelectrical effect that will strictly individual for neoplastic and non-neoplastic tissues. For differentiation various pathologic lesions authors measure the intensity of γ-quantum uptake by cells as well characteristic radiation of microelements presence in the tissue. Thus, the key position of presented method is distinction of the concentration of microelements in malignant and nonmalignant

lesions. Taking in account the literature data adduced above this circumstance could be explained by complex and coupled function of sodium pump in cancerogenesis.

The enzyme Na+,K+ATP-ase possess unique properties because of combination of so different but interrelated functions – pumping and signalling activity essential for tissue growth. Malignant transformation of a cellaccompanies by alterations in functions of this enzyme. So the intracellular concentration of some ions is change together with appearing of disorders of signalling pathway involved in tissue growth.

Presented literature facts regarding participation of Na+, K+ATP-ase in tissue growth allow to consider that sodium pump involves in signalling pathway and its acting associated with the expression of protooncogenes. Therefore, the mutated oncogenes caused the abnormal expression and functioning of Na+,K+ATP-ase. Some literature sources announced about interdependence between abnormal concentration of intracellular ions and disregulation of some oncogenes and initiation of malignant transformation of the cell.

This biological tissue analyzer enables the doctor to establish the nature of the tumor, assess the local or regional spread of the process, determine the boundaries of neoplasms of different localization, assess the extent of surgical intervention and surgical tactics, ensure a negative result at the edges of the resection and reduce the risk of tumor recurrence after its removal.

Recommendations

In the future, the application of the proposed method can objectify and speed up the differential diagnosis of intestinal tumors, and a deep study on other neoplasms of organs and tissues can be the basis of a new direction of instrumental diagnostics in surgery and oncology.

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Team Dysfunction in Project-Based Learning

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Abstract: PBL (Project Based-Learning) is one of the most widely applied methods in the world of higher education in Indonesia nowadays. One of the advantages as well as the reason for choosing the PBL method is group collaboration. The PBL method provides greater space for cooperation between group members in the process of completing project tasks through discussion and implementation of various activities. No exception in BINUS (Bina Nusantara) University, in the last three years the PBL method has been used. But in the implementation of PBL the problem of team dysfunction emerged. Almost every semester there are some students who complain about dysfunction in their work team to the lecturer. This has led to the acquisition of students' scores that are not optimal. This study aims to examine what factors cause dysfunction in the work team in PBL activities. The theoretical base in this study uses Lencioni' model of the five dysfunctions of a team. In this study, in addition to literature studies, questionnaires with a Likert scale also used to 126 students from 4 Character Building classes of BINUS University from even semester 2024-2025 as the respondents. The questions in this study are positive by using a scale calculation from 1 to 5. That is, greater points obtained more effective picture of cooperation in a team. Based on the result of the questionnaire distribution, found several factors that cause dysfunction in the team. Furthermore, this study recommends several steps to overcome dysfunction in the team so that PBL activity achieves optimal result.

Keywords: Team Dysfunction, Project-Based Learning

Introduction

Project-Based Learning

As social creatures, we must work as a team. In 1949, Newcomb, as cited by Driskell, Salas, and Driskell (2020), wrote in his seminal work, "Humans are so thoroughly socialized that almost all their problems must be resolved by making peace with others". A number of academics also contend that people are inherently drawn to forming relationships. For instance, Baumeister and Leary (1995) argue that fundamental human motivation is the drive to fit in. Leary (2010) notes that affiliation by itself won't get a person very far, though. Leary thinks that one of the most important traits of humans is our capacity for teamwork when solving problems. Therefore, both interpersonal and instrumental attachments created to accomplish shared objectives can be included in the fundamental urge to build relationships. The need to survive forces people to band together in cooperative, interdependent communities. It's the same in education, where a lot of learning activities use collaborative methods to accomplish shared objectives more effectively.

One of the collaborative models widely used in higher education institutions in Indonesia today, particularly at BINUS University, is the PBL (Project-Based Learning) model. This approach is primarily applied in Character Building classes (Pancasila Ideology, Citizenship, Religion) and Language courses (Indonesian and English). The competencies aimed to be achieved through PBL, in line with BGA (BINUS Graduate Attributes), include initiative, growth mindset, teamwork, adaptability, and social awareness. This model requires the formation of small student groups consisting of 5–8 members (proportional to the total number of students in a class), fostering collaboration among group members to achieve common goals. Collaboration is particularly emphasized, as active interaction within teamwork is expected to help achieve the main goal of PBL: addressing one of the 17 issues promoted by the SDGs (Sustainable Development Goals). In this study, the number of respondents was 126 students, divided into four classes: LA34, LF11, and LA52, which are CB Citizenship classes, and LZ28, which is a CB Religion class.

The PBL model provides lecturers with broad opportunities to manage learning by incorporating student project work. As previously stated, the main theme chosen by students as a reference for group work must align with one of the seventeen (17) themes of the SDGs. In its discussion, locally rooted issues must be connected to the materials and values taught in Character Building classes. This learning model utilizes project assignments or field activities as the primary means to achieve competencies in knowledge, attitude, and skills (psychomotor abilities). Students, working as a group, are required to collaborate in problem-solving by applying research, analysis, creation, and presentation skills to produce learning products based on real-world experiences outside the campus (Fathurrohman, 2015). In line with Fathurrohman, Martinis (2013, 2013) stated that this learning model aims to develop analytical skills in each student or learner. Anafiza & Djukri (2017) stated that even their critical thinking skills can improve. Wena (2009), Wahyu (2016), and Jusita (2019) mentioned that PBL is an innovative learning model that places greater emphasis on contextual learning through complex activities. The focus of learning in PBL lies in the core principles and concepts of a discipline, involving learners in problem-solving investigations and other meaningful tasks, giving them the opportunity to construct their own knowledge. PBL has great potential to provide a more engaging and meaningful learning experience for students. Classroom collaboration in PBL enables teachers and students to share a discovery process (Wentworth & Davis, 2002). In PBL, lecturers set time limits and constraints for project development. The lecturer continuously encourages the performance of student groups, and after the project is completed, provides feedback in the form of an assessment, which includes a product presentation by students. This presentation covers the production process, and the results or solutions generated through the project. At BINUS University, the PBL presentation format is delivered in the form of a scientific report and a short video lasting 3-5 minutes.

According to Wena (2009), Nafiah and Suyanto (2014), Khotimah and Salimi (2017), the advantages of PBL include enhancing students' learning motivation, increasing their engagement, improving their skills, developing and practicing communication skills in cooperative work groups, and providing opportunities for students to organize projects. Through PBL, students are expected to deepen their understanding of the material and apply what they have learned. Empirical studies on the implementation of PBL show that it can improve learning outcomes, particularly in the cognitive domain, as well as in the affective and psychomotor domains. Active student involvement in learning enhances their comprehension of the meaning of education (Soraya and Purnomo, 2019).

Team dysfunction

In a team, several factors, both directly and indirectly, influence its success in achieving the required graduation competency standards, including engagement (Siregar & Pane, 2024). Engagement is one of the key elements needed to ensure effective group collaboration. A study by Setyawan and Arifin (2018) found that effective communication is a crucial factor affecting team performance. Teams with effective communication tend to be more productive and achieve their goals more efficiently. The same study also found that effective communication helps reduce confusion and enhance work efficiency within a team.

Another study conducted by Sharif and Scandura (2014) showed that strong leadership can improve team performance. Their research found that good leadership motivates team members, facilitates coordination among them, and aids effective decision-making. The study highlighted that effective leadership plays a vital role in shaping a successful team. Leadership's central role is also described in Tuckman's Stage Model. Tuckman, as cited in Siregar et al. (2018), noted that leaderless discussion groups tend to go through four distinct phases: forming, storming, norming, and performing. Teams do not become highly effective until they reach the performing stage. This model provides guidance for leaders to help groups transition through these phases.

Meanwhile, research by Nuraeni et al. (2020) indicates that trust among team members can improve overall team performance. The study shows that mutual trust helps build harmonious working relationships, increases motivation, and enhances collaboration within the team. In addition to these factors, clear task assignments, organizational support, and individual team members' capabilities also influence team performance. A study by Wang et al. (2021, 2021) found that clear tasks improve both team effectiveness and individual performance. Their research also revealed that organizational support fosters trust among team members and helps reduce conflicts within the team.

Hackman (2002) developed a research-based model for designing and managing work groups. His study examined the reasons behind the success of certain teams and identified key factors contributing to their effectiveness. He found that successful teams share three attributes: they meet the needs of both internal and external clients, they cultivate the ability to excel in the future, and team members find meaning and satisfaction within the group. Hackman further expanded his research to pinpoint conditions that enhance a team's chances of success. He introduced what he called the 'Five-Factor Model,' consisting of the following elements: Being a Real Team, Compelling Direction, Enabling Structure, Supportive Context, and Expert Coaching.

Pic. 1: Hackman's 5 Factor Model

Factor 1 - Being a Real Team. What does Hackman mean by 'being a real team'? He identifies key elements necessary to ensure that a team is genuine: members share a common task, team boundaries clearly define who is included or excluded, and team membership remains stable. Instability within a team—such as sudden changes in team members—can disrupt performance. A quick induction process for new members is the recommended solution.

Factor 2 - Compelling Direction. The second factor of this model involves providing your team with a compelling direction. This means setting clear, challenging, and impactful goals. Effective goal setting follows the SMART criteria: Specific, Measurable, Attainable, Relevant, and Time-Bound.

Factor 3 - Enabling Structure. The structure in which your team operates is another critical factor Hackman identifies for success. Some aspects of this structure will be within your control, while others will be shaped by the organization and your role within it.

Factor 4 - Supportive Context. A supportive context is crucial for fostering successful teams. Organizations consist of smaller groups that, when integrated effectively, contribute to the broader entity. Providing adequate support ensures cohesion and efficiency.

Factor 5 - Expert Coaching. The final component of Hackman's Five-Factor Model is expert coaching and mentoring. Through regular performance evaluations and day-to-day team management, leaders can identify members who need assistance with tasks or require guidance in developing interpersonal skills.

Unlike Hackman, who identified five positive factors essential for team success, Lencioni (2002, 2009) instead outlined five negative indicators that can lead to failure in achieving success. Although their approaches differ, both aim to guide teams toward effectiveness. Lencioni's theory, known as *Lencioni's Five Dysfunctions of a Team*, was named after his book's original title upon publication. Lencioni developed a team performance model that highlights five dysfunctions: (a) Absence of trust (b) Fear of conflict (c) Lack of commitment (d) Avoidance of accountability (e) Inattention to results. His framework focuses on identifying and overcoming these dysfunctions to build cohesive and high-performing teams.

Pic. 2: Lencioni's 5 team Dysfunctions

Dysfunction 1: Absence of trust. The fear of being vulnerable with team members prevents the building of trust within the team. Absence of trust is the basis for building a work team. Without the basis of mutual trust, the team cannot continue to work together towards success.

Dysfunction 2: Fear of conflict. The desire to preserve artificial harmony stifles the occurrence of productive, ideological conflict.

Dysfunction 3: Lack of commitment. The lack of clarity or buy-in prevents team members from making decisions they will stick to.

Dysfunction 4: Avoidance of accountability. The need to avoid interpersonal discomfort prevents team members from holding one another accountable for their behaviors and performance.

Dysfunction 5: Inattention to results. The pursuit of individual goals and personal status erodes the focus on collective success.

It can be concluded that factors such as communication, leadership, collaboration, responsibility, commitment, concern for shared goals, and trust among team members have a significant positive impact on team performance. Additionally, clear task assignments and organizational support also influence team effectiveness.

Regarding PBL and teamwork issues, one of the recurring problems in student work groups is team dysfunction. Each semester, team dysfunction emerges, leading to unsatisfactory PBL competency achievement, with student outcomes falling below graduation competency standards. Therefore, the key question this study aims to answer is: What factors contribute to team dysfunction, and how can these issues be addressed? The primary theoretical foundation for this research is Lencioni's The Five Dysfunctions of a Team.

Method

The researcher used three methods to examine the problems faced: Firstly, The Interview Method. The interview method was conducted randomly on groups presenting proposals with the lowest scores from each class where the author teaches. There are four classes being taught: LA34, LF11, LA52, and LZ28, all of which are Character Building classes. Through this method, the researcher aims to identify issues related to project activities, particularly problems in team collaboration. Secondly, Literature Studies. This method is used as a theoretical foundation to strengthen the researcher's argument regarding the team collaboration issues encountered. The basic theory utilized in this research is the five dysfunctions of a team, as proposed by Patrick Lencioni.

And thirdly, The Questionnaire Method. This method utilizes an online format via Google Forms with calculations based on the Likert scale (scale 1-5: 1-Never, 2-Rarely, 3-Sometimes, 4-Usually, 5-Always). There were 126 students involved as respondents with 38 total questions all asked to identify the types of dysfunctions that occur in a team: Dysfunction Trust, Conflict and Result with 8 questions each, and dysfunction Commitment and Accountability with 7 questions each. All the questions asked were positive. Thus, the larger the calculation of the number of numbers based on the Likert scale, the smaller the picture of dysfunction that occurs in a team due to a factor.

The questionnaire method used in this study aims to obtain a description of the results from the treatment previously provided in general for all student groups across four classes. The treatment involved delivering an introductory lecture on the five dysfunctions of a team before presenting the main material in a session. Additionally, the treatment was conducted randomly during group mentoring sessions when students participated in Focus Group Discussions within their respective groups during class learning activities.

Results and Discussion

There is one group from each class with the lowest scores during their proposal presentations: groups with codes T3 (LZ28), T8 (LF11), T3 (LA34), and T7 (LA57). Each group was asked the same question: What challenges did they face in group collaboration that caused their presentation results to be unsatisfactory (below the standard score of 75)? Group T3 (LZ28) answered that the causes were distrust and lack of commitment; Group T8 (LF11) mentioned obstructed communication and reluctance to engage in conflict; Group T3 (LA34) cited weak leadership and inattention to results; and Group T7 (LA57) identified avoidance of accountability and inattention to results.

Why is a team dysfunctional? Driskell et al. (1987, 2006, 2013) state that a team requires good team players, often defined in terms of qualities; that is, they are described as reliable, flexible, or cooperative. In other words, team effectiveness is influenced by the personalities of its members. In addition to individual personalities, Driskell et al. (2010) mention that the team's collective goal and its consistency in achieving that goal are also indicators of effectiveness. The factors influencing productivity and result in a teamwork according to Setiyanti (2012) and Purba (2013) are trust, openness, self-actualization, interdependence, clear goals and direction, good leadership, and tasks that align with teamwork. Meanwhile, Zaky (2023) and Siregar et al. (2018) show that factors such as effective communication, good leadership, and trust among team members have a significant positive influence on team performance. Trust in team member also significantly impacts both team performance and collective efficacy (Chuang, Chou & Yeh, 2004). Mohanvel (2024) stated that by combining task-based execution with creative thinking, a clearer vision and more defined actions emerge, ultimately leading to successful outcomes. Wang (2018) emphasizes the importance of healthy interaction in the team process, from input, process to output. Therefore, Zaky (2023) proposed human resource management to guarantee effective team performance. According to Lencioni (2002, 2009), a team consists of individuals with diverse interests, strengths, and weaknesses. If a team does not exhibit strong and efficient collaboration, dysfunction can occur. According to Lencioni (2005) and Pane et al. (2018), there are five dysfunctions within a team, structured in a pyramid pattern similar to Maslow's hierarchy. Lencioni argues that if a team is unable to resolve an issue at the lowest level (absence of trust), then the issues at the subsequent levels—and ultimately at the peak of the pyramid (inattention to results)—will not be resolved. Therefore, it is important to understand the levels of each dysfunction and how to address them.

Absence of Trust. This occurs when each team member feels uncomfortable and is unwilling to appear vulnerable. A lack of trust among members causes individuals to try to appear strong, which prevents the team from evolving and improving. When trust is absent, team members tend to cover for one another's shortcomings and mistakes, are unwilling to ask for help or advice, hesitate to offer assistance beyond their responsibilities, are reluctant to provide feedback or praise a colleague's skills, and often dislike meetings—avoiding time together as a team.

To overcome this, the team should focus on each member's strengths rather than their weaknesses. When every member has a clear understanding of their own strengths, it can boost individual self-confidence and make it easier for them to reveal their vulnerabilities. Engaging in discussions about each member's strengths can encourage the team to recognize and appreciate one another's positive qualities.

Fear of Conflict. This occurs when each member avoids constructive debate in order to achieve a false sense of harmony. The diversity within a team can offer positive contributions; however, if every member who holds differing opinions or perspectives is too afraid to express their views out of fear of conflict, those benefits cannot be realized. The fear of conflict can lead to hesitation in voicing opinions and concerns, as well as the neglect of topics that might spark conflict—even if addressing those topics could ultimately determine the team's success. This avoidance may also result in increased interpersonal and personal conflicts, along with the emergence of covert communication channels and behind-the-scenes politicking.

To overcome this challenge, designate a devil's advocate in every team meeting—a person tasked with identifying the flaws in each proposal. This encourages every member to defend and uphold their standpoint. Additionally, listing out all the pros and cons of each proposal can help the team grasp the bigger picture. This process demonstrates that expressing differing opinions, even if they are conflicting, can yield positive outcomes for the team.

Lack of commitment. This occurs when members merely pretend to agree with a decision within the group while they actually disagree. This can create ambiguity and misalignment within the organization. It usually happens because teams avoid open discussions about topics that might spark conflict, resulting in a lack of clear understanding regarding the rationale behind a decision and preventing members from fully committing to its implementation. When there is a general lack of commitment among team members, it leads to a decrease in self-confidence—both individually and collectively—and nurtures a fear of failure. This shortfall can also result in repetitive discussions on the same topic, generating ambiguity and speculative guesswork, as well as causing missed opportunities due to excessive time spent on decision-making.

To overcome this, teams can establish a rule that in every meeting, important decisions should be summarized along with the reasons behind them. Additionally, each decision must be clearly outlined in terms of the associated tasks and deadlines, as task clarity forms the foundation for members' commitment.

Avoidance of Accountability. This occurs when team members shy away from their responsibility to address unproductive behaviours exhibited by colleagues or supervisors. Typically, individuals tend to focus solely on their own responsibilities and actions, avoiding involvement in others' matters. However, this approach is counterproductive for the team because the outcomes rely on the performance of all members. Therefore, it is crucial for each member to maintain accountability for both them and their colleagues when making decisions and taking action.

To address this issue, teams can implement regular progress reviews and offer rewards for team achievements rather than individual accomplishments. When team members hold each other accountable, they can more easily identify potential problems and determine the necessary actions to resolve them. Moreover, this practice encourages mutual respect among team members and helps prevent overly detailed supervision from leaders, commonly known as micromanaging.

Inattention to results. This occurs when the team only focuses on individual gratification and personal success, status,

and ego rather than on the success of the team. This dysfunction arises when individuals concentrate solely on their own achievements and status instead of the collective results of the team. Such a focus could lead the team to fail to improve, lose its focus on achieving the collective goal, and even lose members who are committed to the team's success.

To overcome this, it is necessary to clearly define the criteria for evaluating the team's results. When the team knows how to hold one another accountable, they can effectively encourage each other in reaching shared goals. If a member desires individual recognition, an approach can be implemented to ensure that that individual's goals are aligned with the team's shared objectives.

After the teaching process on the factors causing team dysfunction and mentoring through FGD (Focus Group Discussion) activities conducted during classroom lectures, the following results were obtained:

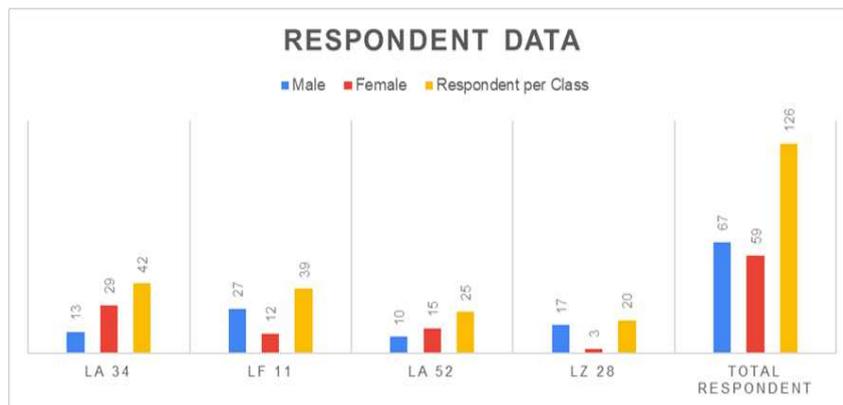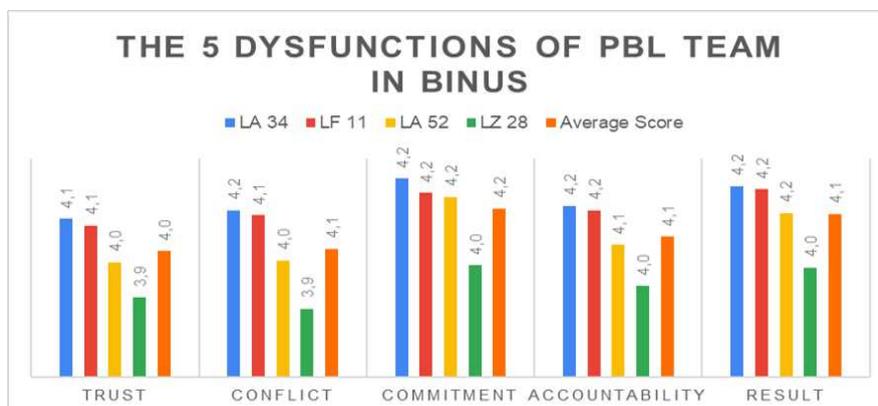Table 1: Respondent data in the study

Table 1 shows the total number of respondents is 126 (67 males, 59 females), consisting of 4 classes:
- LA34: 13 males, 29 females (subtotal: 42)
- LF11: 27 males, 12 females (subtotal: 39)
- LA52: 10 males, 15 females (subtotal: 25)
- LZ28: 17 males, 3 females (subtotal: 20)

Table 2: Final team collaboration score after the treatment process.

The graph in the second table shows that team collaboration in all classes (LA34, LF11, LA52, and LZ28) has been running well after the treatment process, with an average score index of 4.0 - 4.2 on the Likert scale (1-5).

Team effectiveness after the treatment process is supported by verbatim interview data from the student groups that received the lowest scores during the PBL proposal presentations:

Code T3 (LZ28): Previously answered, "The cause is distrust and lack of commitment." After the treatment process, they stated, "Trust among us grew after we communicated more intensively and developed a shared commitment to complete the project tasks we had agreed upon."

Code T8 (LF11): Previously mentioned that their team's challenges obstructed communication and reluctance to engage in conflict. However, after the treatment process, this group admitted that they have become more open with one another, even though verbal debates still occurred a few times. One group member even said, "I feel more at ease after speaking frankly."

Code T3 (LA34): Previously indicated that their team dysfunction was due to weak leadership and inattention to results. After the treatment process, they revealed that trust among them increased, and they tried to value the leadership of their team leader. They realized that trust in the team leader's performance and the importance of achieving the best results are the primary focuses that must be pursued until the project tasks are completed. One team member remarked, "I was initially disappointed and thought we had chosen the wrong team leader. However, I then realized that our team had limited time and needed to keep moving forward. So, we decided together to support each other."

Code T7 (LA57): Avoidance of accountability and inattention to results. The group acknowledged that there was a tendency for members to rely on one another. They also admitted that they did not sufficiently appreciate each other's performance and rarely recognized the achievements of team members. After the treatment process, they improved their performance by carrying out tasks in accordance with the responsibilities that had been agreed upon beforehand. One of the members testified, "I was actually very busy with assignments for other courses. But then I realized that if I persisted with my own style, this team would not function effectively. And I did not want the outcome to be poor."

Conclusion

According to Lencioni, there are five factors that cause team dysfunction: lack of trust among team members, fear of conflict, lack of commitment, avoidance of accountability, and inattention to results. The analysis conducted by the researcher on the BINUS student community found that the factors mentioned in Lencioni's theory occur in an intertwined manner. In other words, these factors are not evenly distributed across every PBL team but appear sporadically among the teams studied. In one group, the researcher found dysfunctions that differed from those in another group.

This study focuses on identifying patterns of dysfunction within teams, with special attention given to those teams

that scored the lowest during the PBL proposal presentations. Based on the initial survey, one group from each class was found to have the lowest score (below 75) when presenting their proposal in class.

From the initial interviews conducted at the start of this study, several dysfunctions were identified in the teams targeted for research: T3 (LA34), T8 (LF11), T7 (LA52), and T3 (LZ28). The identified dysfunctions were then addressed through treatment sessions via FGDs held during the lectures before mid-semester. After the treatment process, the results of the Likert-scale questionnaire administered to 126 respondents—including those problematic teams—indicated that team collaboration in BINUS PBL had improved.

Recommendation

Several recommendations are offered based on the research findings:

In PBL (Problem-Based Learning), lecturers can allow students to form their own project work groups to reduce the likelihood of team dysfunction.

Contextual models, such as small group discussions following the FGD (Focus Group Discussion) pattern in teamwork supported by interactive activities and tools, can be selected to enhance students' academic achievements. In this regard, previous studies can be considered to guide similar future research.

To improve the effectiveness of PBL, BINUS University and other universities need to encourage lecturers to conduct classroom action research.

Acknowledgements or Notes

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Students' Moral Evaluations of Acts of Academic Dishonesty in Online Learning

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Abstract: Online learning has become an essential mode of education, but it remains vulnerable to academic dishonesty. While previous research has established a connection between student engagement and moral evaluations of dishonest behavior in face-to-face settings, few studies have explored how students assess different forms of dishonesty in online learning environments. This study aims to fill this gap by examining undergraduate students' moral evaluations of academic dishonesty in an online context. A total of 1,547 students from a private higher education institution in the Philippines participated, selected through proportionate stratified random sampling based on sex, year level, and school. Descriptive statistics were used to evaluate overall moral assessments, while the Mann-Whitney U Test and Kruskal-Wallis Test were employed to identify demographic differences. The results indicated that students generally view academic dishonesty, including cheating, contract cheating, and plagiarism, as morally wrong in online learning. However, the evaluations varied inconsistently by sex, school, and year level. Based on these findings, academic institutions should prioritize consistent education on cheating, contract cheating, and plagiarism in online learning. It is essential to ensure uniform delivery of this information across schools and departments, while also implementing effective, institution-wide strategies to promote academic integrity.

Keywords: Online Learning, Moral Evaluation, Cheating, Contract Cheating, Plagiarism

Introduction

Even before the outbreak of the coronavirus disease in 2019, online learning had already been introduced as an option

for conducting classes in higher education institutions (Jatmika et al., 2022; Ichiro & Noviyanti, 2022; Kopylova, 2020). However, the pandemic forced colleges and universities worldwide to shift to online learning due to the restrictions imposed (Amzalag et al., 2021; Chen et al., 2020; Doz & Doz, 2023; Hasri et al., 2022; Guzoglu, 2024; Kara, 2021; Kibici & Sarıkaya, 2021; Kilincer, 2021; Lampropoulos & Admiraal, 2023; Samyan & St Flour, 2021; Shaaban, 2023; Terneus & Low, 2024). This modality involves using internet-connected devices to deliver instructions and facilitate assessments (Chiang, Zhu, & Yu, 2022; Dhull & Dhull, 2022; Bucata & Babos, 2023; Benito & Camral, 2023). With its numerous advantages, academic institutions began to view online learning not just as a temporary solution to the challenges posed by the pandemic, but as a necessity in contemporary education (Dhawan, 2020). Although the pandemic has receded, online learning remains widely utilized (Al-Abnaneh et al., 2021), especially during natural and man-made calamities (Mykhalo, Evgen, & Yanina, 2022), solidifying its role as an essential component of modern education. Compared to traditional learning methods, online learning offers flexibility and convenience (Syarafina, 2021; Mohammad, 2022; Rawashdeh et al., 2021), allowing lectures and assessments to be conducted at any time and place. Despite its advantages, significant concerns have emerged, one of which is academic dishonesty (Putra et al., 2023; Paullet et al., 2016; Thomas, 2021). The internet has made information access more convenient (Sevnarayan & Maphoto, 2024), facilitating technologically aided cheating practices (Chiang, Zhu, & Yu, 2022; Paulet, 2020; Bilen & Matros, 2021), and providing students with more opportunities to engage in acts of academic dishonesty. For example, students can use social media to collaborate on assignments that are meant to be completed individually or browse online sites offering academic writing services to complete assessments on their behalf.

Academic dishonesty typically involves individuals engaging in acts, often outlined in student handbooks, to gain an unfair academic advantage (Benson, Rodier, Enström, & Bocatto, 2019; Rodriguez, Guerrero-Roldan, Banares, & Noguera, 2021). These acts are commonly classified as cheating, plagiarism, and contract cheating. While the term "cheating" is often used interchangeably with academic dishonesty (Verhoef & Coetser, 2021; Waltzer, Samuelson, & Dahl, 2022), this study defines cheating as either an intentional or unintentional act that provides an unfair advantage during examinations and assessments. Cheating behaviors include sharing answers, copying answers, using notes during exams, and providing false justifications for tardiness or absences during exams. Plagiarism, on the other hand, refers to the deliberate or unintentional use of someone else's ideas or work without proper acknowledgment (Prashar, Gupta, & Dwivedi, 2023), such as copying text or poorly paraphrasing others' work (Adzima, 2020). Lastly, contract cheating is a form of intentional academic misconduct (Eaton & Dressler, 2019), where a student submits work completed by someone else, either for a fee or free of charge (Harper et al., 2019).

Although these definitions apply to both face-to-face and online settings, the excessive reliance on the internet and technological advances in online learning create distinct challenges. In online learning, students can easily communicate with one another via various websites, applications, and devices. With the abundance of information available on the internet, students can quickly copy, paste, and download content without properly crediting the source. The rapid development of generative artificial intelligence has further complicated the issue of plagiarism (Cotton, Cotton, & Shipway, 2023). Moreover, the absence of foolproof mechanisms in online learning to ensure that students complete their own assessments has contributed to the rise of contract cheating. This issue is exacerbated by the numerous websites and companies, promoted on social media platforms, that offer to complete assessments on

behalf of students. While some studies suggest that online learning has increased incidents of academic dishonesty (San Jose, 2022; Aguilar, 2021; Gutierrez & Padagas, 2019), there is no consensus on whether online learning is directly related to the increase in such behavior. Some studies argue that no such relationship exists (Harris, Harrison, McNally, & Ford, 2020).

The decision to engage in academic dishonesty is believed to be linked to an individual's evaluation of the act (Prashar, Gupta, & Dwivedi, 2023; Waltzer & Dahl, 2021, 2022). As suggested by Otaye-Ebede, Shaffakat, & Foster (2020) and Wood & Bandura (1989), social cognitive theory posits that ethical judgments influence ethical behavior, meaning that students' moral evaluations likely guide their actions. This view is supported by Prashar, Gupta, & Dwivedi (2023) and Waltzer & Dahl (2021), who found that a student's moral evaluation affects their engagement in plagiarism. Waltzer and Dahl (2022) also proposed a framework for situated decision-making on cheating, highlighting the importance of a student's evaluation in deciding whether to cheat. According to this framework, students who judge cheating as wrong are more likely to refrain from it, whereas those who perceive cheating as acceptable may lack sufficient reasons to avoid it. Ajzen & Fishbein (2005) and Turiel (2003), as referenced in Waltzer & Dahl (2022), also emphasize the close relationship between evaluations and decisions. It is essential to recognize that students' evaluations of academic dishonesty play a crucial role in understanding their engagement in such behaviors. While previous studies have established a link between students' evaluations and their actions, few have specifically focused on students' evaluations alone. Moreover, research on evaluations has often been limited to face-to-face learning contexts or plagiarism. This study aims to address this gap by examining students' evaluations of various acts of academic dishonesty in the context of online learning. Additionally, assuming that sex, year level, and degree program influence students' involvement in academic dishonesty, this study also explores whether these factors are related to students' moral evaluations. The study seeks to answer the following research questions:

- What are students' moral evaluations of cheating, plagiarism, and contract cheating in online learning?
- Is there a significant difference in respondents' moral evaluations of cheating, plagiarism, and contract cheating based on sex, year level, and the school corresponding to their degree program?

Method

Participants

Even after the global pandemic, Philippine higher education institutions have continued to utilize online learning for instruction delivery and assessment, particularly during extreme weather conditions. For this study, 1,547 undergraduate students from a private higher education institution in the Philippines were surveyed. To ensure that the sample accurately reflected the diversity of the population in terms of sex, year level, and school, a proportionate stratified random sampling method was used. The Raosoft Sample Calculator was employed to determine the required sample size, which indicated a minimum of 355 respondents.

Of the respondents, 40.3% were male and 59.7% were female. In terms of year level, 32.3% were first-year students, 31% were second-year students, 29.4% were third-year students, and 7.4% were fourth-year students. Regarding the schools where the students' degree programs are clustered, 30.5% were from the School of Arts and Sciences, 32%

from the School of Engineering and Architecture, 26.6% from the School of Tourism, Business, and Management, and 10.9% from the School of Computer Studies.

Instrument

A researcher-made survey questionnaire was employed in the study. The questionnaire included questions about the respondents' demographic profiles (sex, year level, school) and their moral evaluations of various acts of academic dishonesty in online learning. The items related to academic dishonesty were grouped into three categories: cheating, contract cheating, and plagiarism, all within the context of online learning. To assess the clarity and appropriateness of the survey items, the questionnaire was pilot-tested on 30 individuals who were not part of the main sample. The reliability of the instrument was evaluated using Cronbach's alpha coefficient. The reliability analysis yielded a Cronbach's alpha (α) of 0.837, indicating acceptable internal consistency. This result confirms that the items are reliable and effectively measure their intended constructs.

Data Gathering

The researchers began by seeking approval from the University's Ethics Review Committee before initiating data collection. Following approval, they requested permission from the university directors to conduct an online survey using Microsoft Forms with their students. Once the academic director and deans of each school granted approval, a link to the online survey was sent to the teachers, who were asked to distribute it to their students. The first part of the survey included a detailed narrative outlining the voluntary nature of participation and addressing other relevant ethical considerations. Respondents were assured that their participation would not affect them academically or personally. The survey's first page emphasized the importance of confidentiality and anonymity.

Data Analysis

Descriptive statistics, specifically the weighted and average mean, were used to determine respondents' moral evaluations of acts of academic dishonesty in online learning. The Mann-Whitney U Test was employed to assess whether respondents' moral evaluations of cheating, contract cheating, and plagiarism differed based on sex. Meanwhile, the Kruskal-Wallis Test was used to examine whether there were significant differences in respondents' moral evaluations when grouped by school and year level.

Results

Using descriptive data analysis, the results indicate that respondents' moral evaluations of acts of academic dishonesty in online learning received a high composite mean, suggesting that students viewed the items in Table 1 as morally wrong. Among the different categories, students' evaluations of contract cheating had the highest average mean, while those of cheating had the lowest. Of the items listed in Table 4, seeking help from classmates during individual assessments had the lowest weighted mean, indicating that students were uncertain about whether this act is morally wrong.

Table 1. Respondents' Moral Evaluations of Acts of Academic Dishonesty in Online Learning

	Weighted Mean	Verbal Interpretation
Cheating		
1. open your textbooks and notes and/or search on the internet during closed notes assessments?	2.77	Yes
2. seek help from your classmates during individual assessments?	2.07	Maybe
3. misrepresent reasons for late submissions or absences?	2.61	Yes
4. talk and share your answers with your classmates during exams?	2.81	Yes
5. post exams and activities to online forums or groups?	2.80	Yes
Average	**2.61**	**Yes**
Contract Cheating	**Weighted Mean**	**Verbal Interpretation**
6. submit an output that was completed by someone else on your behalf?	2.83	Yes
7. pay someone else to complete your assessments?	2.77	Yes
8. ask another person to attend the class and accomplish your assessments on your behalf?	2.82	Yes
Average	**2.81**	**Yes**
Plagiarism	**Weighted Mean**	**Verbal Interpretation**
9. copy and paste information from the internet without proper citation?	2.72	Yes
10. use AI-generated content without acknowledgement?	2.61	Yes
11. share recorded lectures, exam questions, or course materials on public online platforms without permission?	2.81	Yes
Average	**2.71**	**Yes**
Composite Mean	**2.71**	**Yes**

Legend: 2.50 – 3.00 = Yes; 1.50 – 2.49 = Maybe; and 1.00 – 1.49= No.

Table 2 shows that there were no significant differences in respondents' moral evaluations of cheating in online learning when grouped by sex or year level. However, a significant difference was found when respondents were grouped according to their school. Responses from male and female students had nearly identical mean ranks, and based on the Mann-Whitney U Test analysis, no significant difference was observed between their evaluations based on sex. On the other hand, the Kruskal-Wallis Test analysis revealed no significant differences in evaluations when grouped by year level. In contrast, significant differences were observed when respondents were grouped according to the school of their respective degree programs. Responses from fourth-year students had the highest mean rank, while third-year students had the lowest, indicating that fourth-year students were more likely to evaluate acts of cheating in online learning as morally wrong compared to their peers in lower years. In terms of school, students from the School of Accountancy, Business, and Management had the highest mean rank, suggesting that they were most likely to view acts of cheating in online learning as morally wrong.

Table 2. Significant Difference in Responses on Moral Evaluations of Acts of Cheating in Online Learning When Grouped According to Profile

Sex	Mean Rank	U-statistic*	p-value***	Interpretation
Male	774.65	287,568.50	0.961	Not significant
Female	773.56			
Year Level		Chi-Square**		
1st year	766.25			
2nd year	791.26	3.254	0.354	
3rd year	752.97			Not Significant
4th year	819.33			
School		Chi-Square**		
Arts and Sciences	698.61			
Accountancy, Business, and Management	815.93			
Engineering and Architecture	808.55	21.426	0.000	
Computer Studies	781.40			Significant

* Mann-Whitney U Test
** Kruskal-Wallis Test
***Legend: Significant at p-value < 0.05

Table 3 shows that there are no significant differences in respondents' moral evaluations of contract cheating in online learning when grouped according to their demographic profile.

Table 3. Significant Difference in Responses on Moral Evaluations of Acts of Contract Cheating in Online Learning When Grouped According to Profile.

Sex	Mean Rank	U-statistic*	p-value***	Interpretation
Male	766.73	283,439.00	0.478	Not significant
Female	778.92			
Year Level		Chi-Square**		
1st year	799.40			
2nd year	781.44	7.458	0.059	
3rd year	743.81			Not Significant
4th year	752.08			
School		Chi-Square**		
Arts and Sciences	747.22			
Accountancy, Business, and Management	787.87			
Engineering and Architecture	790.22	5.059	0.168	
Computer Studies	767.56			Not Significant

* Mann-Whitney U Test
** Kruskal-Wallis Test
***Legend: Significant at p-value < 0.05

Responses from female students had slightly higher mean ranks than those from male students, but based on the Mann-Whitney U Test analysis, no significant difference was found in their evaluations based on sex. A similar result was observed when respondents' evaluations were grouped according to year level and school, as indicated by the Kruskal-Wallis Test analysis. Responses from first-year students had the highest mean rank, suggesting that first-year

students are more likely to evaluate acts of contract cheating as morally wrong compared to those in other year levels. Additionally, students from the School of Engineering and Architecture had the highest mean rank, indicating that they are most likely to view acts of contract cheating in online learning as morally wrong.

Table 4 indicates significant differences in respondents' moral evaluations of acts of plagiarism in online learning when grouped by sex and school. In contrast, no significant difference was found in their evaluations when grouped by year level. Based on the Mann-Whitney U Test analysis, there is a significant difference in students' moral evaluations when grouped by sex. Specifically, female students had a higher mean rank than male students, suggesting that female students are more likely to view acts of plagiarism as morally wrong. According to the Kruskal-Wallis Test analysis, there is also a significant difference in students' evaluations when grouped by school. However, no significant difference was observed when evaluations were grouped by year level. Second-year students had the highest mean rank, indicating that they are more likely to evaluate acts of plagiarism as morally wrong compared to students in other year levels. In terms of school, students from the School of Accountancy, Business, and Management had the highest mean rank, suggesting that they are most likely to view acts of plagiarism as morally wrong compared to students from other schools.

Table 4. Significant Difference in Responses on Moral Evaluation on Acts of Plagiarism in Online Learning When Grouped According to Profile

Sex	Mean Rank	U-statistic*	p-value***	Interpretation
Male	730.54	260,854.00	0.000	Significant
Female	803.38			
Year Level		Chi-Square**		
1st year	775.16	6.233	0.101	Not Significant
2nd year	805.75			
3rd year	750.63			
4th year	728.81			
School		Chi-Square**		
Arts and Sciences	771.25			
Accountancy, Business, and Management	793.75	8.381	0.039	Significant
Engineering and Architecture	787.11			
Computer Studies	695.25			

* *Mann-Whitney U Test*
** *Kruskal-Wallis Test*
****Legend: Significant at p-value < 0.05*

Discussion

The results of this study indicate that undergraduate students generally evaluated acts of academic dishonesty, classified into cheating, contract cheating, and plagiarism in online learning, as morally wrong. These acts align with

those commonly recognized by higher education institutions worldwide and are consistent with findings from previous studies. Specifically, the results support the work of Waltzer & Dahl (2021, 2022), whose studies also revealed that students consider acts of cheating to be wrong. However, despite the general consensus that academic dishonesty is wrong, it is important to examine the specific acts within cheating, contract cheating, and plagiarism that students may not necessarily evaluate as wrong. The study's findings showed that undergraduate students were uncertain about whether seeking help from classmates during individual assessments is wrong. This uncertainty further supports Waltzer and Dahl's situated decision-making framework for cheating, which suggests that there are circumstances where cheating is clearly perceived as wrong by students, while in other situations, students may either view it differently or remain uncertain.

When grouped by sex, the results indicated that there were no significant differences in students' evaluations of cheating and contract cheating. This finding aligns with the studies by Hasri, Supar, Azman, Sharip, and Yamin (2022), Salehi and Gholampour (2021), and Yazici, Durak, Dunya, and Senturk (2022), which also reported no significant differences between male and female students in their attitudes and behaviors toward academic dishonesty in online learning. According to Prashar, Gupta, and Dwivedi (2023), gender differences in moral evaluations may not exist when students are primarily guided by social or cultural norms and implicit social duties. This may explain the similarity in evaluations, as students are likely aware of and adhere to their university's policies on cheating and contract cheating in online learning. In contrast, a significant difference was observed in the students' evaluations of plagiarism. These findings are consistent with the results of Chala (2021), which showed that females tend to have more ethical attitudes toward academic dishonesty compared to males. A possible explanation is that, when it comes to plagiarism in online learning, students may rely more on their own moral norms and values. Roxas and Stoneback (2004) and studies by Prashar, Gupta, and Dwivedi (2023) and Zhou, Zheng, and Gao (2019) support this notion, suggesting that males and females differ in their moral orientations, values, and traits, leading to distinct moral evaluations. Furthermore, Gilligan's theory of moral judgment suggests that women tend to approach morality differently than men, as highlighted in Crocetti, Moscatelli, Kaniušonytė, and Rubini (2019), which emphasizes gender differences in moral reasoning.

Lastly, the study found a significant difference in students' evaluations of acts of cheating and plagiarism in online learning when grouped by the school to which their degree program belongs. These findings are somewhat aligned with those of Yazici, Durak, Dunya, and Senturk (2022) and Chala (2021), which indicated that attitudes and behaviors toward academic dishonesty vary by academic discipline or college. However, no significant differences were found in students' evaluations of contract cheating when grouped by school, which aligns with Kayisoglu and Temel's (2017) study, showing that the department a student belongs to does not significantly influence their attitudes. The mixed results may be explained through Lind's dual-aspect theory of moral behavior and development (Lind, 2008), which posits that moral principles are influenced by both affective and cognitive dimensions. The cognitive dimension, according to Lajčiaková (2013), refers to the knowledge and information provided by society, and universities are primary sources of such knowledge. This information can vary depending on the field of study or academic discipline, which may explain the significant difference in moral evaluations when students are grouped by school.

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Conclusion

This study demonstrates that students generally view acts of academic dishonesty in online learning as morally wrong. However, mixed results were found regarding significant differences in students' evaluations of cheating, contract cheating, and plagiarism when categorized by their demographic profiles. Academic institutions should continue their efforts to educate students on the various actions and situations that constitute cheating, contract cheating, and plagiarism in online learning. Furthermore, it is crucial to provide consistent information across different schools and departments. Effective mechanisms to raise awareness of academic dishonesty and promote academic integrity should be implemented uniformly across all schools, departments, and colleges within the university.

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β-glucosidase Activity in Soil Containing *Fusarium oxysporum* **f.sp.** *cubense* (*Foc*) Planted with Cover Crops in Greenhouse and Field Settings

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Abstract: Cavendish banana production in the Philippines is increasingly threatened by *Fusarium* oxysporum f. sp. *cubense* (*Foc*), the causative agent of Fusarium wilt. Enhancing soil microbial activity using cover crops has shown potential in suppressing this pathogen. This study assessed microbial activity by measuring β-glucosidase activity in µg pNP g⁻¹ soil h⁻¹ under both greenhouse and field conditions. Data were analyzed using parametric and non-parametric tests. In the greenhouse, treatments with cover crops showed significantly higher enzymatic activity than those without. *Ipomoea batatas* notably increased β-glucosidase activity, both alone and in combination with other species. Leguminous cover crops like *Arachis pintoi* and *Calopogonium mucunoides* enhanced enzyme activity when intercropping with non-leguminous plants. In the field setting, treatment effects were not statistically significant, but time of sampling had a significant influence. Significant differences were observed between Collection 1 and Collection 2, and Collection 2 and Collection 3, but not between Collection 1 and Collection 3. These findings suggest that specific cover crops can enhance soil microbial function and potentially reduce the impact of Fusarium wilt. While greenhouse results were more pronounced, field data underscore the importance of timing in evaluating soil biological activity.

Keywords: Fusarium oxysporum f.sp. cubense (Foc), β-glucosidase, Cover crops, Greenhouse Setting, Field Setting

Introduction

The Philippines remains one of the top exporters of Cavendish bananas in Asia and one of the leading producers in the world. Despite its economic significance, Cavendish banana production in the country faces increasing threats from destructive plant diseases (Corcolon, 2024). One of the most severe challenges is *Fusarium oxysporum* f. sp. *cubense* Tropical Race 4 (*Foc* TR4), a highly persistent soil-borne pathogen responsible for Fusarium wilt. This disease invades the vascular system of the plant, leading to yellowing, wilting, and eventual death, and can survive in soil for decades. Due to its resilience, *Foc* TR4 has proven extremely difficult to manage, resulting in declining

production areas and forcing many farmers to abandon infected fields or shift to alternative crops (Nozawa et al., 2023).

According to official reports, the total land area planted with Cavendish bananas declined slightly to 84,328 hectares in 2022, which is a 0.6% decrease from the previous year (Corcolon, 2024). The Davao Region in Southern Philippines, home to most of the country's commercial banana plantations, is particularly affected. Most of these plantations are run by corporate growers who are members of the Pilipino Banana Growers and Exporters Association (PBGEA), with the remainder managed by independent farmers. The situation is further complicated by the emergence of *Fusarium mindanaoense,* a newly identified pathogen within the *Fusarium fujikuroi* species complex, which similarly infects Cavendish bananas to TR4. Although genetically distinct, this pathogen underscores the evolving nature of Fusarium wilt and highlights the urgent need for enhanced biosecurity, continued pathogen surveillance, and the development of resistant banana varieties (Nozawa et al., 2023).

Fusarium wilt has been classified into four recognized races based on host susceptibility (Daly, 2006). While the disease can cause considerable economic damage, it is generally regarded as a weak parasite that tends to infect nutrient-deficient or physiologically stressed banana plants. This highlights the importance of proper fertilization and soil health management (Cawoy et al., 2011). In response, researchers and farmers have explored alternative strategies such as the utilization of biological control agents and biofertilizers. For instance, Widyantoro and others (2020) demonstrated that certain microbial treatments—particularly *Streptomyces* and *Bacillus*—can significantly suppress Fusarium wilt, offering a more sustainable disease management approach.

Moreover, the incorporation of cover crops has gained attention for its potential to enhance soil health, reduce nitrate leaching, improve microbial activity, and suppress soil-borne pathogens. Despite widespread adoption of cover cropping in countries such as Kenya and other parts of Africa (Ngome, 2011), many banana growers in the Philippines remain hesitant due to the belief that cover crops may compete with bananas for nutrients and reduce yield. Nevertheless, cover crops such as *A. pintoi, C. mucunoides, I. batatas,* and *Axonopus compressus* are known to contribute positively to soil fertility, nitrogen fixation, and microbial activity (Widyantoro et al., 2020).

One key enzymatic indicator of soil health and microbial function is β-glucosidase, which plays an important role in cellulose degradation and carbon cycling. Preliminary tests from banana farms in Southern Mindanao revealed relatively low β-glucosidase activity, ranging from 19.4 µg pNP to 50 µg pNP g^{-1} soil h^{-1}, suggesting poor microbial function in many soils. This observation warrants further investigation into whether the strategic introduction of cover crops can help in improving and increasing enzymatic activity in the soil and, in turn, suppress *Foc* TR4.

Given the agricultural and economic importance of Cavendish banana farming in the Philippines, particularly in Southern Mindanao, sustainable management strategies are urgently needed. Conventional reliance on chemical control methods, including fungicides and synthetic fertilizers, poses risks to both the environment and farmers' health. Therefore, this study seeks to evaluate the effects of introducing cover crops and biocontrol agents on soil health, particularly by measuring β-glucosidase activity as a proxy for microbial activity. The outcomes aim to provide

an environmentally friendly and scientifically grounded framework for disease management and productivity enhancement in banana farms.

Objectives

The general objective of this study was to evaluate β-glucosidase enzyme activity, measured in µg pNP g^{-1} soil h^{-1}, in soils planted with various cover crops under greenhouse and field conditions. In the greenhouse setting, the study examined soils planted with different combinations of cover crops—*A. pintoi*, *C. mucunoides*, *I. batatas*, and *A. compressus*—organized as single, double, triple, and quadruple plantings. It aimed to quantify enzyme activity across these treatments, determine statistically significant differences, and assess the corresponding effect sizes to understand the influence of plant diversity on soil enzymatic function. In the field setting, the study assessed β-glucosidase activity in soils subjected to four treatments: (1) planting with *A. pintoi* alone, (2) application of biocontrol agents alone, (3) combination of *A. pintoi* and biocontrol agents, and (4) absence of cover crops. The research further aimed to evaluate significant differences and effect sizes among these treatments, as well as analyze changes in enzyme activity across collection periods by examining mean gains or losses over time.

Significance of the Study

This study is of critical importance due to the substantial contribution of Cavendish banana farming to the Philippine economy. Southern Mindanao is recognized as a major global supplier of export-quality Cavendish bananas, distributing to various markets across Asia and beyond. To maintain high production levels and mitigate the spread of *Foc* TR4 many farmers have relied heavily on chemical inputs such as fungicides and synthetic fertilizers. However, there are serious health and environmental concerns associated with these chemical-based interventions. In response, this study explored sustainable alternatives, specifically the utilization of cover crops and the introduction of biocontrol agents, as environmentally friendly strategies to promote soil health and enhance crop productivity in banana farming systems.

Furthermore, the adoption of cover cropping practices remains largely unexplored in banana farms across the Davao Region. This research introduced innovative agronomic approaches applicable to both small-scale and commercial banana plantations, offering practical insights into soil management. By identifying effective cover crop species suited to specific soil conditions, the study provides a valuable reference for banana growers in selecting appropriate plant combinations. Overall, the findings support the development of practices that are sustainable and aimed at improving farm resilience, lessening dependency on agrochemicals, and fostering long-term productivity in the Cavendish banana industry.

Method

Study Site Description

The study was carried out in two distinct settings: a greenhouse pot experiment at the University of Southeastern Philippines (USeP) in Barrio Obrero, Davao City, and a field trial at the Puyod Banana Farm located in Lasang, Davao

City. The greenhouse experiment was carried out at the USeP Obrero Campus, specifically at the greenhouse facility located near Gate 4, adjacent to the Planning Office—previously known as the Expanded Tertiary Education Equivalency and Accreditation Program or the ETEAAP Office. Conversely, the field experiment was conducted at the Puyod Banana Farm in Barangay Lacson, Lasang, Davao City, Philippines. The Puyod Farm spans approximately 300,000 square meters and the experimental site was established in Line 7, encompassing 5.7 hectares, and is characterized as being infected with *Foc* TR4, a known pathogen affecting banana production.

Greenhouse Pot Experiment Design

The pot experiment was carried out at the greenhouse facility of USeP, Obrero Campus. Soil samples used in the experiment were collected from areas verified to be free of *Foc* TR4, ensuring a pathogen-free baseline for the study. Four cover crop species were evaluated: *A. pintoi* or commonly known as Pinto peanut, *C. mucunoides* or commonly known as Calopo, *I. batatas* or commonly known as Ornamental sweet potato, and *A. compressus* or commonly known as Green frog grass. These cover crops were planted individually in 24 cm-diameter pots and tested in various combinations—pairs, triplets, and all four species combined—resulting in a total of 15 treatment groups. Additionally, four control groups were included, bringing the total number of treatments to 19. In total, 95 pots were prepared for the greenhouse experiment, with five replicates per treatment.

Each pot was planted with a newly propagated banana plant and subjected to its respective cover crop treatment. The pots were arranged randomly from left to right and labeled using designated codes to maintain experimental rigor. To facilitate the planting and observation of cover crops in specific spatial arrangements, each pot was divided into grid sections measuring approximately 2 square inches. These grid sections served as defined planting zones for the cover crops, whether grown singly or in combination. Control treatments involved the use of three cultivars of banana namely, Giant Cavendish Tissue Culture Variants known as GCTCV 218 and GCTCV 219—both inoculated with *Foc* TR4—and Grand Naine, with one group inoculated and another group uninoculated with *Foc* TR4. The greenhouse pot experiment was conducted over two months.

Field Experimental Design

The field experimental design followed a Randomized Complete Block Design (RCBD) to account for potential spatial variability across the field. Soil sampling was carried out by collecting samples from a depth of 10 cm from the surface of the soil and approximately 30 cm from the base of each banana plant. These samples were obtained at six-month intervals from designated farm plots to monitor soil conditions over time. This approach ensured that the temporal and spatial dynamics of soil microbial activity were adequately captured throughout the study period.

In the field setting, *A. pintoi* was selected as the cover crop due to its known benefits in suppressing pathogens and enhancing soil health. Additionally, Plant Growth-Promoting Bacteria (PGPB) and *Trichoderma harzianum* were applied as biological amendments to further improve plant resilience and soil microbial activity. A total of four treatments were established, each replicated five times across the experimental plots. This design ensured statistical robustness and allowed for meaningful comparisons among the treatments.

Soil Collection, Characterization, and Preparation

Soil samples were collected from each pot used in the greenhouse experiment. From each pot, four subsamples were randomly taken at approximately 5 cm depth and mixed thoroughly to form a representative composite sample, following the procedure outlined by Brzezińska and others (2001). The composite soil was then passed through a mesh sieve (2 mm) to remove debris and ensure homogeneity. A 1-gram portion of the sieved soil from each replicate was carefully weighed and transferred into a 50 mL centrifuge tube for laboratory analysis. All centrifuge tubes were properly labeled according to treatment and replicate for identification and traceability.

In the field experiment, 25 to 30 soil subsamples were collected per treatment. These were combined to form a single composite sample per treatment. From the composite, only 2 kilograms of soil were retained and processed. The retained composite samples were sieved using a 2 mm mesh to ensure consistency in texture and particle size. The sieved samples were then submitted to the laboratory for analysis, including β-glucosidase enzyme activity testing, which serves as a microbial activity indicator. Subsequently, a 1-gram aliquot from each replicate was weighed and placed in a 50 mL centrifuge tube, which was labeled appropriately to maintain sample integrity and facilitate accurate data recording.

β-glucosidase Enzyme Test

All reagents used for the laboratory assays were pre-prepared following the protocol by Lapis-Gaza and Pattison (2021). This involved accurately mixing and appropriately storing solutions such as PNG, Tween, buffers, and a stop solution. Each solution was clearly labeled for easy identification, and early preparation enhanced workflow while minimizing human error. Preparing reagents ahead of time also ensured uniformity across all replicates. Moreover, it reduced interruptions during experimental runs, supporting smooth and reliable data collection.

A standard curve for p-nitrophenol was established using six prepared solutions, adapted from McGrath et al. (2021). Absorbance readings at 410 nm were used to generate a linear calibration curve, allowing for accurate determination of p-nitrophenol concentrations and enzymatic activity in soil samples. This curve functioned as a baseline to consistently quantify β-glucosidase activity across treatments. Maintaining a strong linear relationship between absorbance and concentration was vital to the test's accuracy. Deviations from linearity could compromise enzyme activity estimates. Hence, data points were monitored for outliers, and multiple readings were performed to ensure dependable results.

Soil β-glucosidase activity was determined by measuring the release of p-nitrophenol from the PNG substrate. Samples were incubated with buffer, Tween, and PNG at 31°C for one hour. The reaction was stopped by adding a stop solution, followed by centrifugation. The supernatant's absorbance was then measured at 410 nm to quantify enzymatic activity. This process enabled the assessment of microbial function involved in carbon cycling. All samples were treated identically to ensure procedural consistency. The Time 60 reading captured the endpoint of enzyme activity. This provided a dependable estimate of microbial activity affected by different cover crop treatments (adapted from the study of Lapis-Gaza and Pattison, 2021).

To eliminate background absorbance, a control lacking the PNG substrate was prepared and handled the same way as test samples. The absorbance at 410 nm ("Time 0") was subtracted from the final ("Time 60") reading to correct for non-enzymatic color development. This ensured a more accurate estimation of true enzyme activity. Differentiating between actual enzymatic action and other reactions or soil coloration was crucial. Using parallel controls confirmed that only p-nitrophenol resulting from β-glucosidase was measured. Consistent incubation time and temperature helped maintain reliability among samples. Including this correction step enhanced the validity of the enzyme activity data obtained (adapted from the study of Lapis-Gaza and Pattison, 2021).

To calculate β-glucosidase activity, the concentration of released p-nitrophenol was computed using a linear regression equation derived from the standard curve. Results were expressed in micrograms of pNP released per gram of soil per hour (μg pNP g^{-1} soil h^{-1}). When the R^2 value of the standard curve dropped below 0.90, fresh standards were made and absorbance tests repeated to uphold accuracy. This verification step helped ensure the consistency and trustworthiness of results across treatments (adapted from the study of Lapis-Gaza and Pattison, 2021).

Upholding a high correlation coefficient was key to interpreting enzyme activity correctly. This strategy reduced potential measurement errors and allowed valid comparisons between groups. Frequent standard curve checks also helped flag anomalies during data collection. Altogether, this approach enhanced the precision and reliability of enzymatic assessments throughout the study. Consistent calibration also helped streamline troubleshooting whenever unexpected results occurred. This methodological rigor contributed to generating trustworthy data across both greenhouse and field experiments (adapted from the study of Lapis-Gaza and Pattison, 2021).

Cover Crop Collection and Preparation

Cover crops grown in both greenhouse and field settings were gathered and carefully prepared. For the greenhouse setup, cover crops were collected once during the study period. In the field setting, however, cover crops were collected three times, following a six-month interval between each collection to monitor growth and development over time. This allowed for the assessment of biomass accumulation trends and their potential relationship with soil enzymatic activity throughout the experiment. Variations in environmental conditions, such as rainfall and temperature during each collection period, were also noted, as these factors likely influenced both cover crop performance and microbial activity.

Following the collection of cover crop samples, the dry weight of the harvested biomass was determined. It is worth noting that certain treatments lacked cover crops and were consequently omitted from the biomass assessment. After obtaining the dry weights, total biomass was calculated for each treatment. The resulting biomass values were then statistically correlated with the amount of p-nitrophenol (pNP) released in the soil per hour, as measured during the 6th and 12th months of the experiment. This analysis aimed to assess the potential relationship between cover crop biomass and soil enzymatic activity. A positive correlation would suggest that greater biomass contributes to enhanced microbial activity. Understanding this relationship could help guide the selection of high-performing cover crops in future soil health interventions.

Decontamination of Organic Samples

All organic samples collected from both the greenhouse pot experiment and the field experiment were sterilized via autoclaving to eliminate potential pathogens. The sterilized materials were then placed in black garbage bags and disposed of in designated waste bins following institutional biosafety protocols. Additionally, soil samples used in the pot experiment were subjected to heat treatment at 60°C for one hour to effectively inactivate *Foc* TR4. Soil samples that were taken to the laboratory and subsequently treated with hazardous chemicals, classified as destructive and carcinogenic, were segregated and disposed of following laboratory hazardous waste disposal guidelines to ensure environmental and personnel safety.

Statistical Analysis

The data obtained from the previous computations underwent comprehensive statistical analyses to identify patterns, assess significance, and measure effect sizes. For the soil samples collected in the greenhouse setting, the Shapiro-Wilk test was used to determine whether the data followed the normal distribution. Levene's test was also conducted to evaluate the homogeneity of variances across treatment groups. A one-way Analysis of Variance (ANOVA) was then performed to assess whether significant differences existed among the treatment means. When significant results were found, Tukey's Honestly Significant Difference (HSD) test was used as a post hoc analysis to identify specific pairwise differences between treatments. To complement these analyses, effect sizes were calculated to gauge the practical significance and magnitude of the observed differences.

For the field experiment data, the same preliminary tests (Levene's test for homogeneity of variance and Shapiro-Wilk for normality) were conducted. Given the potential deviations from normality and unequal variances, the Kruskal-Wallis non-parametric test was conducted to evaluate the differences among treatment groups. To analyze the temporal variation across collection periods (6th and 12th months), one-way ANOVA was conducted, followed by post hoc analysis using paired t-tests. Effect sizes were also calculated to quantify the strength of differences observed between the collection periods.

Results

β-glucosidase enzyme activity in USeP Obrero Greenhouse Setting

A total of 19 treatments were evaluated using soil samples collected from the greenhouse facility at the University of Southeastern Philippines (USeP), Obrero Campus. Each treatment was replicated five times, resulting in a total of 95 experimental units. Table 1 presents the average β-glucosidase activity across all treatments, expressed as micrograms of p-nitrophenol (μg pNP) released per gram of soil per hour (μg pNP g^{-1} soil h^{-1}). The activity levels observed ranged from 13.30 to 47.50 μg pNP g^{-1} soil h^{-1}. The highest enzymatic activity was recorded in Treatment 14 (C. *mucunoides* + *I. batatas* + green frog grass + Grand Naine in Foc TR4-inoculated soil), which released an average of 47.50 μg pNP g^{-1} soil h^{-1}. In contrast, the lowest value was observed in Control 2 (Grand Naine in Foc-inoculated soil without any cover crop), with an average of 13.30 μg pNP g^{-1} soil h^{-1}.

Among the single planting treatments, Treatment 3 (*I. batatas* + Grand Naine in Foc-inoculated soil) exhibited the highest β-glucosidase activity (46.03 μg pNP g⁻¹ soil h⁻¹), while the lowest was observed in Treatment 4 (green frog grass + Grand Naine in Foc-inoculated soil), which recorded 25.40 μg pNP g⁻¹ soil h⁻¹. In the double planting treatments, the highest enzyme activity was recorded in Treatment 5 (*A. pintoi* + *C. mucunoides* + Grand Naine in Foc-inoculated soil) with 41.93 μg pNP g⁻¹ soil h⁻¹, whereas the lowest was found in Treatment 8 (*C. mucunoides* + *I. batatas*+ Grand Naine in Foc-inoculated soil), with 27.33 μg pNP g⁻¹ soil h⁻¹. For the triple planting treatments, the highest activity, as previously noted, was observed in Treatment 14, while the lowest was from Treatment 12 (*A. pintoi* + *C. mucunoides* + green frog grass + Grand Naine in Foc-inoculated soil), which released 40.17 μg pNP g⁻¹ soil h⁻¹.

Table 1. Average Amount of Pnp Released in Greenhouse Setting

Treatment	Combination	Mean	S.E.	C.I. (95%)
T1	Pinto peanut	36.37[ab]	4.65	12.92
T2	Calopo	31.63 [ab]	2.66	7.40
T3	Ornamental Sweet Potato	46.03[a]	8.33	23.12
T4	Green Frog Grass	25.40 [ab]	2.31	6.41
T5	Pinto peanut+Calopo	41.93[a]	9.89	27.46
T6	Pinto Peanut+Ornamental Sweet Potato	37.20 [ab]	5.79	16.08
T7	Pinto Peanut +Green Frog Grass	32.87 [ab]	1.56	4.34
T8	Calopo +Ornamental Sweet Potato	27.33 [ab]	3.19	8.85
T9	Calopo + Green Frog Grass	37.73 [ab]	2.68	7.43
T10	Ornamental Sweet Potato +Green Frog Grass	40.53 [ab]	8.99	24.96
T11	Pinto Peanut +Calopo +Ornamental Sweet Potato	46.87[a]	6.18	17.16
T12	Pinto Peanut +Calopo +Green Frog Grass	40.17 [ab]	6.13	17.01
T13	Pinto Peanut +Ornamental Sweet Potato+Green Frog Grass	41.17 [ab]	6.07	16.87
T14	Calopo +Ornamental Sweet Potato +Green Frog Grass	47.50 [a]	5.92	16.44
T15	Pinto Peanut +Calopo +Ornamental Sweet Potato +Green Frog Grass	31.07 [ab]	3.41	9.46
C1	No cover crop + Grand Naine + Uninoculated	25.77 [ab]	5.46	15.17
C2	No cover crop + Grand Naine + Inoculated	13.30[b]	3.97	11.03
C3	No cover crop + GCTCV 218 + Inoculated	38.90 [ab]	4.14	11.50
C4	No cover crop + GCTCV 219 + Inoculated	20.30[ab]	1.45	4.03

Means sharing the same letter do not exhibit statistically significant differences at the 0.05 level, as determined by Tukey's HSD test; Uninoculated= without Foc; Inoculated= with Foc; N=95

In the quadruple planting treatment, the average β-glucosidase activity recorded was 31.07 μg pNP g⁻¹ soil h⁻¹. Among the control treatments, the highest enzymatic activity was observed in Control 3 (without cover crop + GCTCV 218

in Foc TR4-inoculated soil), which recorded 38.90 µg pNP g⁻¹ soil h⁻¹. In contrast, the lowest activity was detected in Control 2 (no cover crop + Grand Naine in Foc TR4-inoculated soil), with an average of 13.30 µg pNP g⁻¹ soil h⁻¹.

The dataset satisfied the assumptions of homogeneity of variance and normality, as confirmed by the results of the Levene's tests and Shapiro-Wilk. These outcomes indicated normal distribution of data, and variances were homogenous, thus fulfilling the prerequisites for parametric analysis. Consequently, one-way Analysis of Variance (ANOVA) revealed statistically significant differences among the treatments ($p < 0.05$), indicating that the type and combination of cover crops had a significant effect on soil β-glucosidase activity.

Post hoc analysis using Tukey's Honestly Significant Difference (HSD) test further identified significant pairwise differences between Treatment 3 (T3) and Control 2 (C2), Treatment 5 (T5) and C2, Treatment 11 (T11) and C2, and Treatment 14 (T14) and C2. Treatment 3 consisted of soil planted with *I. batatas* alone, while Treatment 5 included a combination of *A. pintoi* and *C. mucunoides*. Treatment 11 was composed of *A. pintoi*, *C. mucunoides*, and *I. batatas*, and Treatment 14 involved a mixture of *I. batatas*, *A. compressus*, and *A. pintoi*. Control 2, by contrast, was planted only with Grand Naine and inoculated with Foc TR4, without any cover crop intervention.

These findings suggest that *I. batatas* is a particularly effective cover crop for enhancing β-glucosidase activity in the soil, both when planted singly and in combination with other species. Moreover, leguminous cover crops such as *A. pintoi* and *C. mucunoides* also demonstrated significant potential for improving soil enzyme activity, especially when combined with non-leguminous cover crops. This highlights the synergistic effect of diverse cover crop combinations on promoting soil microbial function and overall soil health.

β-glucosidase enzyme activity in Puyod Banana Farm, Davao City

A total of 20 soil samples from five treatments collected at the Puyod Banana Farm field site were tested and analyzed for β-glucosidase activity. These treatments were monitored across three collection periods, with both soil samples and dry matter collected every six months. Table 2 presents the average values of *p*-nitrophenol (µg pNP) released per gram of soil per hour (µg pNP g⁻¹ soil h⁻¹) for each treatment across all collection intervals.

Among the three collection periods, the second collection exhibited the highest average β-glucosidase activity across all treatments, followed by the third and first collections, respectively. It is noteworthy that the second collection was conducted during a period of low precipitation, whereas the first and third collections were performed during periods of high precipitation. The highest enzymatic activity was recorded in Treatment 5 during the second collection (63.54 µg pNP g⁻¹ soil h⁻¹), followed by Treatment 3 (61.21 µg pNP g⁻¹ soil h⁻¹) and Treatment 1 (61.08 µg pNP g⁻¹ soil h⁻¹). In contrast, the lowest activity was observed in Treatment 4 during the third collection (25.50 µg pNP g⁻¹ soil h⁻¹), as well as in Treatment 1 (26.71 µg pNP g⁻¹ soil h⁻¹) and Treatment 5 (29.38 µg pNP g⁻¹ soil h⁻¹) during the first collection.

Using the Shapiro-Wilk normality test, the data generally met the assumptions of normality and homogeneity of variance, except for Treatments 2 and 3. For these two treatments, the p-values were less than the significance level

(p < 0.05), indicating that the data were not normally distributed. As a result, the Kruskal-Wallis test, a non-parametric rank-based method, was applied to assess differences among treatments. The test results indicated that there was no statistically significant effect of treatment on β-glucosidase activity (p > 0.05) as shown in Table 2.

Table 2. Average Amount of Pnp Released in Field Setting

Treatment	Combination	1ST Collection*	2ND Collection	3RD Collection
1	218 + biocontrol (Plant Growth Promoting Bacteria-*Bacillus* sp.) + *T. harzianum* + no ground cover	26.71[ab]	61.08 [ab]	31.29 [ab]
2	Grand Naine + ground cover, no herbicide	37.54 [ab]	46.50 [ab]	50.00 [ab]
3	218 + ground cover, no herbicide	38.50 [ab]	61.21 [ab]	40.38 [ab]
4	Grand Naine + no ground cover + biocontrol (Plant Growth Promoting Bacteria- *Bacillus* sp.) + *T. harzianum*	39.42 [ab]	52.21 [ab]	27.29 [ab]
5	Grand Naine + ground cover, no herbicide + biocontrol (Plant Growth Promoting Bacteria- *Bacillus* sp.) + *T. harzianum*	29.38 [ab]	63.54 [ab]	35.21 [ab]
	Regardless of Treatments	34.31[b]	56.91[a]	36.83[b]

Means sharing the same letter do not exhibit statistically significant differences at the 0.05 level, as determined by Kruskal-Wallis test (for treatments) and Paired t test (regardless of treatments); N=20; 1st Collection; 2nd collection; 3rd collection

Additionally, the mean gains and losses in β-glucosidase activity across the three collection periods were analyzed. The Shapiro-Wilk test confirmed that the distribution of these data met the assumption of normality. One-way ANOVA was used to evaluate whether the observed changes differed significantly between treatments, and the results indicated no significant difference. However, despite the lack of statistical significance, the calculation of Omega squared (ω^2) revealed small to medium effect sizes, suggesting that the presence of cover crops and biocontrol agents had a measurable, albeit modest, influence on changes in soil enzymatic activity.

According to Tomczak and Tomczak (2014), effect size represents the extent to which the independent variable accounts for variation observed in the dependent variable. The results showed that the highest effect size was observed between Collection 3 and Collection 2 (ω^2 = 22.28%), followed by Collection 1 and Collection 2 (ω^2 = 19.20%), and Collection 1 and Collection 3 (ω^2 = 1.15%) (Figure 1). These values suggest that while the differences in mean gain and loss among treatments were not statistically significant, there is evidence of interaction between the variables, implying that biological inputs may still influence soil activity under certain conditions.
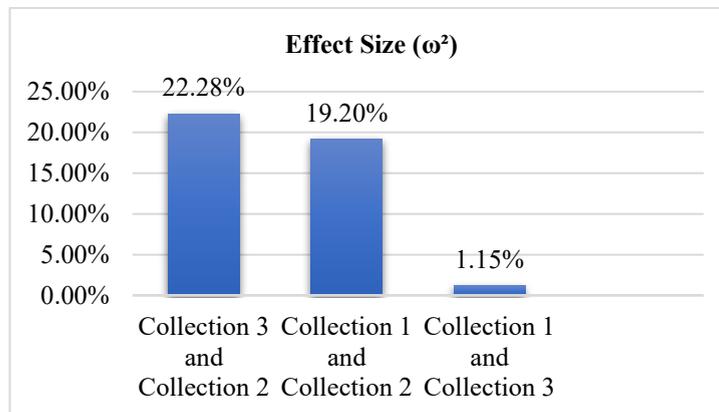
Figure 1. Effect size of β-glucosidase activity between collections

Furthermore, assumptions for repeated measures ANOVA were tested using Mauchly's test of sphericity. The test indicated that the assumption was met (p > 0.05), and the null hypothesis—stating that the variances of the differences are equal—was not rejected. This allowed for valid interpretation of repeated measures ANOVA results, which revealed a significant effect of collection time on β-glucosidase activity.

Post hoc analysis using paired t-tests was conducted to determine where these time-based differences occurred. The results indicated significant differences between Collection 1 and Collection 2 (p < 0.05), and between Collection 2 and Collection 3 (p < 0.05). However, Collection 1 and Collection 3 (p > 0.05) did not exhibit a statistically significant difference, as summarized in Table 2.

While exact environmental data were not quantified, observational records provide further insight. During Collection 1, low precipitation was recorded. By the time of Collection 2, cover crops had already been established, and both biocontrol agents and *T. harzianum* had been introduced. Although Collection 2 occurred during a period of high precipitation, increased microbial activity was likely driven by the combined effects of soil moisture, temperature, and organic litter decay. Both soil samples and dry matter (cover crops) were collected during this period, contributing to the observed increase in β-glucosidase activity.

Discussion

β-glucosidase enzyme activity in USeP Obrero Greenhouse Setting

The results demonstrated that the use of cover crops significantly enhanced microbial activity in the soil, as evidenced by increased β-glucosidase activity measured in µg pNP released gram/soil/hr. Among the evaluated species, *I batatas* exhibited a strong capacity to promote enzymatic activity, whether planted singly or in combination with other cover crops. Similarly, leguminous species such as *A. pintoi* (Pinto peanut) and *C. mucunoides* also contributed positively to microbial function, particularly when combined with non-leguminous species. These findings underscore the synergistic potential of diverse cover crop systems to improve soil biological activity and overall fertility.

Supporting this, a related study using phospholipid fatty acid (PLFA) profiling demonstrated that the application of vermicast biofertilizer (VB) significantly enhanced soil microbial diversity. Specifically, the VB treatment increased

the abundance of gram-negative bacteria, total fungi, and arbuscular mycorrhizal fungi (AMF), while elevating the fungi-to-bacteria (F/B) ratio ($P \leq 0.05$). Although actinomycete biomass declined, the overall microbial structure indicated a more functionally active and ecologically balanced soil environment. These changes were attributed in part to elevated Soil Labile Amino Nitrogen (SLAN), which supports microbial proliferation and nutrient cycling (Pitiki et al., 2024). These findings complement the current study's results, suggesting that organic inputs—whether in the form of cover crops or biofertilizers—contribute meaningfully to enhanced soil biological health.

A. pintoi specifically demonstrated outstanding effects not only in increasing β-glucosidase activity but also in boosting soil organic matter. Characterized by its small, numerous leaves and robust adaptability, *A. pintoi* is highly shade-tolerant, capable of thriving under up to 50% reduced light, and produces dense ground cover with minimal maintenance. Its litter breaks down quickly, enriching the soil with vital nutrients like nitrogen, phosphorus, potassium, and calcium, while also contributing to nitrogen fixation from the atmosphere. It has been successfully implemented in high-elevation orange plantations, and in banana, coffee, and oil palm plantations, where it has shown strong potential for weed and nematode suppression, soil improvement, and even for ornamental landscaping. The study of Rui & Liang (2013) further highlighted *A. pintoi*'s contribution to increased carbon and nitrogen availability in the soil, both of which play critical roles in the regulation of β-glucosidase activity.

Similarly, *C. mucunoides* emerged as a highly promising species for improving soil conditions and facilitating land restoration. Its vigorous root system enhances soil structure, increases porosity, and improves water infiltration while reducing runoff and nutrient leaching. These characteristics make it especially useful in rehabilitating degraded lands, fallow fields, and wastelands. However, its application is limited by physical seed dormancy due to a hard, impermeable seed coat, which restricts water absorption and leads to inconsistent germination. To overcome this limitation, methods such as mechanical scarification, acid treatment, or hot water treatment are recommended (Namitha et al., 2021).

When used in combination, *A. pintoi* and *C. mucunoides* produced significantly higher levels of β-glucosidase activity compared to treatments without cover crops. Specifically, treatments T3, T5, T11, and T14 showed significant differences ($p < 0.05$) in µg pNP released g^{-1} soil h^{-1} when compared with Control 2 (C2), which consisted of Grand Naine inoculated with Foc TR4 and lacked cover crops. This contrast highlights the influence of cover crop biomass, particularly leguminous cover crops—on enzymatic activity. According to Balota & Auler (2011), *C. mucunoides* enriches microbial biomass in nitrogen and phosphorus, thereby promoting microbial growth and enzyme production.

Notably, the effectiveness of these treatments is further validated by the error bar analysis: the non-overlapping error bars between T3, T5, T11, T14 and C2 reinforce the results of Tukey's HSD test, confirming significant differences in β-glucosidase activity. This suggests that observed changes are not random but can be attributed to the biological influence of the cover crops used.

Under good scientific practice, the study also reported both statistical significance and effect size. Effect sizes provide a quantitative estimate of the impact of treatments on outcomes and offer insight beyond p-values alone. As described by Becker (2000), effect size reflects the degree to which the independent variable influences the dependent variable.

In the greenhouse experiment, the effect size was calculated using η^2 (eta squared), which yielded a value of 0.488, indicating a large effect. This implies that approximately 48.8% of the variation in β-glucosidase activity can be attributed to the presence of cover crops. As emphasized by Grizzard & Shaw (2017), effect sizes should also be accompanied by estimates of statistical uncertainty, such as standard errors, to provide a more nuanced interpretation of treatment impacts, especially when degrees of freedom vary across experimental designs.

Collectively, these findings highlight the substantial role of cover crops—particularly *A. pintoi* and *C. mucunoides*—in enhancing soil enzymatic activity, microbial biomass, and nutrient availability. The integration of leguminous and non-leguminous species, coupled with organic amendments such as vermicast, offers a promising strategy for improving soil health, promoting microbial diversity, and supporting sustainable agricultural systems.

β-glucosidase enzyme activity in Puyod Banana Farm, Davao City

This study investigated the effects of cover crops and biological control agents on soil enzymatic activity, measured through β-glucosidase activity (μg pNP g^{-1} soil h^{-1}), under field conditions in Puyod Banana Farm. A total of 20 soil samples from five treatments were evaluated across three collection periods, each spaced six months apart. Although the Kruskal-Wallis test showed no statistically significant differences among treatments ($p > 0.05$), temporal variations in enzymatic activity were observed. The second collection consistently yielded the highest β-glucosidase activity across all treatments, followed by the third and first collections, respectively. Treatment 5 showed the highest enzymatic activity in the second collection (63.54 μg pNP g^{-1} soil h^{-1}), supporting the notion that the combination of ground cover and biocontrol agents, including *T. harzianum* and *Bacillus* sp., may play a role in enhancing microbial function. Moreover, the integration of *T. harzianum* and *Bacillus sp.* may have enhanced microbial activity by stimulating root exudation and antagonizing pathogens, thereby creating a favorable niche for decomposer communities

The use of *T. harzianum* and Plant Growth Promoting Bacteria (PGPB) such as *Bacillus* sp. is supported by literature showing their potential to induce systemic resistance in plants and enhance microbial activity in the soil (Rodriguez-Romero et al., 2010; Mohiddin et al., 2010; Dawar et al., 2010; Yao et al., 2023). Trichoderma species are known for their ability to control soil-borne diseases, stimulate plant growth, enhance nutrient efficiency, and promote overall soil health through mechanisms like competition, antibiosis, and mycoparasitism.

Analysis of collection time effects using repeated measures ANOVA revealed a significant difference across periods ($p > 0.05$), with post hoc paired t-tests confirming significant differences between Collection 1 and 2, and Collection 2 and 3, but not between Collection 1 and 3. These findings align with meteorological data from PAGASA, which reported the highest precipitation during the second collection (30.2 mm), followed by the first (0.2 mm), and the third (trace amounts). Higher precipitation levels during Collection 2 likely increased soil moisture, promoted cover crop growth, and accelerated the decomposition of organic residues—factors known to stimulate microbial activity (Bot & Benites, 2005; Su et al., 2020). Likewise, increased temperatures recorded during the second collection (35°C) may have contributed to higher soil respiration rates, in line with findings by Pietikainen and others (2004).

Despite the observed trends, correlation analysis indicated no statistically significant relationship between β-

glucosidase activity and biomass collected across treatments at the 6th and 12th months ($p > 0.05$). However, a positive association was noted in most treatments, suggesting that biomass production may still influence enzymatic activity, though not to a statistically significant degree. Treatments T3, T4, and T5 showed positive associations in the 6th month, while T2, T4, and T5 did so in the 12th month. These patterns point to a general trend where increased biomass may contribute to higher microbial activity through increased substrate availability for microbial decomposition.

The findings also underscore the importance of cover crop selection and environmental conditions in shaping soil biological responses. During the third collection, very low precipitation and heat stress led to poor survival of cover crops in several plots, resulting in lower biomass and reduced enzymatic activity. This highlights that soil organic matter accumulation is heavily influenced by the quality and persistence of cover crops (Bot & Benites, 2005; Shah et al., 2017). Residues from well-established cover crops enhance nutrient cycling and microbial activity, which are critical for long-term soil health.

Moreover, effect size analysis using Omega squared (ω^2) revealed small to moderate effects of cover crops and biocontrol treatments over time, even though statistical significance was not achieved. The highest effect size was observed between Collection 3 and 2 (22.28%), followed by Collection 1 and 2 (19.20%), and Collection 1 and 3 (1.15%). These values suggest that while treatment effects were not statistically significant, temporal environmental factors and biomass dynamics may have influenced microbial responses.

Overall, while treatment effects in the field setting were not statistically conclusive, the study revealed biologically meaningful trends. The presence of ground cover and biological control agents appeared to enhance microbial activity, especially under favorable environmental conditions. Further studies under controlled settings are recommended to isolate the effects of specific cover crops and biocontrol agents on soil enzymatic activity. Integrating well-adapted cover crops such as *A. pintoi* and *C. mucunoides*, along with microbial inoculants, offers promising potential to promote sustainable soil management practices in banana production systems.

Conclusion

The greenhouse and field experiments collectively demonstrated the potential of cover crops and biological inputs to enhance soil microbial activity, as measured by β-glucosidase activity (µg pNP released g^{-1} soil h^{-1}). In the greenhouse setting, significant differences were observed among treatments, with cover crops—particularly *I. batatas*, *A. pintoi*, and *C. mucunoides*—exhibiting strong effects on soil enzymatic activity. Treatments with combinations of leguminous and non-leguminous cover crops consistently outperformed the control (Grand Naine inoculated with Foc TR4 without cover crops), and statistical analyses confirmed these effects with a large effect size ($\eta^2 = 0.488$), indicating that nearly half of the variability in soil microbial activity could be attributed to the presence of cover crops.

In the field experiment, although statistical differences among treatments were not significant, temporal patterns in β-glucosidase activity were evident. The second collection period showed the highest enzymatic activity, likely influenced by optimal environmental conditions such as high precipitation and temperature. These factors enhanced

cover crop biomass production and residue decomposition, thus supporting microbial proliferation. Effect size analysis further indicated that the presence of ground cover and biocontrol agents (*T. harzianum* and *Bacillus sp.)* had small to moderate effects on soil microbial function over time.

Overall, the results emphasize the beneficial role of integrating cover crops and biocontrol agents in improving soil biological health. While controlled greenhouse conditions allowed clearer attribution of treatment effects, the field study highlighted the importance of environmental factors such as precipitation and temperature in modulating microbial responses. The synergistic use of leguminous cover crops and microbial inoculants offers a sustainable strategy to enhance soil fertility, support plant health, and improve resilience in banana-based cropping systems. Future research should explore long-term impacts and optimize species combinations under varying climatic and management conditions to maximize these benefits.

Recommendations

Based on the findings of both the greenhouse and field experiments, several recommendations can be made to enhance soil microbial activity and promote sustainable soil health in banana-based cropping systems. First, the use of leguminous cover crops such as *A. pintoi* and *C. mucunoides*, along with non-leguminous species like *I. batatas*, is strongly encouraged. These cover crops demonstrated significant potential in increasing β-glucosidase activity and improving organic matter content, especially when planted in combinations. Therefore, integrating diverse cover crop species—particularly mixing legumes with non-legumes—may optimize soil microbial responses and nutrient cycling.

Additionally, the application of biological control agents such as *T. harzianum* and Plant Growth Promoting Bacteria (PGPB) like *Bacillus* sp. is recommended. These biocontrol agents not only offer disease suppression against soil-borne pathogens such as *Foc* TR4 but also contribute positively to microbial activity and soil fertility. Their combined use with cover crops can create a synergistic effect that enhances both plant and soil health.

Given that precipitation and temperature were shown to influence cover crop biomass and enzymatic activity, it is important to align the establishment of cover crops with local seasonal climatic patterns. Establishing cover crops before peak rainfall periods can improve biomass accumulation and support microbial proliferation through increased residue decomposition. Furthermore, seed pre-treatment for *C. mucunoides*—including scarification or hot water soaking—is recommended to address dormancy issues and promote consistent germination, particularly in degraded or restoration-priority lands.

Although a positive association between biomass and β-glucosidase activity was observed, it was not statistically significant. Therefore, further studies should be conducted to investigate this relationship under different environmental conditions and with a larger sample size. Investigating microbial community composition alongside enzymatic activity can offer deeper insights into the dynamics of the soil microbiome.

Finally, long-term field trials are recommended to assess the sustainability and effectiveness of cover cropping and

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biological control interventions over multiple cropping seasons. Continuous monitoring of soil health indicators, such as enzymatic activity and microbial biomass, will help determine the lasting benefits of these practices and support their broader adoption in climate-resilient and ecologically sustainable agricultural systems.

Acknowledgements or Notes

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Exploring the Impact of Multiple Representations on Algebra Learning

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Abstract: Algebra is a fundamental part of mathematics that develops students' problem-solving and analytical skills, yet many learners struggle with it when taught using traditional methods, often resulting in poor performance and limited understanding. To address this, educators have adopted innovative approaches such as Multiple Representations-Based Instruction (MRBI), which uses graphs, equations, and verbal explanations to improve comprehension and engagement. This study examined the effect of MRBI on the Algebra performance of 62 Grade 9 students at Kapayapaan Integrated School, selected based on their first grading period results. The students were evaluated through an Algebra test and a survey questionnaire. Researchers employed an experimental approach to assess the differences in performance between students who experienced Conventional teaching and those who were taught using MRBI. The analysis using t-tests demonstrated a notable gain in post-test scores among MRBI students, highlighting it as a superior teaching method. However, Pearson correlation analysis showed no significant relationship between students' perceptions of MRBI and their test performance. These findings suggest that MRBI enhances students' problem-solving abilities, although longer exposure may yield greater benefits. Despite its advantages, the Conventional method remains a useful teaching approach in Algebra. Future research may explore integrating educational technology with MRBI.

Keywords: Multiple Representation-Based Instruction, Conventional Teaching Method

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Introduction

Mathematics is more than just solving equations or memorizing formulas. It plays an important role in how people make sense of the world. From everyday tasks like budgeting or measuring ingredients, to more complex thinking such as analyzing patterns or solving problems Math helps us reason, communicate, and make informed decisions. Because of this, it is considered a core subject in education since it shapes how students think and learn throughout their academic journey.

However, despite the importance of mathematics, many students continue to find it difficult to learn this subject matter especially in formal classroom settings. Traditional teaching methods often focus heavily on lectures and memorization. This can make math feel mechanical or disconnected from real life. Algebra, in particular, is a subject where many students struggle. Its use of symbols and abstract concepts can be confusing when introduced without enough support or context, leading to frustration or disinterest.

To help address this challenge, researchers and educators have explored more effective ways to teach math. One promising approach is Multiple Representation-Based Instruction (MRBI). This method of instruction uses a variety of visual aids, including tables, graphs, diagrams, symbols, and words, to convey mathematical ideas. The goal is to make learning more approachable and significant by providing students several ways to grasp a concept. This strategy is supported by several recent studies.

Morales et al. (2020), found that using multiple representations helped students understand of decimals, fractions, and percentages better. This finding was confirmed by the research of Al-Sarry (2020) that showed students developed stronger math literacy when they were exposed to diverse forms of explanation. Likewise, Çetin and Aydın (2020), through a meta-analysis, confirmed the overall effectiveness of MRBI in improving mathematical achievement. Ulusoy and İncikabi (2019) also emphasized that using visual aids and real-world examples helped students connect better with mathematical ideas.

The National Council of Teachers of Mathematics also supports various uses of representations in mathematics instruction (NCTM, 2020). They stressed that thinking algebraically entails identifying patterns, assessing connections, and switching between various modes of representation with ease. Students' comprehension improves as they learn to view word problems, equations, graphs, and tables as related representations of the same concept. Recent findings by Vale and Barbosa (2023) and Nirawati et al. (2020) support this, noting that exposure to various representations strengthens students' reasoning and problem-solving skills.

Representations can be both internal and external. Internal representations are the mental images or ideas that students form in their minds, while external representations include visual aids, symbols, and diagrams. Connecting these two forms can help students see concepts from multiple angles, which is especially helpful for different learning styles.

As Hague (2024) observed, this approach not only enhances understanding but also makes math more engaging and relevant.

In the Philippine context, there remains an urgent need to strengthen math education. International assessments have shown that Filipino students continue to struggle with mathematics. The 2022 Programme for International Student Assessment (PISA), for example, revealed that many students are still performing below the expected level in math, science, and reading (Organisation for Economic Co-operation and Development, 2023). These results highlight ongoing challenges in teaching methods, learning environments, and student engagement.

Given these concerns, there is a growing need to explore teaching strategies that are more student-centered and meaningful. MRBI offers a practical way to make math more understandable and relatable for students. By presenting concepts in multiple formats, teachers can help learners build a stronger foundation and improve their overall performance in mathematics.

Therefore, this study aimed to evaluate the effectiveness of Multiple Representations-Based Instruction (MRBI) in improving Algebra performance among Grade 9 students at Kapayapaan Integrated School. Its specific objectives were to: (1) analyze the performance levels of students in both experimental and control groups; (2) determine if a statistically significant difference exists between those taught with MRBI and those under conventional instruction; and (3) investigate the correlation between students' perceptions of MRBI and their scores on the post-test.

Method

The study utilized an experimental research design and focused on the collection and evaluation of quantitative data from student participants. Consistent with typical experimental protocols, two groups were established: an experimental group and a control group. The experimental group received instruction using the Multiple Representations-Based Instruction (MRBI) strategy, whereas the control group was taught through traditional methods. This structure enabled a direct comparison between the two groups, providing insights into the impact of the intervention and allowing for an objective assessment of its instructional effectiveness.

The researchers employed two instructional approaches—Multiple Representations-Based Instruction (MRBI) and the Conventional Teaching Method—to assess the Algebra performance of selected Grade 9 students at Kapayapaan Integrated School. Both pre-test and post-test assessments were conducted to measure the participants' understanding before and after the intervention. The pre-test established the baseline performance, while the post-test, administered to both the control and experimental groups using the same instrument, served as the endline measure. The results provided comparative data to determine the effectiveness of each teaching strategy on students' learning outcomes.

Out of five sections taking Algebra class in Grade 9 at Kapayapaan Integrated School, two were chosen as the participants of the study. The researchers chose two sections; one was considered the control group (G9-Emerald) and the other one as the experimental group (G9-Jade). They discussed the same lesson and was taught by one teacher and had similar grades (within the range of 79% - 89%). This was done to avoid student and teacher factors. The

researchers were able to get 32 participants out of 44 under the Conventional Teaching Method. On the other hand, out of the total population of 44 students, 30 participants were taught with Multiple Representation-Based Instructions.

The researchers employed a purposive non-random sampling technique to select the participants for the study. Selection criteria required that students have similar grades ranging from 79% to 89% during the first grading period. Additionally, both the control and experimental groups were taught by the same teacher to maintain consistency in instructional delivery.

The study was conducted in Kapayapaan Integrated School (KIS) located at Sitio Manfil, Kapayapaan Ville, Canlubang, Calamba City. KIS is supervised by a principal. Its main mission is to provide students with effective and innovative programs making them productive, globally competitive, and an academic school of excellence in the Division of Calamba City. The researchers selected KIS because, based on their field studies, even the alumni observed that most of the students find learning mathematics very difficult since it is the least concrete. Indeed, the researchers chose Kapayapaan Integrated School.

Before exposing the two groups into two separate approaches, the researchers gave pre-examination covering the scheduled topics for the last two weeks of the second quarter. The participants were exposed to the treatment which lasted for seven days. After the intervention, both experimental group and control group were given a post-examination. However, only the experimental group answered the perception questionnaire. The researchers also did an interview with the cooperating teacher regarding her view in teaching Algebra with the use of MRBI as a new approach of teaching. Furthermore, using the appropriate statistical technique, the researchers thoroughly analyzed the data they collected.

The researcher constructed a self-made examination. The constructed test was a 30-item multiple choice type in Algebra with one corresponding point each. It covers only the topic that the participants have learned during the last two weeks of the second quarter in the Algebra class. Additionally, the researchers created a perception questionnaire that asked students about their opinions on the employment of many external representations.

The test was validated by three Mathematics professors from City College of Calamba and one Math high school teacher from Kapayapaan Integrated School. The perception questionnaire was validated by two Professional Education teachers. The two instruments were also pilot tested by selected students. The researchers considered the comments and suggestions provided during the validation of the self-made examination to ensure that the recommended revisions were critically analyzed for test improvement.

Descriptive and inferential statistical techniques were used to analyze the gathered data. Measures including mean, standard deviation, frequencies, and percentages were used in descriptive statistics to assess the participants' performance. To compare the performance in pretest and posttest of the students between those who were exposed to the Multiple Representation-Based Instruction and the students who were exposed in the Conventional Teaching Method, the paired t-test was used. While the independent t-test was used to compare both pre-tests and post-tests of the two groups. To determine if correlation exists between nominal/ordinal data and quantitative data, the perception

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of the students and their level of performance in Algebra in the posttest was established using Pearson r product moment correlation coefficient.

Results

To ensure baseline comparability before the intervention, the pre-test Algebra scores of the control and experimental groups were evaluated. The control group achieved a mean score of 11.06 with a standard deviation of 2.33, whereas the experimental group had a mean of 10.83 and a standard deviation of 1.98 (refer to Table 1). These findings indicate that the two groups demonstrated comparable levels of performance prior to the implementation of the instructional strategies.

Table 1. Pre-test Algebra Performance Level of Two Groups

Section	Mean	SD
Control Group	11.06	2.33
Experimental Group	10.83	1.98

As shown in Table 1, the mean difference between the groups was only 0.23, indicating no significant difference in their pre-test scores. This similarity establishes a reliable foundation for comparing the effects of the two teaching approaches during the post-test phase. It ensures that any observed differences in performance after the intervention can be attributed more confidently to the instructional method used.

After the intervention, post-test results indicated a marked difference in performance between the control and experimental groups. The control group achieved a mean score of 16.06 with a standard deviation of 2.45, while the experimental group obtained a higher mean of 20.63 and a standard deviation of 3.32 (see Table 2). These results suggest that students instructed through Multiple Representations-Based Instruction (MRBI) performed significantly better than those who received traditional teaching.

Table 2. Post-test Algebra Performance Level of Two Groups

Section	Mean	SD
Control Group	16.06	2.45
Experimental Group	20.63	3.32

The difference of 4.57 points between the post-test means demonstrates a substantial improvement in favor of the experimental group. This improvement suggests that the MRBI strategy was more effective in enhancing students' understanding and application of algebraic concepts. It also highlights the instructional value of engaging students through multiple formats and representations in learning mathematics.

To assess the significance of improvement within each group, paired sample t-tests were conducted. For the control group, the t-test yielded a t-computed value of -12.078, which exceeded the t-tabulated value of ±2.030, indicating a statistically significant improvement from pre-test to post-test (see Table 3). As a result, the null hypothesis was

rejected, confirming that the observed improvement was not due to chance.

Table 3. Test of Significance of the Control Group Strategy

	Mean	SD	t-computed	t-tabulated
Pre-test	11.06	2.33	-12.078	±2.030
Post-test	16.06	2.45		

The results indicate that the control group, which was taught using the Conventional Teaching Method, showed improvement from the pre-test to the post-test. This suggests that the traditional approach remains effective in enhancing students' algebra performance. Its effectiveness may be attributed to the foundations of the K to 12 curriculum, which promotes a learner-centered environment even within conventional teaching practices.

In the experimental group, the same statistical procedure revealed an even more significant result. The computed t-value was -13.959, which surpassed the t-tabulated value of ±2.045 (see Table 4). This indicates a highly significant difference between the pre-test and post-test scores of students exposed to MRBI.

Table 4. Test of Significance of the Experimental Group Strategy

	Mean	SD	t-computed	t-tabulated
Pre-test	10.83	1.98	-13.959	±2.045
Post-test	20.63	3.32		

These findings strongly suggest that Multiple Representation-Based Instruction had a positive and substantial effect on students' algebra performance. By engaging students through various forms of representation—such as symbols, visuals, verbal explanations, and real-life applications—MRBI likely enhanced their understanding, retention, and ability to apply algebraic concepts. This supports the conclusion that MRBI is not only effective but can serve as a powerful alternative to traditional teaching methods in mathematics instruction.

To determine whether students' perceptions of MRBI influenced their performance, a correlation analysis was conducted. The mean perception score was 3.44, while the post-test mean score was 20.63. The computed r-value was 0.1088, interpreted as Very Low Correlation, and it fell below the r-tabulated value of 2.048, leading to the acceptance of the null hypothesis (see Table 5).

Table 5. Relationship between Perception and Post-test

	Mean	r-value	r-tabulated	Interpretation
Post-test	20.63	0.1088	2.048	Very Low
Perception	3.44			Correlation

The results indicate that students' perceptions of MRBI were not significantly related to their actual post-test scores. Whether students had a positive or negative perception of the teaching method, it did not significantly affect their

performance. This suggests that learning outcomes were primarily influenced by the instructional strategy itself rather than by the students' subjective views.

Discussion

The outcome of the current study presented significant evidence concerning the efficacy of Multiple Representations-Based Instruction (MRBI) in math teaching. The pre-test scores exhibited no statistically significant difference among the experimental and control groups in respect of mean scores, ensuring that both groups shared the same level of math competence (Tong et al., 2022).

The superior performance of the experimental group in the post-test compared to the control group aligned with contemporary research on mathematical instructional approaches. Larson and company (2022) previously established that employing diverse representations enhances students' comprehension of mathematical concepts. Similarly, Van Dooren and others (2020) found that visual aids substantially improve students' capacity to solve complex thematic problems. The current findings reinforced these conclusions, suggesting that MRBI's multi-modal approach provided students with complementary pathways to understand mathematical concepts.

Despite the demonstrated effectiveness of MRBI, it is noteworthy that the K-12 methodology initially developed a learner-centered environment while maintaining elements of conventional teaching. This observation is consistent with Makonye and Stepwell's (2016) research, which found that students with lower academic achievement often benefit from conventional teaching approaches, particularly direct verbal exposition. This suggests that while innovative methods like MRBI show promise, traditional instructional techniques retained value within a balanced pedagogical framework.

The improvement observed in the experimental group from pre-test to post-test can be attributed to the fundamental strengths of multiple representations in mathematics education. As Llinares et al. (2021) proposed, utilizing multiple representations not only fostered stronger conceptual understanding of mathematical functions, but also heightened student engagement with mathematical ideas, and facilitated meaningful connections between seemingly disparate mathematical concepts. This study's results provided empirical support to this perspective.

Interestingly, the study revealed no significant correlation between students' perceptions of MRBI and their actual performance on the post-test. This result resonated with Erdoğan et al.'s (2021) work which proved that learning how to find and represent graphical information enhances algebraic representation capabilities irrespective of the learners' subjective perception of the learning process. This perception versus performance discrepancy confirmed the need to use objective performance measures instead of having just the learners' self-reports as a basis when assessing instructional quality.

Overall, these findings supported the conclusion that MRBI holds significant advantages for teaching mathematics, specifically in building conceptual knowledge and problem-solving skills. The implications of these findings also appeared to show that math education can potentially benefit from a thoughtful blending of alternative instructional

methods such as MRBI with more conventional teaching methods, particularly for meeting diverse learning needs.

Conclusion

In the study, the participants of both control and treatment group did not have any knowledge about the topic Variation based on their level of performance and level of proficiency in the administered pretest, since the Grading system on K to 12 Curriculum has a base of 60%. Though the participants of both control and experimental group have the same level of performance in the test before the intervention, since they were chosen based on their grade in Mathematics in the first grading period, which is 79% - 89%, the participants exposed in Multiple Representations-Based Instruction improved their level of proficiency and performed better in their post-test compared to the participants in Conventional Teaching Method.

Thus, the Multiple Representations-Based Instruction really helps improve the performance level of the students because it helps encourage active participation in the discussion as well as enhances their ability to think deeply. It also helps the students to understand the lesson with the use of effective multiple representation instructions and makes mathematical concepts linger in their minds. It also enhanced students' problem-solving skills.

Aside from this, the participants in the experimental group have positive insights about Multiple Representation Based Instruction. However, the perception of the students about Multiple Representations-Based Instruction does not affect their performance in post-test after the intervention. Also, the Multiple Representations-Based Instruction helped the teacher explain the lesson easily, connect Math concept to real life situations, and encourage the students to actively participate in the discussion.

Recommendations

The results of the study further forward the idea that teachers continue to explore and integrate Multiple Representation-Based Instruction (MRBI) as a teaching approach, particularly when it has been shown to enhance student engagement and improve academic performance. By presenting mathematical concepts through a variety of formats—such as written and spoken symbols, visual aids, manipulatives, and real-life contexts—teachers can provide students with richer, more meaningful learning experiences. Educators are encouraged to involve students in the learning process by incorporating hands-on activities that utilize different forms of representation. This strategy not only accommodates diverse learning styles but also deepens students' conceptual understanding by helping them make connections across multiple representations. In addition, future researchers are encouraged to further investigate the interplay between external and internal representations in mathematics learning. Studies that examine how students mentally process and relate to external tools such as diagrams, symbols, and models could provide deeper insights into how these representations support cognitive development and mathematical reasoning.

Acknowledgements or Notes

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Development of Selectively Permeable Polymer Membranes for Textile Applications

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Abstract: Commonly referred to as a 'second skin' waterproof and breathable membranes prevent the passage of liquid water while allowing water vapor to escape. Today, these membranes are widely utilized in the form of hydrophobic microporous and hydrophilic non-porous structures. In this study, breathable yet water-resistant PVDF-based blend membranes were successfully fabricated using the dry/wet phase inversion technique. In the experimental study, the potentially used polymers polyether sulfone (PES) and cellulose acetate (CA) stand out in terms of selective permeability properties and application advantages. To prepare composite polymer membranes for both polymers, PVDF: additive polymer ratios of 80:20 and 90:10 was used with a total polymer concentration of 18% (w/w). Using the phase inversion method, membrane production was carried out by varying the polymer solution compositions and casting parameters (such as temperature and thickness), and the performance results were compared. The produced membranes were subjected to morphological structure examination via scanning electron microscopy (SEM), water vapor transmission rate (MWTR) test, tensile test, and weight/thickness measurements. PVDF/PES blends demonstrated superior mechanical strength and flexibility, while PVDF/CA blends offered enhanced water vapor permeability, particularly at lower casting temperatures and thinner film structures. The casting temperature of 60 °C, the casting thickness of 200 µm and the blend of PVDF with 10% PES led to the formation of a more robust structure, which improved both mechanical properties and MVTR. As compared to other formulation, this combination optimized the balance between permeability and mechanical performance.

Keywords: Selective permeable polymer membrane, Phase inversion method, Waterproof breathable membrane, PVDF blend membrane

Introduction

The human skin has a breathable structure that allows water vapor to escape while preventing the penetration of liquid water. Similarly, in the textile industry, breathable and waterproof membranes have been developed to ensure comfort and protection. (Gugliuzza & Drioli, 2013). Depending on the production method, these membranes exhibit either a hydrophilic non-porous (Figure 1) (Zhu et al., 2013) or a hydrophobic microporous structure (Figure 2) (Gong et al., 2023).
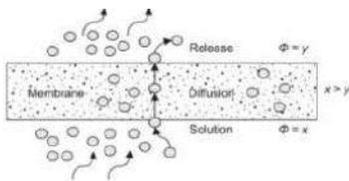

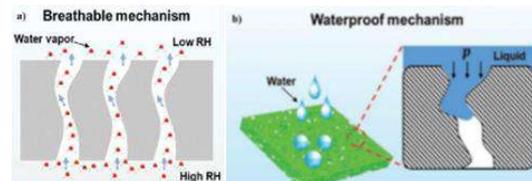Figure 1: Hydrophilic Pore-Free Membrane

Figure 2: Hydrophobic Microporous Membrane

Hydrophobic microporous membranes prevent liquid water penetration while allowing water vapor permeability and are generally produced through melt extrusion, biaxial stretching, or phase inversion methods (Chang & Liu, 2023). In this work, the dry/wet phase inversion method was employed, which enables the formation of the desired microstructure by controlled solidification of polymer solutions in a coagulation bath. This method offers significant advantages in optimizing the water vapor permeability, mechanical strength, and thermal stability of membranes. This study aims to fabricate PVDF-based (Figure 3) blend membranes using PES (Figure 4) and CA (Figure 5) polymers through the dry/wet phase inversion method.
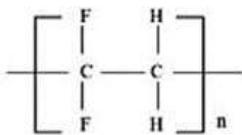
Figure 3: Pvdf Structure
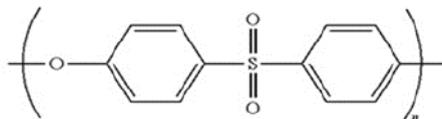
Figure 4: Pes Structure
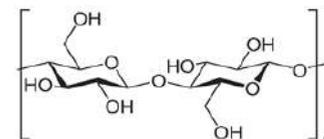
Figure 5: Ca Structure

PES enhances the durability of membranes due to its chemical resistance and thermal stability (Almansouri et al., 2024), while CA contributes to environmental sustainability due to its natural origin and improves water vapor permeability (Liu et al., 2022). The combination of these polymers with PVDF integrates the advantages of each material, enabling the development of high-performance membranes.

In this study, the effects of production parameters such as polymer solution composition, casting temperature, casting thickness, and coagulation bath temperature on membrane morphology and performance were examined using mechanical tests, weight/thickness analysis, SEM and MVTR testing methods.

Material and Method

Material

Poly (vinylidene fluoride-co-hexafluoropropylene) (PVDF, 455,000 Mw, 110,000 Mn), polyether sulfone (PES), cellulose acetate and N, N-Dimethylacetamide were procured from Sigma-Aldrich.

Apparatus

Flat sheet membranes were formed using a casting machine (MTI Corporation, Automatic film applicator) and a casting knife (MTI Corporation, 250 mm). The cross-sectional morphology of the membrane samples was examined by scanning electron microscopy (SEM) using an instrument (TESCAN, VEGA 3SBH). Mechanical strength tests were performed with AMETEK LLYOD LS1 model mechanical testing device according to the ASTM D638 standard. Water vapor permeability was tested using a conditioning chamber (Mayso brand) in accordance with the ASTM D96 standard. The thickness of the produced membranes was measured with a digital caliper (Mitutoyo, 150 mm, 0.01 mm resolution) and weight measurement was made with a precision balance (DENSİ, 0.1 mg precision).

Production Method

Phase inversion techniques are widely used and effective methods for the fabrication of porous polymer membranes (Figure 6). These techniques involve the controlled transformation of a polymer solution into a solid film. Phase inversion processes are generally classified into liquid-induced phase separation (LIPS), vapor-induced phase separation (VIPS), non-solvent induced phase separation (NIPS), and thermally induced phase separation (TIPS) (Geleta et al., 2023).

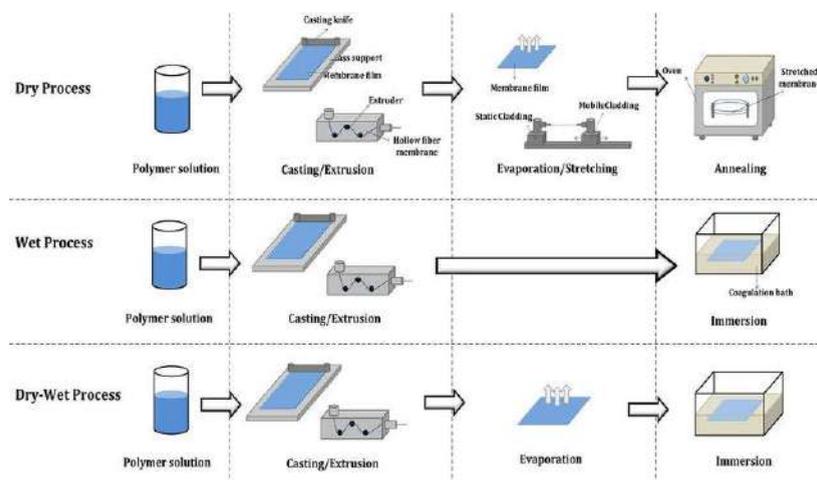Figure 6: Dry, Wet and Dry/Wet Phase Inversion Processes

Among these, NIPS involves dissolving the polymer in a suitable solvent to form a homogeneous casting solution, which is then immersed into a non-solvent medium (typically water). This process induces liquid-liquid phase separation, leading to formation of various pore structures. Additives in the casting solution, evaporation conditions,

and the solidification temperature significantly influence the membrane's pore morphology and permeability.

Membrane Fabrication

In this work, a dry/wet phase inversion method based on NIPS was used. At room temperature, PVDF-based blend polymer solutions with a total polymer concentration of 18% (w/w) were prepared by dissolving the polymers in N,N-Dimethylacetamide (DMAc), and stirred overnight at 250 rpm using a magnetic stirrer to obtain homogeneous casting solutions. The solutions were kept at room temperature and used after degassed. Flat-sheet membranes were fabricated by casting the polymer solutions onto glass plates using a doctor blade. Initially, a defined volume of the homogeneously mixed membrane solution was poured onto the glass surface. Doctor blade was adjusted to the desired thickness, was then positioned over the solution. Subsequently, a uniform film was formed on the glass substrate at a constant speed of 14 mm/s using an automatic film applicator. The cast films were allowed to stand for 30 seconds to allow partial solvent evaporation and then immersed into a coagulation bath containing distilled water at the same temperature as casting temperature. The membranes were kept in the bath for 1 minute to allow phase separation to occur. A simplified visualization of the applied method is shown in Figure 7.
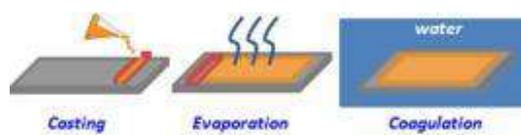
Figure 7: Schema of Membrane Fabrication Method

Membranes were fabricated under various experimental conditions by altering parameters such as casting temperature, film thickness, and polymer blend ratios. These variables were systematically adjusted to investigate their effects on membrane morphology and performance. A summary of the membrane formulations and corresponding fabrication parameters is presented in Table 1, providing a clear overview of the experimental design.

Tablo 1: Fabrication Parameters of The Prepared Membranes

Membrane Code	Polymer Composition* (Primary: Second poly.)	Knife Gap (µm)	Casting/ Bath Temperature (°C)
PV/CA-01	80% PVDF/ 20%CA	150	25
PV/CA-02	80% PVDF/ 20%CA	150	40
PV/CA-03	80% PVDF/ 20%CA	200	25
PV/CA-04	80% PVDF/ 20%CA	200	40
PV/CA-05	80% PVDF/ 20%CA	200	60
PV/CA-06	90% PVDF/ 10%CA	150	25
PV/CA-07	90% PVDF/ 10%CA	150	40
PV/CA-08	90% PVDF/ 10%CA	200	25
PV/CA-09	90% PVDF/ 10%CA	200	40

PV/CA-10	90% PVDF/ 10%CA	200	60
PV/CA-11	95% PVDF/ 5%CA	150	25
PV/CA-12	95% PVDF/ 5%CA	150	40
PV/CA-13	95% PVDF/ 5%CA	150	60
PV/CA-14	95% PVDF/ 5%CA	200	25
PV/CA-15	95% PVDF/ 5%CA	200	40
PV/CA-16	95% PVDF/ 5%CA	200	60
PV/CA-17	95% PVDF/ 5%CA	250	40
PV/CA-18	95% PVDF/ 5%CA	250	60
PV/PES-01	80% PVDF/ 20%PES	150	25
PV/PES-02	80% PVDF/ 20%PES	150	40
PV/PES-03	80% PVDF/ 20%PES	200	25
PV/PES-04	80% PVDF/ 20%PES	200	40
PV/PES-05	80% PVDF/ 20%PES	200	60
PV/PES-06	90% PVDF/ 10%PES	150	25
PV/PES-07	90% PVDF/ 10%PES	150	40
PV/PES-08	90% PVDF/ 10%PES	200	25
PV/PES-09	90% PVDF/ 10%PES	200	40
PV/PES-10	90% PVDF/ 10%PES	200	60
PV/PES-11	70% PVDF/ 30%PES	150	25
PV/PES-12	70% PVDF/ 30%PES	150	40
PV/PES-13	70% PVDF/ 30%PES	150	60
PV/PES-14	70% PVDF/ 30%PES	200	25
PV/PES-15	70% PVDF/ 30%PES	200	40
PV/PES-16	70% PVDF/ 30%PES	200	60
PV/PES-17	70% PVDF/ 30%PES	250	25
PV/PES-18	70% PVDF/ 30%PES	250	40
PV/PES-19	70% PVDF/ 30%PES	250	60

*All casting solutions were prepared with 18% polymer mixture and 82% solvent combination.

Characterization of the Fabricated Membranes

The fabricated membranes were characterized through a series of analytical methods to evaluate their physical, mechanical, and microstructural properties, as well as their water vapor permeability. For each membrane type, three parallel samples were prepared to ensure statistical accuracy.

Thickness and Weight

The produced membranes were cut into three parallel samples of 3x3 size. A digital caliper (0.01 mm resolution) was

used to measure the thickness of the cut samples, while an analytical balance (±0.0001 g precision) was used for weight measurements.

Mechanical Test

Tensile strength of the membranes was determined using an AMETEK LLYOD LS1 model mechanical testing machine. The samples were prepared by cutting them according to the dimensions specified in ASTM D638. The test was conducted according to ASTM D882, and the thickness and width of the gauge section were measured prior to testing. Subsequently, the specimens were mounted on the testing device with a 25 mm gauge length between the two grips and a crosshead speed of 100 mm/min was applied. Three samples were prepared from each membrane to be tested.

Membrane Morphology

Microstructural analysis was conducted using scanning electron microscopy (SEM); the membrane sample was cut into appropriate dimensions, immersed in liquid nitrogen, and fractured to obtain a smooth cross-section. The fractured membrane was then mounted on a vertical specimen holder using carbon tape. After Au/Pd sputter coating for 120 seconds at a current of 20 mA using a Quorum coater, SEM images were acquired at the desired magnifications.

Water Vapor Transmission Rate

Lastly, the water vapor transmission rate (MVTR) was determined in accordance with the ASTM E96-16 standard. In this test, approximately 10 g of distilled water was added into a GC vial. The membrane samples, cut to fit the opening of the vial cap, were carefully placed over the opening in the cap. The cap was then securely closed onto the vial to ensure proper sealing and to prevent any leakage during the test. The initial weight of the vial was recorded and the samples were tested for 7 days under controlled conditions of 38 °C and 50% relative humidity. Every 24 hours, the vials were reweighed and the change in mass was used to calculate the water vapor transmission rate.

$$\text{MVTR} = \frac{\Delta m}{A \times t}$$

Δm is the mass gain (g),

A is the test area (m^2),

T is the duration (days).

MVTR is commonly expressed in g/m^2.day.

Results and Discussion

Mechanical Test Results

The mechanical properties of PVDF-based blend membranes were investigated through tensile testing. The effects of

polymer blend composition (CA and PES at different ratios), membrane thickness and testing temperature on both tensile strength and percentage strain were systematically analyzed. The tensile strength results are presented in Figure 8, and the percentage strain at maximum load is shown in Figure 9.
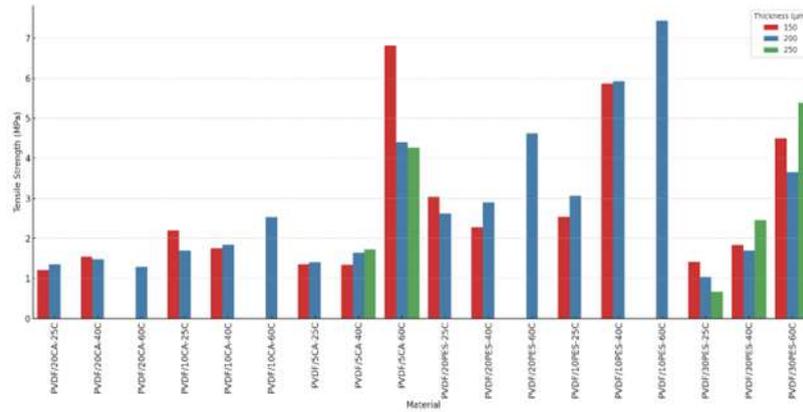
Figure 8: Tensile Strength by Material and Thickness
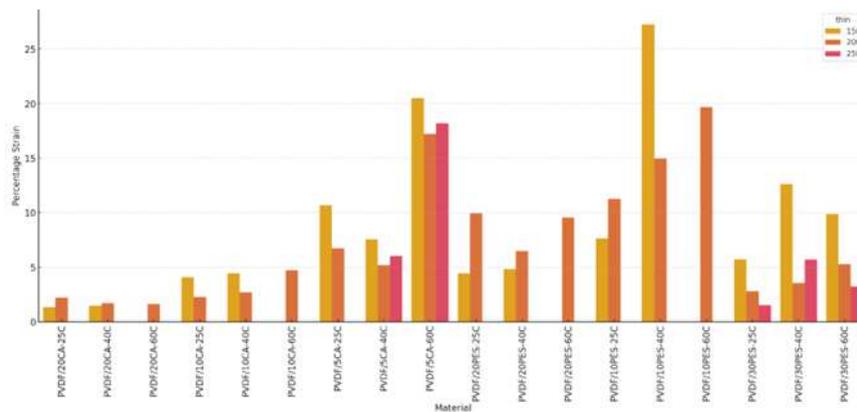
Figure 9: Percentage Strain at Maximum Load By Material and Thickness

Membranes prepared with PVDF/CA blends exhibited relatively moderate tensile strength and strain values. For instance, PVDF/5CA membranes showed enhanced elongation at break, especially at elevated temperatures (e.g., 20.5% strain and 6.81 MPa at 60 °C), suggesting improved flexibility and toughness due to lower CA content and higher testing temperatures. In contrast, PVDF/20CA membranes generally demonstrated lower strain (1.3%-2.2%) and tensile strength values (1.2-1.5 MPa), indicating a stiffer structure. PVDF/PES blends, on the other hand, significantly outperformed CA-based membranes in terms of both mechanical strength and elongation. PVDF/10PES membranes showed excellent mechanical behavior, with the highest tensile strength of 7.43 MPa and 19.67% strain observed at 60 °C. Moreover, PVDF/30PES-60C reached 5.38 MPa tensile strength, revealing the demonstrating reinforcing effect of PES even at higher blend ratios.

Water Vapor Transmission Rate Results

The water vapor transmission rate (MVTR) of PVDF blend membranes varied with polymer composition, fabrication

temperature, and thickness. MVTR results of the membranes are given in Figure 10.
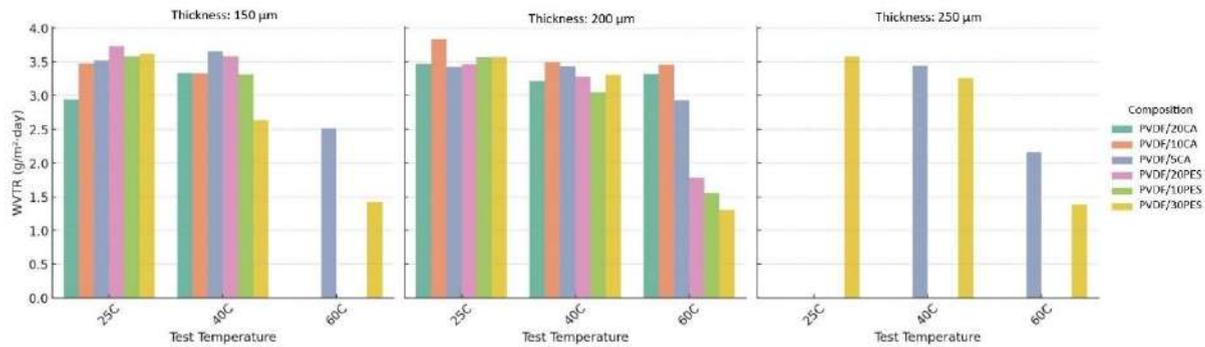
Figure 10: MVTR Comparison by Composition and Temperature

PVDF/20PES and PVDF/10CA blends at 150 µm thickness showed higher MVTR, especially at 25 °C and 40 °C, due to more open porous structures. Raising the casting temperature to 60 °C reduced MVTR, particularly in PES-containing membranes, indicating denser morphologies. PVDF/30PES showed a sharp MVTR drop at 60 °C. Thicker membranes (250 µm) exhibited lower MVTR due to increased diffusion path length.

Membrane Morphology Results

SEM analysis of the selected membranes revealed a typical asymmetric morphology characterized by a dense top layer and a porous substructure. The PV/PES-10 membrane exhibited a uniformly distributed sponge-like architecture, which is favorable for both mechanical strength and water vapor permeability. In contrast, PV/CA-10 membrane displayed macrovoids and finger-like structures, resulting in reduced mechanical stability. Meanwhile, PV/PES-05 membrane showed the presence of denser regions, which may potentially restrict breathability. SEM images of the mentioned membranes are given in Figure 11.
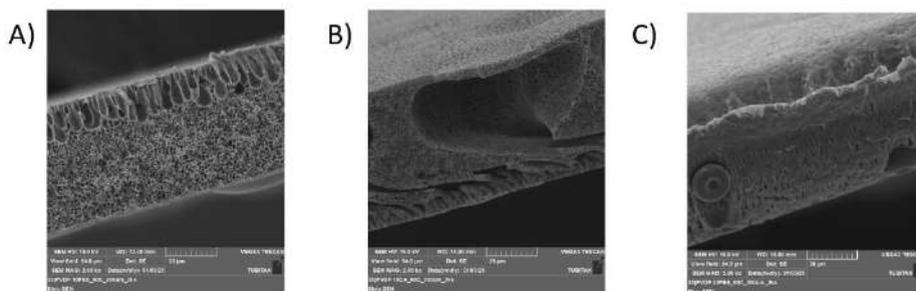
Figure 11: SEM images A) PV/PES-10, B) PV/CA-10 C) PV/PES-05

Conclusion

In this study, breathable yet water-resistant PVDF-based blend membranes were successfully fabricated using the dry/wet phase inversion technique. The incorporation of PES and CA significantly influences the mechanical and

vapor transmission performance of the membranes.

- PVDF/PES blends demonstrated superior mechanical strength and flexibility, while PVDF/CA blends offered enhanced water vapor permeability, particularly at lower casting temperature and with thinner film structures.

- The variation in casting parameters such as temperature and thickness played a crucial role in tailoring the membrane morphology and performance. These findings highlight the potential of PVDF-based polymer blends for use in textile applications requiring both durability and breathability, offering a promising pathway for future membrane development.

- PV/PES-10 membrane demonstrated the most balanced performance in terms of mechanical strength and water vapor transmission rate (MVTR). This membrane, with a tensile strength of 7.435 MPa and a percentage strain of 19.68%, exhibited excellent flexibility and toughness, ideal for applications requiring durability and elongation. Additionally, its MVTR was 1.554 $g/h.m^2$, which, although lower than that of some other membranes is indicative of a good balance between water vapor permeability and structural integrity, making it highly suitable for breathable but waterproof applications.

- The production parameters also played a crucial role in the performance of this membrane. The casting temperature of 60 °C and the blend of PVDF with 10%PES led to the formation of a more robust structure, which improved both mechanical properties and MVTR. As compared to other formulations, this combination optimized the trade-off between permeability and mechanical performance.

PV/PES-10 membrane is considered the best performing membrane, suitable for applications where a combination of high tensile strength and controlled water vapor permeability is desired.

Recommendations

Based on the findings of this study, the PV/PES-10 membranes formulation is recommended for applications requiring a balance of high mechanical durability and moderate water vapor permeability. This particular blend-produced at casting temperature of 60 °C with a polymer composition of PVDF and 10%PES-demonstrated the most favorable combination of tensile strength, elongation and moisture vapor transmission (MVTR). Future studies should focus on optimizing the casting and post-treatment conditions to further enhance the membrane's performance. Additionally, PVDF_HFP based membranes will also be prepared and investigated to explore alternative formulations with potentially improved flexibility and permeability properties. Moreover, the PV/PES-10 composition may serve as a reference point for the development of breathable yet water-resistant membranes for applications in textiles, biomedical devices and protective coatings. Further research into the long-term stability and chemical resistance of these membranes is also recommended to broaden their practical applicability.

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also extend my loved ones for their continuous support during this process.

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School Self-evaluation of Students with Specific Developmental Learning Disabilities in Inclusive Education in the Slovak Republic – Research through the SPAS Questionnaire

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Abstract: Specific developmental learning disabilities affect a student's school self-evaluation in primary education. Other factors that influence a student's self-evaluation include peer, teacher and self-reported successes and failures. Our paper focuses on the issue of school self-evaluation of students with specific developmental learning disabilities. We present a partial quantitative study that was conducted using the Student's Perception of Ability Scale, known globally by the acronym SPAS. The research population consisted of 100 respondents – students diagnosed with specific developmental learning disabilities who are educated in inclusive primary schools in Slovakia. The age of the respondents ranged from 10 to 15 years. The obtained research data were processed using mathematical and statistical methods. In line with other empirical research (Bear et al., 2002; Bryan & Pearl, 1979; Čornák & Popelková, 2009; Gans et al., 2003; Chapman & Boersma, 1979, 1992; Möller et al., 2008; Zeleke, 2004), the study also confirmed that students with specific developmental learning disabilities show lower school self-evaluation than their intact peers.

Keywords: Inclusive education, School self-evaluation, SPAS, Specific developmental learning disabilities

Introduction

The topic of school success and school self-evaluation of students with specific developmental learning disabilities

(hereinafter referred to as SDLD), among which are dyslexia (reading disorder), dysgraphia (writing disorder), dysorthography (spelling disorder) or dyscalculia (numeracy disorder), has been the focus of experts for several decades now. The manifestations of SDLDs affect the acquisition of basic school skills at a socially required level. The consequences of these disorders, which are linked with school failure or emotional problems, extend not only throughout the whole of school attendance and are expressed in the form of reduced school performance, but also affect the personality of their bearer.

The ideas of self-concept and self-evaluation are both the subject of research in psychology. Self-concept is a specific personality construct, a complex image of oneself composed of partial mental representations, characteristics, opinions and desires (Vágnerová, 2010). It relates to the thoughts, feelings and evaluations individuals have about themselves (Karakayali, 2021). Self-concept includes various partial aspects: self-image, opinions about oneself and self-evaluation, but also the relationship to oneself and the ability to regulate one's own expressions and activities (Vágnerová, 2010). Self-concept and self-evaluation are thus closely related.

Self-evaluation, as one of the components of self-concept, is understood as the result of social comparison and self-assessment based on observation of one's own activities (Markus & Wurf, 1987, Suls & Sanders, 1982 in Blatný, 2010). From a cognitive point of view, self-evaluation is an appreciation of one's own competencies and qualities; from an emotional point of view it is the relationship one has with oneself and the degree of self-acceptance. It reflects to what extent a person is satisfied with himself; whether he thinks positively or negatively about himself, or in what proportion these positive and negative attributes are present (Vágnerová, 2010).

Self-concept is a multidimensional construct that has changed over the years upon the adopting of different theories (Carrillo-López et al., 2022). Depending on what theories they adopt, experts most often include the academic (school) or professional dimension, the social and physical (bodily) dimension, but also the emotional (psychological) and family dimension among the dimensions/components of self-concept (García et al., 2011; Shavelson, 1976 in Marsh & Martin, 2011; Vágnerová, 2010). School self-concept is usually defined as the perception of students' competencies in school in general (globally) or in a specific academic area (specifically) (Rosen, 2010). One of the most important components of interventions for students with SDLD is precisely the building of a positive school self-concept. Therefore, it is important that all teaching be aimed at improving it (Bartoňová & Vítková, 2016).

On the basis of theoretical foundations, we can state that school self-evaluation, as a component of a student's school self-concept, is how students perceive themselves in this role – whether they consider themselves to be academically successful or unsuccessful. Studies dealing with the issue of school self-evaluation of students with SDLD are older data – but they agree in the view that these students have lower school self-evaluation (Bear et al., 2002; Čornák & Popelková, 2009; Gans et al., 2003; Chapman & Boersma, 1979, 1992b; Möller et al., 2008; Zeleke, 2004).

Research points to an association between school self-concept and students' academic performance (Miller & Moran, 2012). These studies describe that the more positive a student's school self-evaluation is, the better his or her achieved results are (Carrillo-López et al., 2022). This statement is also strengthened by a systematic review from Peperkorn and Wegner (2020), which states that school self-concept does indeed affect students' academic performance. Given

the above-stated, we consider it important to work with students who experience this low school self-concept or school self-evaluation. From the viewpoint of school success and school self-evaluation, students with SDLD are considered a risk group (Psychodiagnostika, 2025), because the students are usually aware of their own school failures (Harčaríková, 2010). We therefore consider it important to examine this issue in the context of SDLD.

Method

In this paper, we present a partial quantitative study whose aim was to determine the level of school self-evaluation of students with SDLD aged 10 to 15 years old studying in inclusive primary schools in Slovakia. The research was conducted using the standardised Student's Perception of Ability Scale, known worldwide under the abbreviation SPAS, which is one of the instruments for measuring school self-evaluation. The questionnaire was translated into Slovak by Matějček and Vágnerová (Psychodiagnostika, 2025). Research carried out using this questionnaire in the context of the SDLD is mostly older (Akande, 1997; Cullen, Boersma & Chapman, 1981; Čornák and Popelková, 2009; Dyson, 2003; Eiserman, 1988; Friedman & Medway, 1987; Heyman, 1990; Chapman & Boersma, 1979, 1992b; Robinson & Conway, 1990).

The SPAS questionnaire provides information about a student's attitude towards his/her own school performance. According to Žilinčík and Novotný (2014), this questionnaire can be used to determine how a student experiences and evaluates his/her own school performance and what his/her idea of his/her ability in individual subjects is. It contains 48 items, which are divided into 6 subscales: 1. general abilities, 2. mathematics, 3. reading, 4. writing, 5. spelling and 6. self-confidence.

The research set of the study presented herein consisted of 100 respondents – boys and girls with a diagnosis of SDLD, who are educated in inclusive primary schools in Slovakia (boys N=64, girls N=36). The age of the respondents was in the range from 10 to 15 years. Research data were obtained in seven districts of western and central Slovakia through special educators in counselling and prevention centres and school special educators in inclusive primary schools from September 2024 to January 2025. Each intermediary of research data received a cover letter for the research and informed consent. The directors of the counselling and prevention centres and inclusive primary schools were also informed about the course of the research. The research data obtained were processed using mathematical and statistical methods. We used statistical services to process the study data, which were evaluated using the JASP and SPSS programs. In analysing the data, we used descriptive statistics methods (mean, median, mode, standard deviation, skewness, slope, minimum and maximum). We verified the normality of the data distribution using the Shapiro–Wilk's test. We verified the differences between groups using the non-parametric Mann–Whitney U-test for data without a normal distribution and the Student's T-test for data with a normal distribution. We verified the equality of variances with the Student's T-test using Levene's test. We used the One Sample T-test to compare our data with norms, since we had available the average values of the variables in the norms.

Based on the research objectives, which included determining the level of school self-evaluation of both boys and girls with SDLD aged 10 to 15, we posited the following hypotheses.

Hypotheses

We established a total of 12 hypotheses, from which we selected 4 hypotheses for the purposes of the partial research of this paper:

- H1: The level of school self-evaluation of boys and girls with specific developmental learning disabilities is significantly reduced compared to the norms, as stated by the authors of the questionnaire.
- H2: The level of school self-evaluation of girls is significantly increased compared to boys among students with specific developmental learning disabilities.
- H3: The level of school self-evaluation of younger students with specific developmental learning disabilities is significantly increased compared to older students with specific developmental learning disabilities.
- H4: The level of school self-evaluation in the reading subscale is significantly reduced in students with dyslexia compared to students without dyslexia.

Hypothesis no. 1 is based on a generally known fact – that students with SDLD have lower school self-evaluation (Bear et al., 2002; Bryan & Pearl, 1979; Čornák & Popelková, 2009; Gans et al., 2003; Chapman & Boersma, 1979, 1992; Möller et al., 2008; Zeleke, 2004).

Hypothesis No. 2 is based on the claims of the authors of the questionnaire that school-age girls have more positive school self-evaluation than boys of the same age (Akande, 1997; Burns 1982 in Boersma & Chapman, 1992).

Hypothesis No. 3 is based on the claims that with increasing age, the perception of school self-evaluation in boys and girls becomes increasingly negative (Bryan & Pearl, 1979; Kuscuoglu & Hartas, 2022).

Hypothesis No. 4 is based on the assumption that there is a relationship between the diagnosis of SDLD and the subscale of the questionnaire that this diagnosis primarily affects.

Results

H1: The level of school self-evaluation of boys and girls with specific developmental learning disabilities is significantly reduced compared to the norms, as stated by the authors of the questionnaire.

This hypothesis is divided into sub hypotheses based on gender (male, female) and age (10 to 15 years); a total of 12 sub hypotheses (H1a – H1l).

To compare our results with the norm, we used a One sample T-test, which compares the mean values of the variable. The norms for the individual age groups are listed below each table of the One Sample T-test.

H1a: The level of school self-evaluation of 10-year-old boys with specific developmental learning disabilities is significantly reduced compared to the norms, as stated by the authors of the questionnaire.

Table1. Descriptive Statistics for The SPAS In 10-Year-Old Boys

N=6	SPAS
Modus	16.000
Median	26.500
Mean	24.667
SD	5.989
Skewness	-0.540
Slope	-0.960
P-value Shapiro-Wilk	0.567
Minimum	16.000
Maximum	32.000
1st quartile	20.750
3rd quartile	27.750

SD – standard deviation

Table 2. One Sample T-Test for Comparison of The SPAS In 10-Year-Old Boys with The Norm

	t	df	p	Mean Difference	95% CI for Mean Difference Lower	Upper	d_{Cohen}
SPAS	-0.791	5	0.232	-1.933	$-\infty$	2.993	-0.323

Note. For the Student t-test, the alternative hypothesis specifies that the mean is less than 26.6. SPAS – school self-evaluation, t – result of the T-test, df – degrees of freedom, p – significance, d_{Cohen} – effect size We found that there is no significant difference in the level of school self-evaluation of 10-year-old students compared to the norm; p= 0.232, d_{Cohen} =-0.323. Hypothesis H1a was not confirmed.

H1b: The level of school self-evaluation of 11-year-old boys with specific developmental learning disabilities is significantly reduced compared to the norms, as stated by the authors of the questionnaire.

Table 3. Descriptive Statistics for The SPAS In 11-Year-Old Boys

N=13	SPAS
Modus	16.000
Median	16.000
Mean	17.615
SD	6.076
Skewness	1.234
Slope	1.406
P-value Shapiro-Wilk	0.078
Minimum	10.000
Maximum	32.000
1st quartile	16.000
3rd quartile	18.000

SD – standard deviation

Table 4. One Sample T-Test for Comparison of The SPAS In 11-Year-Old Boys with The Norm

	t	df	p	Mean Difference	95% CI for Mean Difference		d_{Cohen}
					Lower	Upper	
SPAS	- 4.263	12	**5.507×10⁻⁴**	-7.185	-∞	-4.181	-1.182

Note. For the Student t-test, the alternative hypothesis specifies that the mean is less than 24.8. SPAS – school self-evaluation, t – result of the T-test, df – degrees of freedom, p – significance, d_{Cohen} – effect size We found that there is a significant difference in the level of school self-evaluation of 11-year-old boys compared to the norm; p<0.001; d_{Cohen}=-1.182, which is a large difference. Eleven-year-old boys had significantly lower self-evaluation (M=17.615) compared to the norm (M=24.8). Hypothesis H1b was confirmed.

Figure 1. Raincloud Graph for The Level of School Self-Evaluation In 11-Year-Old Boys Compared to The Norm

H1c: The level of school self-evaluation of 12-year-old boys with specific developmental learning disabilities is significantly reduced compared to the norms, as stated by the authors of the questionnaire.

Table. 5 Descriptive Statistics for the SPAS in 12-Year-Old Boys

N=13	SPAS
Modus	12.000
Median	16.000
Mean	19.231
SD	8.298
Skewness	0.758
Slope	-0.756
P-value Shapiro-Wilk	0.042
Minimum	11.000
Maximum	35.000
1st quartile	12.000
3rd quartile	26.000

SD – standard deviation

Table 6. One Sample T-Test for Comparison of The SPAS In 12-Year-Old Boys with The Norm

| | t | df | p | Mean Difference | 95% CI for Mean Difference | | d_{Cohen} |
					Lower	Upper	
SPAS	-1.551	12	0.073	-3.569	$-\infty$	0.533	-0.430

Note. For the Student t-test, the alternative hypothesis specifies that the mean is less than 22.8. SPAS – school self-evaluation, t – result of the T-test, df – degrees of freedom, p – significance, d_{Cohen} – effect size We found that there is no significant difference in the level of school self-evaluation of 12-year-old boys compared to the norm; p=0.073, d_{Cohen}=-0.430. Hypothesis H1c was not confirmed.

H1d: The level of school self-evaluation of 13-year-old boys with specific developmental learning disabilities is significantly reduced compared to the norms, as stated by the authors of the questionnaire.

Table 7. Descriptive Statistics for The SPAS In 13-Year-Old Boys

N=11	SPAS
Modus	12.000
Median	12.000
Mean	12.455
SD	9.802
Skewness	1.469
Slope	2.806
P-value Shapiro-Wilk	0.076
Minimum	0.000
Maximum	36.000
1st quartile	7.000
3rd quartile	13.000

SD – standard deviation

Table 8. One Sample T-Test for Comparison of The SPAS In 13-Year-Old Boys with The Norm

| | t | df | p | Mean Difference | 95% CI for Mean Difference | | d_{Cohen} |
					Lower	Upper	
SPAS	-4.279	10	**8.071×10^{-4}**	-12.645	$-\infty$	-7.289	-1.290

Note. For the Student t-test, the alternative hypothesis specifies that the mean is less than 25.1. SPAS – school self-evaluation, t – result of the T-test, df – degrees of freedom, p – significance, d_{Cohen} – effect size We found that there is a significant difference in the level of school self-evaluation of 13-year-old boys compared to the norm; p<0.001, d_{Cohen}=-1.290. This difference is large. Thirteen-year-old boys had significantly lower self-evaluation (M=12.455) compared to the norm (M=25.1). Hypothesis H1d was confirmed
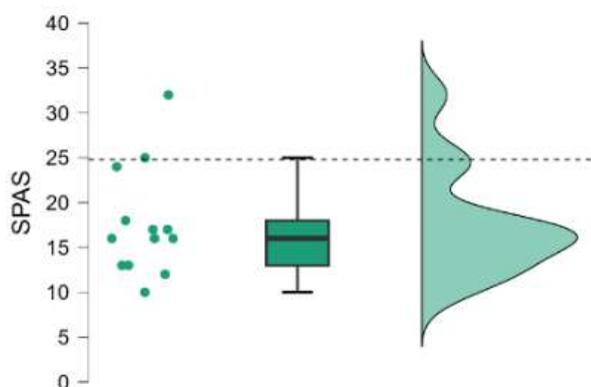
Figure 2. Raincloud Graph for The Level of School Self-Evaluation Of 13-Year-Old Boys Compared to The Norm

H1e: The level of school self-evaluation of 14-year-old boys with specific developmental learning disabilities is significantly reduced compared to the norms, as stated by the authors of the questionnaire.

Table 9. Descriptive statistics for The SPAS In 14-Year-Old Boys

N=15	SPAS
Modus	16.000
Median	16.000
Mean	17.867
SD	7.170
Skewness	0.199
Slope	-0.919
P-value Shapiro-Wilk	0.483
Minimum	7.000
Maximum	30.000
1st quartile	13.500
3rd quartile	23.000

SD – standard deviation

Table 10. One Sample T-Test for Comparison of The SPAS In 14-Year-Old Boys with The Norm

	t	df	p	Mean Difference	95% CI for Mean Difference		d_{Cohen}
					Lower	Upper	
SPAS	-3.421	14	**0.002**	-6.333	$-\infty$	-3.073	-0.883

Note. For the Student t-test, the alternative hypothesis specifies that the mean is less than 24.2. SPAS – school self-evaluation, t – result of the T-test, df – degrees of freedom, p – significance, d_{Cohen} – effect size We found that there is a significant difference in the level of school self-evaluation of 14-year-old boys compared to the norm; $p<0.01$, $d_{Cohen}=-0.883$. This difference is large. Fourteen-year-old boys had significantly lower self-evaluation (M=17.867) compared to the norm (M=24.2). Hypothesis H1e was confirmed.

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Figure 3. Raincloud graph For the Level of School Self-Evaluation In 14-Year-Old Boys Compared to The Norm

H1f: The level of school self-evaluation of 15-year-old boys with specific developmental learning disabilities is significantly reduced compared to the norms, as stated by the authors of the questionnaire.

Table 11. Descriptive Statistics for The SPAS In 15-Year-Old Boys

N=6	SPAS
Modus	22.000
Median	19.000
Mean	17.833
SD	5.193
Skewness	-0.333
Slope	-2.349
P-value Shapiro-Wilk	0.191
Minimum	11.000
Maximum	23.000
1st quartile	13.750
3rd quartile	22.000

SD – standard deviation

Table 12. One Sample T-Test for Comparison of The SPAS In 15-Year-Old Boys with The Norm

	t	df	p	Mean Difference	95% CI for Mean Difference		d_{Cohen}
					Lower	Upper	
SPAS	-2.107	5	**0.044**	-4.467	$-\infty$	-0.195	-0.860

Note. For the Student t-test, the alternative hypothesis specifies that the mean is less than 22.3. SPAS – school self-evaluation, t – result of the T-test, df – degrees of freedom, p – significance, d_{Cohen} – effect size We found that there is a significant difference in the level of school self-evaluation of 15-year-old boys compared to the norm; $p<0.01$, d_{Cohen}=-0.860. This difference is large. Fifteen-year-old students had significantly lower self-evaluation (M=17.833) compared to the norm (M=22.3). Hypothesis H1f was confirmed.
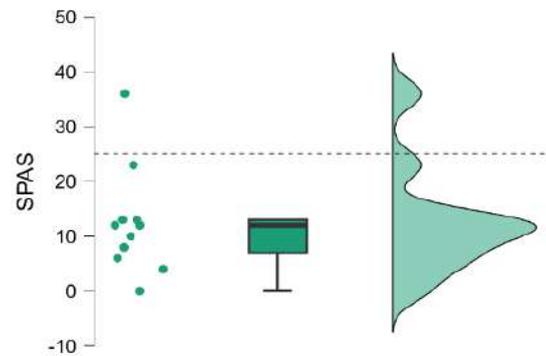
Figure 4. Raincloud Graph for The Level of School Self-Evaluation Of 15-Year-Old Boys Compared to The Norm

H1g: The level of school self-evaluation of 10-year-old girls with specific developmental learning disabilities is significantly reduced compared to the norms, as stated by the authors of the questionnaire.

Table 13. Descriptive Statistics for The SPAS In 10-Year-Old Girls

N=5	SPAS
Modus	7.000
Median	15.000
Mean	13.400
SD	5.320
Skewness	-0.106
Slope	-1.753
P-value Shapiro-Wilk	0.685
Minimum	7.000
Maximum	20.000
1st quartile	9.000
3rd quartile	16.000

SD – standard deviation

Table 14. One Sample T-Test for Comparison of The SPAS In 10-Year-Old Girls with The Norm

	t	df	p	Mean Difference	95% CI for Mean Difference		
					Lower	Upper	d_{Cohen}
SPAS	-7.230	4	**9.709×10⁻⁴**	-17.200	$-\infty$	-12.128	-3.233

Note. For the Student t-test, the alternative hypothesis specifies that the mean is less than 30.6 SPAS – school self-evaluation, t – result of the T-test, df – degrees of freedom, p – significance, d_{Cohen} – effect size We found that there is a significant difference in the level of school self-evaluation of 10-year-old girls compared to the norm; $p<0.001$, $d_{Cohen}=-3.233$. This difference is large. Ten-year-old girls had significantly lower self-evaluation (M=13.400) compared to the norm (M=30.6). Hypothesis H1g was confirmed.
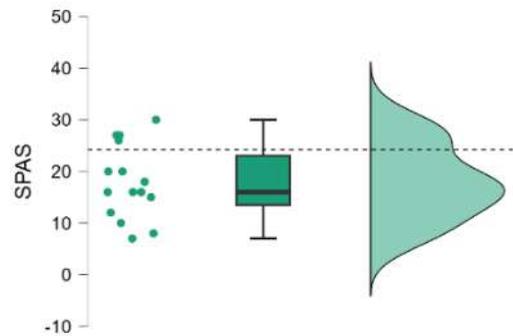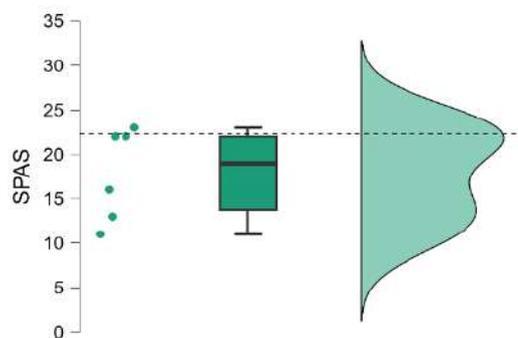
Figure 5. Raincloud Graph for The Level of School Self-Evaluation In 10-Year-Old Girls Compared to The Norm

H1h: The level of school self-evaluation of 11-year-old girls with specific developmental learning disabilities is significantly reduced compared to the norms, as stated by the authors of the questionnaire.

Because of the low number of respondents of the given gender and age (N=2), we decided not to include this subhypothesis in the interpretation of our research.

H1i: The level of school self-evaluation of 12-year-old girls with specific developmental learning disabilities is significantly reduced compared to the norms, as stated by the authors of the questionnaire.

Table 15. Descriptive Statistics for The SPAS In 12-Year-Old Girls

N=8	SPAS
Modus	6.000
Median	15.500
Mean	15.500
SD	5.976
Skewness	0.000
Slope	-0.217
P-value Shapiro-Wilk	0.996
Minimum	6.000
Maximum	25.000
1st quartile	11.750
3rd quartile	19.250

SD – standard deviation

Table 16. One Sample T-Test for Comparison of The SPAS In 12-Year-Old Girls with The Norm

	T	Df	P	Mean Difference	95% CI For Mean Difference		D_{cohen}
					Lower	Upper	
SPAS	-4.733	7	**0.001**	-10.000	-∞	-5.997	-1.673

Note. For the Student t-test, the alternative hypothesis specifies that the mean is less than 25.5. SPAS – school self-evaluation, t – result of the T-test, df – degrees of freedom, p – significance, d_{Cohen} – effect size We found that there is a significant difference in the level of school self-evaluation of 12-year-old girls compared to the norm; $p<0.01$,

d_{Cohen}=-1.673. This difference is large. Twelve-year-old girls had significantly lower self-evaluation (M=15.5) compared to the norm (M=25.5). Hypothesis H1i was confirmed.
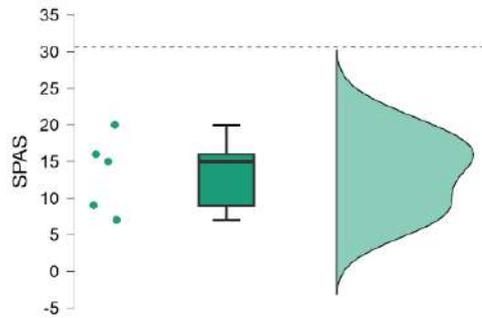

Figure 6. Raincloud Graph for The Level of School Self-Evaluation In 12-Year-Old Girls Compared to The Norm

H1j: The level of school self-evaluation of 13-year-old girls with specific developmental learning disabilities is significantly reduced compared to the norms, as stated by the authors of the questionnaire.

Table 17. Descriptive Statistics for the SPAS In 13-Year-Old Girls

N=8	SPAS
Modus	1.000
Median	10.000
Mean	11.375
SD	7.891
Skewness	0.292
Slope	-1.037
P-value Shapiro-Wilk	0.706
Minimum	1.000
Maximum	23.000
1st quartile	6.750
3rd quartile	16.500

SD – standard deviation

Table 18. One Sample T-Test for Comparison of The SPAS In 13-Year-Old Girls with The Norm

	t	df	p	Mean Difference	95% CI for Mean Difference		d_{Cohen}
					Lower	Upper	
SPAS	-5.314	7	5.533×10^{-4}	-14.825	-∞	-9.539	-1.879

Note. For the Student t-test, the alternative hypothesis specifies that the mean is less than 26.2. SPAS – school self-evaluation, t – result of the T-test, df – degrees of freedom, p – significance, d_{Cohen} – effect size We found that there is a significant difference in the level of school self-evaluation of 13-year-old girls compared to the norm; p<0.001, d_{Cohen}=-1.879. This difference is large. Thirteen-year-old girls had significantly lower self-evaluation (M=11.375) compared to the norm (M=26.2). Hypothesis H1j was confirmed.
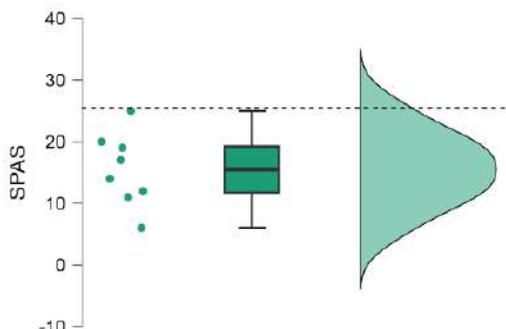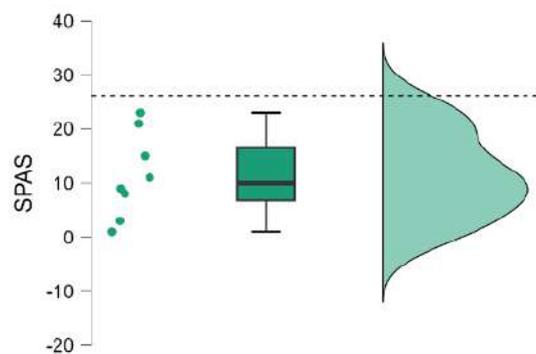
Figure 7. Raincloud graph For the Level of School Self-Evaluation In 13-Year-Old Girls Compared to The Norm

H1k: The level of school self-evaluation of 14-year-old girls with specific developmental learning disabilities is significantly reduced compared to the norms, as stated by the authors of the questionnaire.

Table 19. Descriptive statistics For the SPAS In 14-Year-Old Girls

N=10	SPAS
Modus	23.000
Median	23.000
Mean	21.100
SD	9.562
Skewness	-0.589
Slope	-1.155
P-value Shapiro-Wilk	0.186
Minimum	6.000
Maximum	33.000
1st quartile	13.500
3rd quartile	28.750

SD – standard deviation

Table 20. One Sample T-Test for Comparison of The SPAS In 14-Year-Old Girls with The Norm

	t	df	p	Mean Difference	95% CI for Mean Difference		d_{Cohen}
					Lower	Upper	
SPAS	-1.620	9	0.070	-4.900	$-\infty$	0.643	-0.512

Note. For the Student t-test, the alternative hypothesis specifies that the mean is less than 26. SPAS – school self-evaluation, t – result of the T-test, df – degrees of freedom, p – significance, d_{Cohen} – effect size We found that there is no significant difference in the level of school self-evaluation of 14-year-old girls compared to the norm; p=0.070, d_{Cohen}=-0.512. Hypothesis H1k was not confirmed.

H1l: The level of school self-evaluation of 15-year-old girls with specific developmental learning disabilities is significantly reduced compared to the norms, as stated by the authors of the questionnaire.

Because of the low number of respondents of the given gender and age (N=3), we decided not to include this subhypothesis in the interpretation of our research.

H2: The level of school self-evaluation of girls is significantly increased compared to boys among students with specific developmental learning disabilities.

The result of this hypothesis (H2) is based on the results of subhypotheses H1. Within this hypothesis (H2), we compared the level of school self-evaluation between girls and boys with SDLD of all age categories.

Table 21. Descriptive statistics for the SPAS in the group of boys and girls

	SPAS	
N1=64, N2=36	1	2
Modus	16.000	23.000
Median	16.000	16.500
Mean	17.797	16.139
SD	7.856	8.367
Skewness	0.370	0.020
Slope	-0.334	-0.864
P-value Shapiro-Wilk	0.114	0.596
Minimum	0.000	1.000
Maximum	36.000	33.000
1st quartile	12.000	9.000
3rd quartile	23.250	23.000

1 – boys, 2 – girls, SD – standard deviation Since the data were normally distributed in both groups, we used the parametric Student's T-test to calculate the difference between the groups.

Table 22. Levene's Test for Equality of Variances

	F	df_1	df_2	p
SPAS	0.432	1	98	0.513

F – result of Levene's test, df1 – degrees of freedom for groups, df2 – degrees of freedom for individuals, p – significance

Table 23. Student's T-test For Differences in Self-Evaluation Between Boys and Girls

	t	df	p	d_{Cohen}
SPAS	0.990	98	0.838	0.206

Note. For all tests, the alternative hypothesis specifies that group 1 is less than group 2. SPAS – school self-evaluation, t – result of the T-test, df – degrees of freedom, p – significance, d_{Cohen} – effect size Using Levene's test, we found that the condition of equality of variances was met; p=0.513, F=0.432. We further found that there is no significant difference between boys and girls in the level of school self-evaluation; p = 0.838, d_{Cohen}=0.206. Hypothesis H2 was not confirmed.

H3: The level of school self-evaluation of younger students with specific developmental learning disabilities is significantly increased compared to older students with specific developmental learning disabilities.

The result of this hypothesis (H3) is again based on the results of sub-hypotheses H1. We set a boundary between younger age (10, 11, 12 years) and older age (13, 14, 15 years). Within this hypothesis (H3), we compared the level of school self-evaluation between girls and boys of younger school age and older school age.

Since the data were normally distributed in both groups, we used the parametric Student's T-test to calculate the difference between the groups

.

Table 24. Descriptive Statistics for The SPAS In Younger and Older Students

	SPAS	
N1=47, N2=53	1	2
Modus	12.000	23.000
Median	17.000	16.000
Mean	18.383	16.151
SD	7.097	8.727
Skewness	0.541	0.186
Slope	-0.438	-0.695
P-value Shapiro-Wilk	0.058	0.480
Minimum	6.000	0.000
Maximum	35.000	36.000
1st quartile	12.500	10.000
3rd quartile	24.500	23.000

1 – younger students (10, 11 and 12 years old), 2 – older students (13, 14 and 15 years old),

SD – standard deviation

Table 25. Levene's test For Equality of Variances

	F	df_1	df_2	p
SPAS	2.754	1	98	0.100

F – Levene's test result, df1 – degrees of freedom for groups,

df2 – degrees of freedom for individuals, p – significance

Table 26. Student's T-test for Differences in Self-Evaluation Levels Between Younger and Older Students

	t	df	p	d_{Cohen}
SPAS	1.392	98	0.084	0.279

Note. For all tests, the alternative hypothesis specifies that group 1 is greater than group 2. SPAS – school self-evaluation, t – result of the T-test, df – degrees of freedom, p – significance, d_{Cohen} – effect size Using Levene's test, we found that the condition of equality of variances was met; p=0.100, F=2.754. We further found that there is no significant difference between younger and older students in the level of school self-evaluation; p = 0.084, d_{Cohen}=0.279. Hypothesis H3 was not confirmed.

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H4: The level of school self-evaluation in the reading subscale is significantly reduced in students with dyslexia compared to students without dyslexia.

For this hypothesis (H4), we assumed a significant difference in the level of school self-evaluation in the reading subscale in students with dyslexia and without dyslexia. In the scope of this hypothesis (H4), we investigated whether there is a relationship between a specific SDLD (dyslexia) and the subscale of the SPAS questionnaire that this SDLD primarily affects (reading subscale).

Table 27. Descriptive statistics of School Self-Evaluation in The Reading Subscale in Children with and Without Dyslexia

	HS reading	
N0=27, N1=73	0	1
Modus	3.000	0.000
Median	5.000	2.000
Mean	4.074	2.397
SD	2.336	2.133
Skewness	-0.292	0.725
Slope	-0.925	-0.134
P-value Shapiro-Wilk	0.120	3.603×10^{-5}
Minimum	0.000	0.000
Maximum	8.000	8.000
1st quartile	2.500	1.000
3rd quartile	6.000	4.000

0 – children without dyslexia, 1 – children with dyslexia, SD – standard deviation

Table 28. Mann-Whitney U-Test for Comparing School Self-Evaluation in The Reading Subscale in Children with and Without Dyslexia

	U	p	d_{Cohen}
HS reading	1391.500	**7.314×10^{-4}**	0.644

U – result of the Mann-Whiteny U-test, p – significance, d_{Cohen}-effect size We found that there is a significant difference in school self-evaluation in the reading subscale in both boys and girls with and without dyslexia at the significance level, $p<0.001$, $d_{Cohen}=0.644$, with higher values found among the group without dyslexia (M=4.074) compared to the group with dyslexia (M=2.397). Hypothesis H4 was confirmed – there is a link between dyslexia and the SPAS reading subscale.
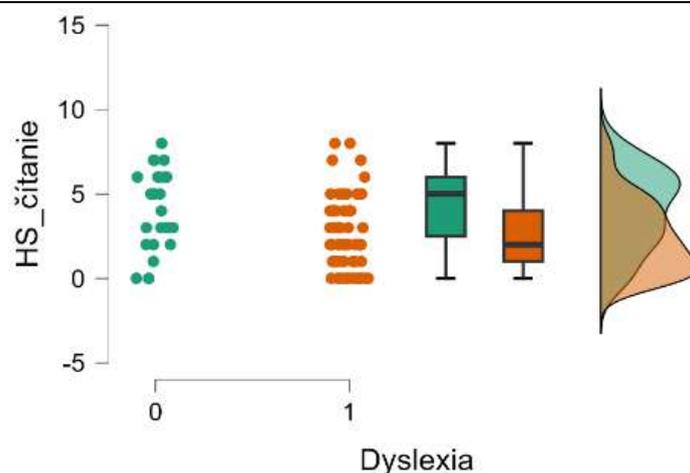
Figure 8. Raincloud graph For the Level of School Self-Evaluation in The Reading Subscale for Boys and Girls with And Without Dyslexia

Discussion

The goal of the partial research was to determine the level of school self-evaluation of boys and girls with SDLD aged 10 to 15 years studying in inclusive primary schools in Slovakia. Because the size of the study set in subhypotheses H1h (11-year-old girls; N=2) and H1l (15-year-old girls; N=3) was small, we decided not to include these two subhypotheses in the interpretation of hypothesis H1.

Upon processing the data obtained through the SPAS questionnaire, we found that the lower level of school self-evaluation of boys and girls with SDLD aged 10 to 15 years old was confirmed with statistical significance in 7 out of 10 (originally 12 – see explanation above) sub-hypotheses of H1 divided by gender and age (H1a to H1l) – specifically in boys aged 11, 13, 14 and 15 years old and in girls aged 10, 12 and 13 years old. Because school self-concept and school self-evaluation are highly subjective (Karakayali, 2021; Vágnerová, 2010), the failure to confirm a significant difference in the three remaining monitored sub-hypotheses – H1a (10-year-old boys), H1c (12-year-old boys) and H1k (14-year-old girls) – may be related to this fact.

Significantly lower school self-evaluation was confirmed in 7 out of 10 sub-hypotheses of H1, and thus in the vast majority. This finding corresponds with those of other authors (Akande, 1997; Cullen, Boersma & Chapman, 1981; Čornák & Popelková, 2009; Friedman & Medway, 1987; Heyman, 1990; Chapman & Boersma, 1979, 1992b). Given the three remaining sub-hypotheses of hypothesis H1 were not confirmed, the assumption H1 as a whole cannot be considered confirmed.

We further found that there is no significant difference between boys and girls in the level of school self-evaluation (H2); that is, our assumption when formulating the hypotheses – that girl, based on research (Akande, 1997; Burns 1982 in Boersma & Chapman, 1992), would have a higher school self-evaluation than boys – was not confirmed in our study.

The results of our research also show that there is no significant difference between younger and older students in the level of school self-evaluation (H3) (a comparison of the younger group of 10, 11, 12-year-old students with the older group of 13, 14, 15-year-old students); that is, the assumption, based on research (Bryan & Pearl, 1979; Kuscuoglu & Hartas, 2022), we used as a basis to formulate the hypothesis that younger students would have higher school self-evaluation than older students was not confirmed in our study.

The last task of our study was to determine whether there is a relationship between the diagnosis of SDLD and the subscale of the SPAS questionnaire that this diagnosis primarily affects (specifically, the relationship between dyslexia and the reading subscale) (H4). We investigated this aim by comparing the school self-evaluation in the reading subscale in a group of students with dyslexia and a group without dyslexia. We found that there is a significant difference in the school self-evaluation in the reading subscale between students with dyslexia and those without dyslexia, with the group without dyslexia naturally achieving higher school self-evaluation values. In this case, our assumption was confirmed.

Conclusion

SDLD is characterised by a discrepancy between reduced performance in handling common tasks and intact intellectual abilities. SDLD is not expressed only in the area in which the disorder predominates; it can also be accompanied by other difficulties – in speech, concentration, behaviour, perception, orientation or motor skills – which suggests the relatedness of these disorders (Bartoňová, 2018, 2020; Zelinková, 2015). The consequences of SDLD extend not only throughout school attendance and in reduced school performance, but also affect the adult life and personality (self-concept and self-evaluation) of their carrier (Bartoňová, 2018; Harčaríková, 2008a). In our view, the topic of school self-concept and self-evaluation of students with SDLD is a constantly current topic despite the fact that it has not been given sufficient attention in the last two decades. Because school results are influenced not only by students' cognitive abilities, but also by their perception of their own abilities (Bloom, 1976 in Boersma & Chapman, 1992a; Carrillo-López et al., 2022; Peperkorn & Wegner, 2020), we consider it important and beneficial to examine this issue in the context of students with SDLD, who in terms of school self-evaluation and self-concept represent a risk group of students.

Our research shows that boys aged 11, 13, 14 and 15 and girls aged 10, 12 and 13 with SDLD have a significantly low level of school self-evaluation compared to their intact peers.
Another finding is that there is no difference in school self-evaluation in terms of gender (between girls and boys) or in terms of age (between the younger group of 10, 11, 12-year-old students and the older group of 13, 14, 15-year-old students). At the same time, we found that there is a relationship between the diagnosis of SDLD and the subscale of the SPAS questionnaire that this diagnosis primarily affects (specifically, the relationship between the diagnosis of dyslexia and the reading subscale).

A limit of the research is the size of the research sample (N=100), which we plan to expand in the future in order to re-verify the hypotheses. The study was conducted in the Slovak Republic; therefore, it cannot be generalised in the context of other countries.

The study is part of the VEGA project solution No. 1/0196/23 Approaches, interventions and attitudes of teachers towards students with specific developmental learning disabilities and specific behavioural disorders (ADHD) in Slovak primary schools and also part of the Grant project solution No. UK/1151/2025 School self-evaluation of students in primary schools with an inclusive approach to education.

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Early Childhood Intervention Services in the Context of the Transformation of the Counselling and Prevention System in Slovakia

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Abstract: The counselling and prevention system in Slovakia underwent a transformation process, dividing services into five levels of support. The goal was to improve the quality and accessibility of services for children and pupils with special educational needs. The transformation, effective from January 1, 2023, is part of the Recovery and Resilience Plan of the Slovak Republic, with emphasis on inclusive education. This paper presents results of original research focused on identifying the current state and quality of early childhood intervention services after the transformation, as well as its impact on service quality. The findings confirmed the provision of a broad range of early childhood intervention services and generally positive evaluation of material resources in counselling and prevention centres by professionals working there. However, technical equipment was evaluated less favourably. Staffing results confirmed the predominance of special educators and psychologists within the counselling and prevention system, including early childhood intervention services. The availability of early childhood intervention services — in terms of time, geography, and financial affordability — was mostly rated positively. However, several shortcomings were identified, particularly in geographical and financial accessibility, technical equipment, and the availability of specialised experts, such as speech therapists, therapeutic pedagogues, and social pedagogues. These weaker areas could hinder the effective functioning of services and comprehensive support for young children and their families. The findings provide a valuable basis for improving service quality, including early childhood intervention services, and for further systemic reforms within Slovakia's counselling and prevention system.

Keywords: Transformation, Counselling and Prevention System, Early Childhood Intervention Services, Quality, Slovakia

Introduction

Early childhood intervention is a term used to describe services and support available for children with developmental delays, disabilities, and other developmental issues, as well as their families (Centers for Disease Control and Prevention [CDC], 2023). It includes the entire process from the earliest possible diagnosis to the provision of

interventions for children, education, guidance, and parental support (European Association of Service Providers for Persons with Disabilities [EASPD], 2020). As such, early childhood intervention is a critical component of comprehensive care for individuals with disabilities. It supports the development of weakened areas and functions in the child, preserved compensatory mechanisms, and positively influences the individual's overall development. It is a key determinant in increasing the functionality of a child with disabilities and in mitigating the adverse consequences of a disability. Therefore, children with disabilities represent a critical group of early childhood intervention service recipients (Hunt, 2019; Lopúchová, 2011). Experts around the world have highlighted the importance of the family and support services in early childhood intervention for children with disabilities, as demonstrated in numerous research findings (e.g. Rey-Guerra et al., 2022; Bagur et al., 2022; Spence et al., 2023; McConkey et al., 2023). Early childhood intervention services should be directed not only toward the child but also toward supporting the family, which should actively cooperate with professionals. A family-centered approach is thus preferred.

Early childhood intervention is part of the counselling and prevention system under the Ministry of Education, Research, Development, and Youth of the Slovak Republic. Since January 2023, this system has undergone significant transformation. The reform is part of Slovakia's Recovery and Resilience Plan, specifically Component 6, which focuses on accessibility, development, and quality of inclusive education. The aim of this reform was not only the transformation of counselling and prevention institutions but also the enhancement of advisory services, including early childhood intervention services (Plán obnovy a odolnosti SR, 2021).

Currently, the counselling and prevention system comprises counselling and prevention institutions, divided into counselling and prevention centres and specialized counselling and prevention centres. The transformation also included a restructuring of professional activities into five levels of support. Each level has clearly defined tasks, location of service provision, and required professional staff. Early childhood intervention is included at multiple levels (levels 3–5), most notably at level 5, which is carried out specifically in specialized counselling and prevention centres (Zákon č. 245/2008 Z.z.). Thanks to this reform, specialized centres can now focus specifically on the provision of early childhood intervention services (Ministerstvo školstva, výskumu, vývoja a mládeže SR, 2022).

Regarding the enhancement of early childhood intervention services provided within the counselling and prevention system, several quality-determining attributes can be identified. The material and technical equipment of institutions providing early childhood intervention is a fundamental pillar of high-quality services for families with children with disabilities (Anaby et al., 2013; Hatzigianni et al., 2023). During the transformation, this aspect was emphasized along with appropriate staffing. Increasing the qualifications and professionalism of staff is a key strategy in improving early childhood intervention services on an international level (Irvine et al., 2023). Another important factor is the accessibility of early childhood intervention services in terms of geography, capacity, and cost. The timeliness of care provision, which significantly affects quality, depends on this accessibility. The reform also aimed at improving service accessibility.

The quality of early childhood intervention services is also significantly influenced by the level of cooperation among professionals within an institution and across institutions. A transdisciplinary model of service provision directly contributes to service quality (EASPD, 2022). Moreover, a core element of high-quality services for young children

is partnership with parents. A family-centered focus is based not only on providing services to the child but to the family as a whole. The relationship with the family is essential for achieving successful outcomes (Shalapatova & Kotzeva, 2023). It is important to emphasize that the quality of early childhood intervention services, particularly accessibility, is influenced by the family's socio-economic situation. It affects which services the family can access, geographically and financially (Costanzo & Magnuson, 2024). According to Ünver and Nicaise (2016), limited accessibility (geographical, capacity-related, or financial) is one of the primary obstacles to early childhood intervention service provision.

In the Slovak context, another critical area involves the provision of specific early childhood intervention services (particularly therapies) by private institutions. These therapies are typically not offered by public institutions and are not integrated with services provided by counselling and prevention institutions (Fričová et al., 2018).

The transformation of the counselling and prevention system aimed to improve the quality of early childhood intervention services. However, families with young children with disabilities in Slovakia still encounter certain barriers to receiving high-quality early childhood intervention. The attributes of quality and the critical areas in practice motivated us to investigate the current state of early childhood intervention services in Slovakia following the transformation of the counselling and prevention system.

Method

Research Problem

The transformation of the counselling and prevention system is part of the Recovery and Resilience Plan of the Slovak Republic. In 2023, it brought changes to the functioning of the entire counselling and prevention system, particularly the restructuring of professional activities into five levels of support. Early childhood intervention is included in several of these support levels, with particular emphasis on the fifth support level. The aim of the transformation was to improve the quality of services provided in counselling and prevention institutions, including early childhood intervention services. However, this transformation brings new challenges and questions regarding the change itself. Is the support system adequately staffed with a sufficient number of professionals to ensure the quality provision of services and support to young children and their families? What role does the family play in the process of delivering early childhood intervention services? Are early childhood intervention services more accessible after the transformation? What challenges do counselling professionals encounter when providing early childhood intervention services? Are counselling and prevention institutions sufficiently equipped to provide this type of support to young children and their families? Answers to these and other questions will be sought in the quantitative research conducted as part of this study.

Research Objective

The primary objective of this research was to identify and subsequently analyse the current state of early childhood intervention services provided to children with disabilities and their families within the reformed system of counselling and prevention in Slovakia.

The partial objectives of the study were focused particularly on:

- assessing the availability of services in terms of financial and time accessibility,
- examining the staffing conditions of these services,
- analysing the material and technical resources available for service provision.

Research Questions

RQ1: What are the time-related characteristics of early childhood intervention service provision in counselling and prevention institutions following the transformation of the counselling and prevention system (e.g., length of waiting period, frequency of sessions)?

RQ2: What is the financial accessibility of early childhood intervention services in counselling and prevention institutions after the transformation of the counselling and prevention system?

RQ3: What is the composition of professional staff providing early childhood intervention services to young children with disabilities and their families following the transformation of the counselling and prevention system?

RQ4: How do professional staff in counselling and prevention institutions evaluate the material and technical resources in relation to the provision of early childhood intervention services?

RQ5: In what ways has the quality of early childhood intervention services changed or improved after the transformation of the counselling system in Slovakia, from the perspective of professional staff in counselling and prevention institutions?

RQ6: What challenges do professional staff in counselling and prevention institutions encounter following the transformation of the counselling and prevention system?

Given the nature of the research and its focus on identifying the current state of early childhood intervention services after the transformation of the counselling and prevention system, we decided to formulate research questions instead of hypotheses.

Research Methods

The questionnaire method was used for data collection. A self-constructed questionnaire was employed due to the specific nature of the researched topic. The questionnaire consisted primarily of closed-ended items, semi-closed items, Likert scale items, and one open-ended item. It was distributed electronically to the email addresses of directors of counselling and prevention institutions or to the shared email addresses of these institutions. The contact directory of institutions was obtained from the Slovak Centre of Scientific and Technical Information database (CVTI SR, 2024). The questionnaire was sent out twice during the period from February 2024 to April 2024. Subsequently, in July 2024, follow-up telephone communication with each institution was conducted to verify whether the questionnaire had been completed. The total number of relevant responses, after excluding incomplete or duplicate entries, was 70.

Additional methods used for data analysis included content analysis (applied to the open-ended and semi-closed items) and descriptive analysis using percentage distribution (applied to the closed and semi-closed items).

Research Sample

The research sample was selected using purposive sampling. The questionnaire was distributed to all available counselling and prevention institutions in Slovakia, according to the directory provided by the Slovak Centre of Scientific and Technical Information. The questionnaire was sent to a total of 161 institutions. The target group primarily consisted of directors of the contacted institutions, or designated personnel authorised by the institution's director.

The research sample consisted of a total of 70 respondents (n = 70) from counselling and prevention institutions. Specifically, 56% of the respondents were from public counselling and prevention institutions, 14% were from public specialised counselling and prevention institutions, 23% were from private counselling and prevention institutions, and 7% were from private specialised counselling and prevention institutions.

Ethics of Research

During the conduct of the research, we adhered to the fundamental principles of the General Data Protection Regulation (GDPR) as well as to the guidelines set out in the internal regulation of the Rector of Comenius University in Bratislava No. 14/2023. In accordance with this internal regulation, we made every effort to strictly uphold transparency, professional and moral standards, and scientific integrity.

The questionnaire distributed externally was designed to address all respondents appropriately and respectfully, without distinction. Participation in the research was voluntary, and respondents were informed about the purpose of the study. We requested only information relevant to the aims of the research, and all collected data were processed anonymously.

Results

The research examined several parameters, such as material and technical resources, staffing of the institutions, time management, and service fees. The respondents' views on the quality of services provided after the transformation were also included. As expected, the staffing composition of counselling and prevention institutions with professional personnel is diverse. According to 33% of respondents (representing 23 institutions), the most represented group of professionals (five or more staff members per institution) are psychologists. The second most represented group, according to respondents, are special education teachers (19%). Concerning other professional staff members, therapeutic pedagogues are the least represented, with no such staff present in 84% of the institutions (59 institutions). Additionally, speech and language therapists are absent in 36% of institutions (25 institutions), and social pedagogues are absent in 44% of institutions.

A psychologist plays a key role not only in diagnosing and creating the client's psychological profile but especially in providing psychological support and accompanying the client throughout the entire process. Respondents reported

that in 33% of cases, there are five or more psychologists employed (see Figure 1.), while 20% of facilities have only one psychologist.
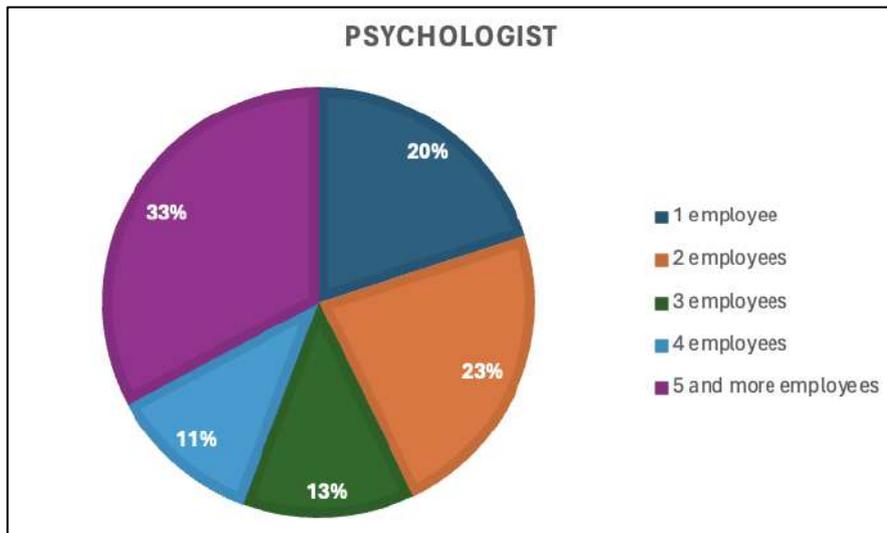
Figure 1. Number of Psychologist

Special education teachers primarily work with individuals with disabilities. Their participation in early childhood intervention services is more than essential. According to the responses, 19% of facilities have five or more special education teachers (see Figure 2.). In contrast, 11% of facilities have only one. Notably, the research recorded 1% of respondents reporting that their facility does not employ a special education teacher.
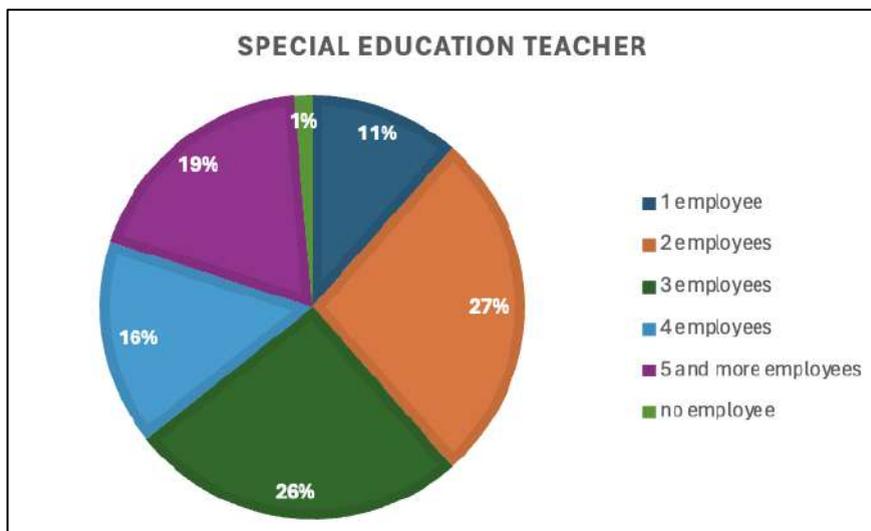
Figure 2. Number of Special Education Teachers

The number of speech and language therapists in Slovakia is relatively low, which is naturally reflected in the research results. As many as 36% of the facilities surveyed do not employ a speech and language therapists (see Figure 3.). One speech therapy specialist is employed in 34% of facilities, and 26% employ two speech and language therapists.
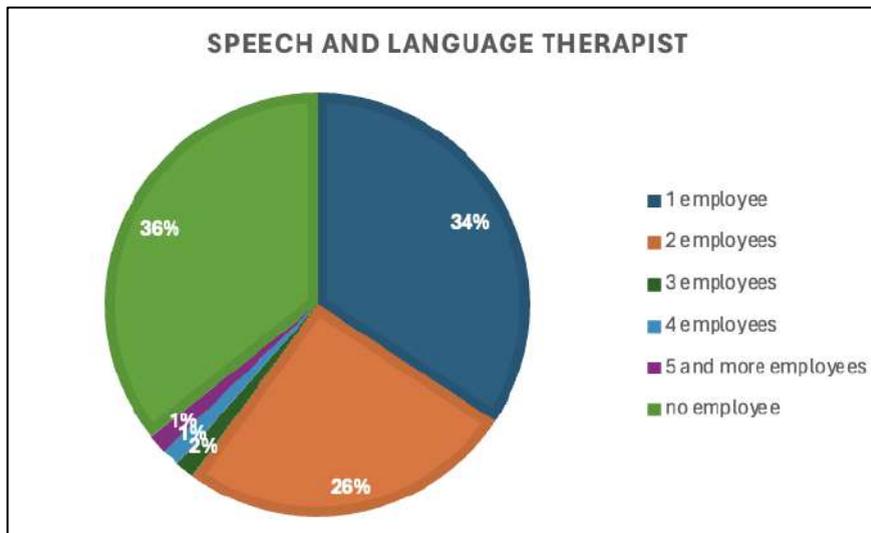
Figure 3. Number of Speech and Language Therapists

A similar situation applies to therapeutic pedagogues. Up to 84% of respondents reported that their facility does not employ a therapeutic pedagogue. In 11% of cases, the facilities employ one (see Figure 4.).
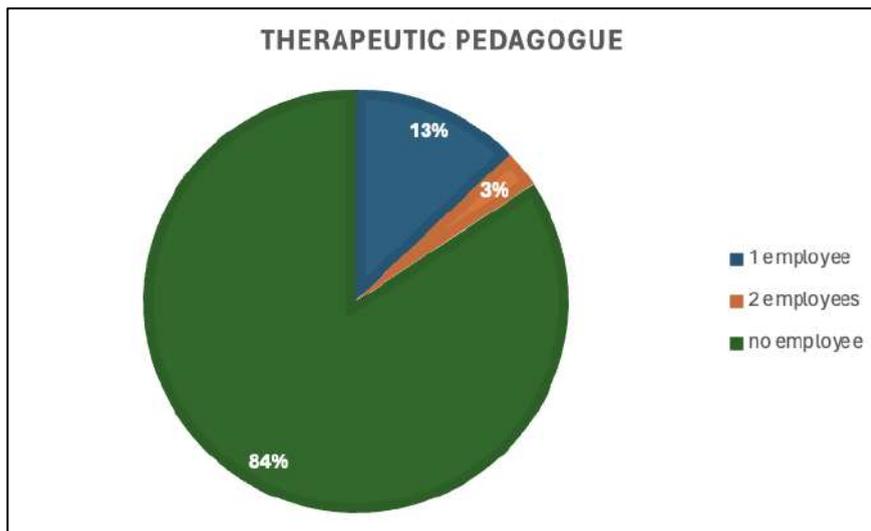
Figure 4. Number of Therapeutic Pedagogues

In addition to the professionals mentioned above, other expert staff can also be valuable additions to the counselling team. In 30% of cases, respondents indicated one, two, or three such employees at their facility (see Figure 5.). The answers most frequently mentioned physiotherapists, economists/administrative workers, career counsellors, and social workers. One response expressed dissatisfaction with the insufficient number of professional staff.
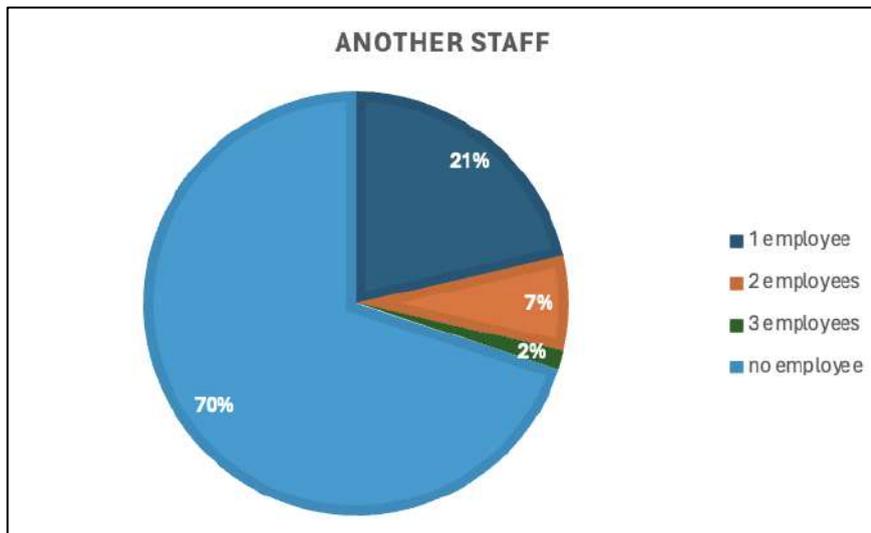
Figure 5. Number of Other Staff

In addition to staff composition, the research also focused on the full-time equivalent (FTE) employment of professional staff in counselling and prevention facilities. Up to 64% of facilities reported employing five or more full-time professionals (see Figure 6.). Among the remaining facilities, 21% employ four full-time professionals, 12% employ three, and 3% employ two.
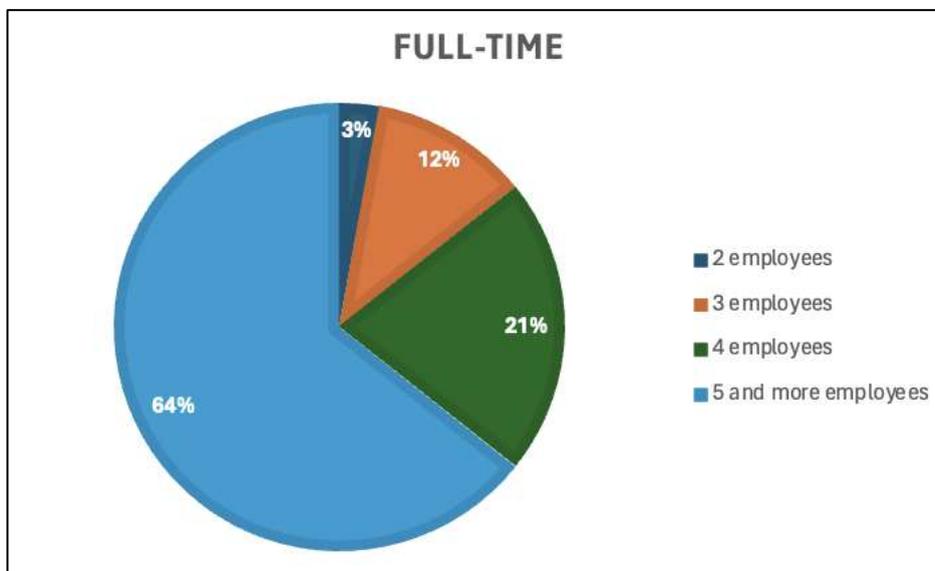
Figure 6. Full-time equivalent employment of professional staff

An important determinant of the quality of counselling services is the availability of adequate material and technical equipment—not only in terms of quantity but particularly regarding its variety and suitability for the clientele. Basic equipment was not examined, as furnishings and basic technology (computers, printers) are expected to be standard. Instead, the research focused on more specialized equipment such as aids, stimulation materials, toys, diagnostic materials, child-specific applications, and other multimedia devices.

In terms of educational aids, 32% of respondents rated their institutions' equipment as good, and 31% rated it as very good (see Figure 7.). Twenty percent rated the equipment as excellent, while 13% found it sufficient. Only 4% reported insufficient equipment.
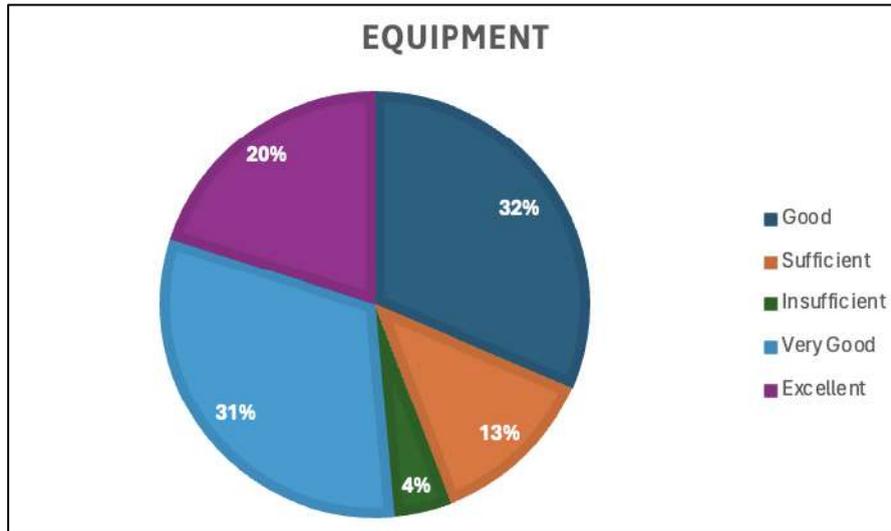
Figure 7. The availability of Equipment

The availability of toys is crucial for the effective work and care provided by professionals for children with disabilities. Of the respondents surveyed, 34% rated their toy equipment as good, 24% as very good, and 19% as excellent. The remaining 14% rated it as sufficient, and 9% as insufficient (see Figure 8.).
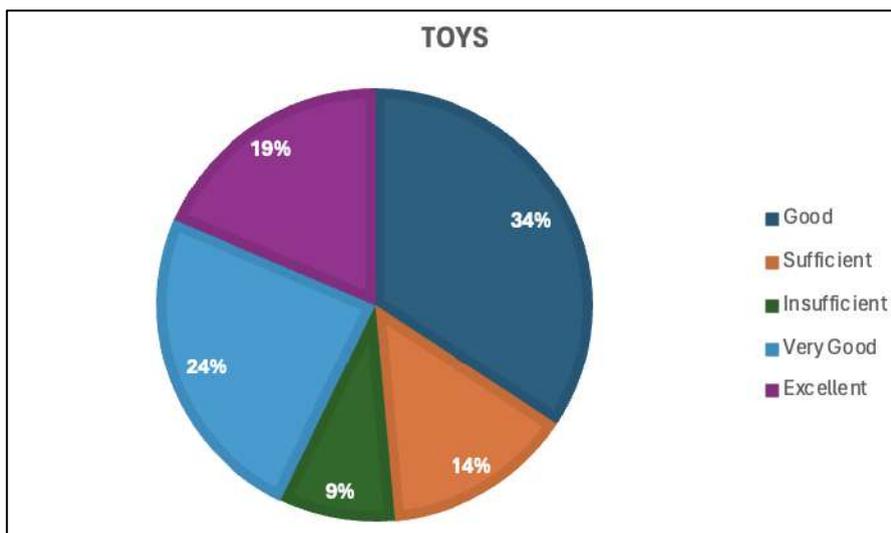
Figure 8. The availability of toys

Regarding stimulation materials, 30% of respondents rated the equipment as good and 20% as sufficient (see Figure 9.). Encouragingly, 19% considered it excellent, and 17% very good. Nevertheless, 14% of respondents expressed dissatisfaction and rated the equipment as insufficient.
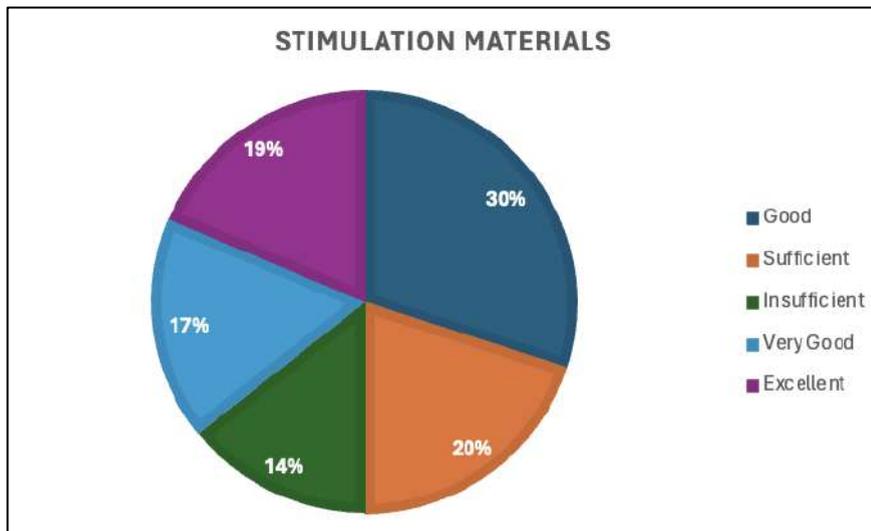
Figure 9. The availability of Stimulation Materials

In assessing the availability of diagnostic materials, 38% of respondents rated it as good, 26% as very good, and 16% as excellent (see Figure 10.). Fourteen percent considered it sufficient, while only 6% considered it insufficient.
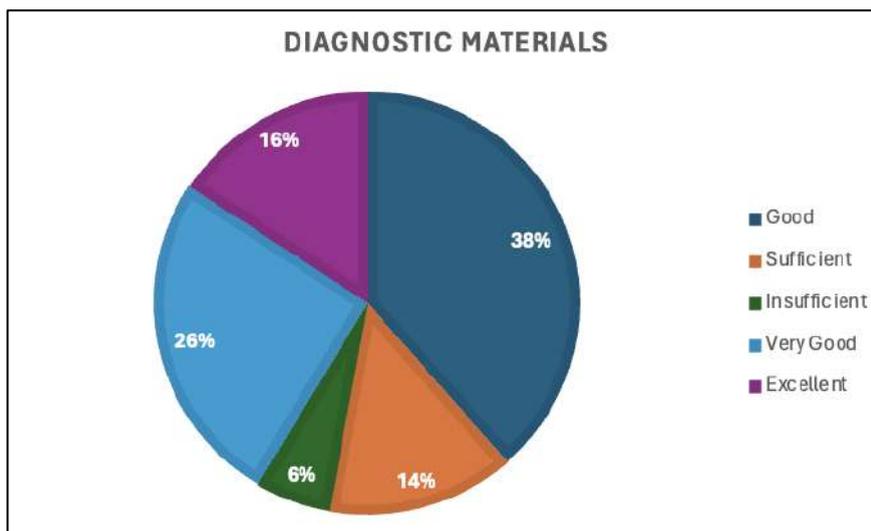
Figure 10. The availability of Diagnostic Materials

When it comes to specific technical equipment in counselling and prevention institutions, the results were less positive than for material resources. Although the overall assessment remained mostly favorable, a higher proportion of negative responses appeared. The availability of applications for children on computers/laptops/phones/tablets was rated negatively by a significant portion of respondents. While 28% of respondents considered it sufficient, 26% deemed it insufficient (see Figure 11.). Another 26% rated it as good, 13% as very good, and only 7% as excellent.
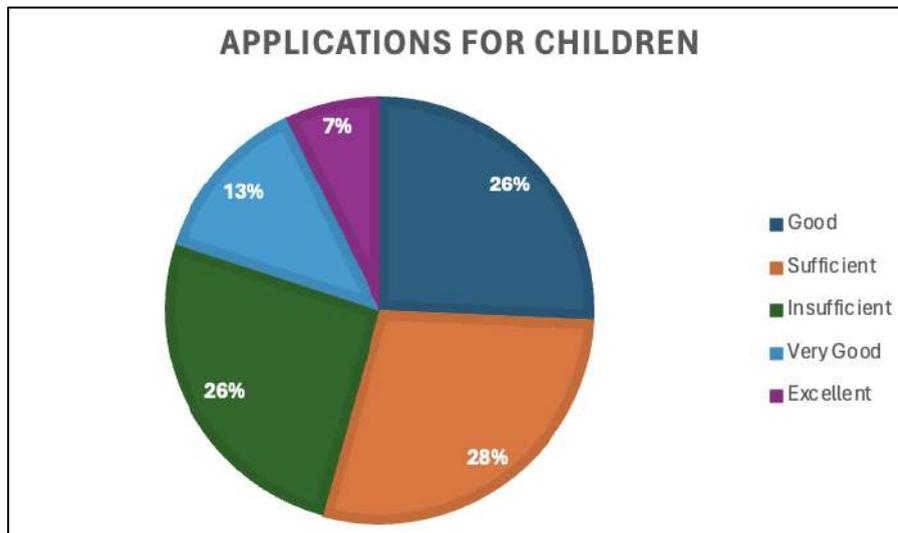
Figure 11. The availability of Applications for Children

The availability of additional multimedia devices was rated as good by 30% of respondents, sufficient by 26%, and insufficient by 21% (see Figure 12.). Only 12% of respondents selected very good, and 11% excellent. These results suggest that applications and multimedia equipment are among the least available resources in counselling and prevention institutions, which may pose challenges for implementing interventions and other professional activities.
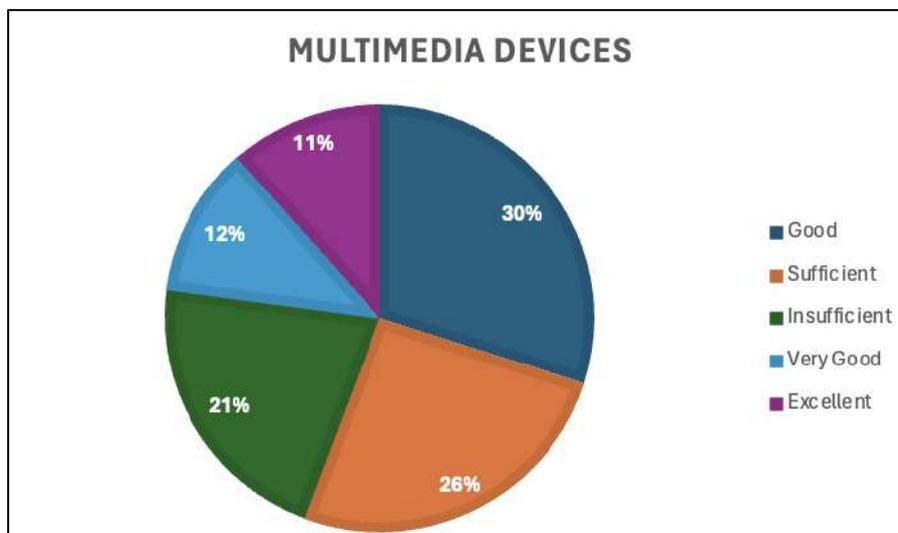
Figure 12. The availability of Multimedia Devices

The research also focused on service accessibility—specifically in terms of time and service charges. The average waiting time for accessing early childhood intervention services varied, with the most common response being 3–4 weeks, selected by 51% (see Figure 13.). This was followed by a 1–2 month waiting period (30%). Other responses included 3–4 months (9%), 1–2 weeks (6%), and 5–6 months (4%), which indicates a significant delay that could lower the quality of service provision.
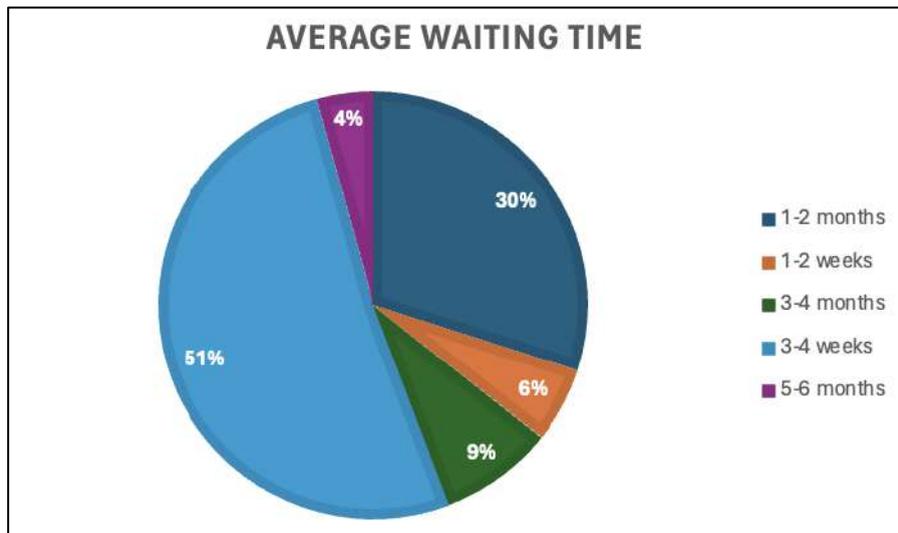
Figure 13. Average Waiting Time for Accessing ECI Services

The average frequency of visits for one client/family in counselling and prevention institutions is once every two weeks, selected by 47% of respondents (see Figure 14.). Twenty percent reported once per month, 13% once per week, 6% once per quarter, and 4% once every six months. The "Other" option was selected by 10%, with responses such as "individual, as needed," and "variable, depending on the problem." Therefore, it can be concluded that more than half of counselling and prevention institutions enable their clients to attend regular sessions, although with varying frequencies.
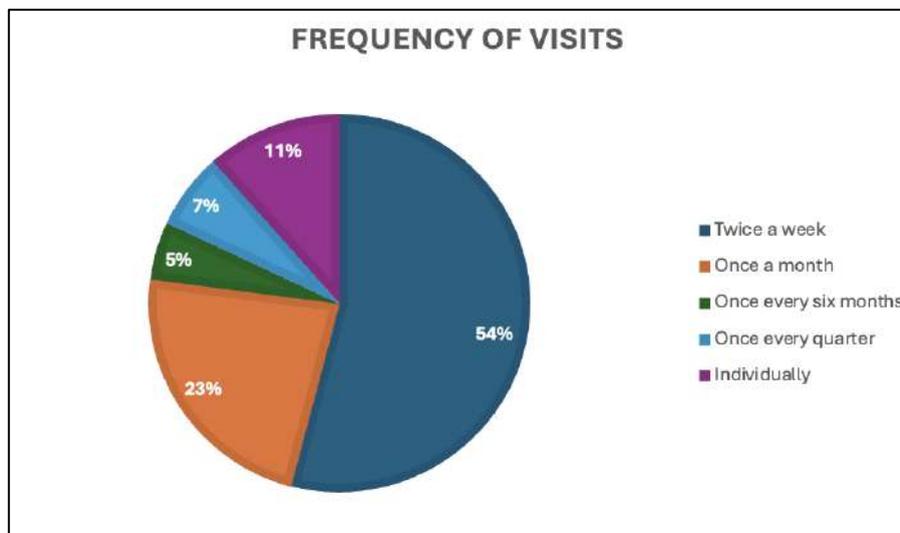
Figure 14. The Average Frequency of Visits for One Family

In terms of financial accessibility, it is a positive finding that 76% of respondents indicated their early childhood intervention services are free of charge. Fees were reported in 24% of the counselling and prevention institutions, which primarily included private institutions (see Figure 15.).
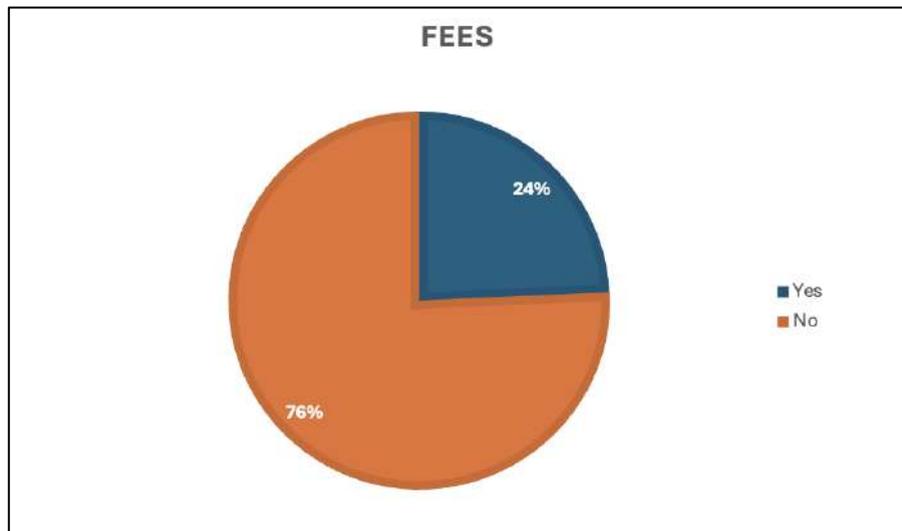
Figure 15. Fees for ECI Services

Given that nearly a quarter of these institutions charge for services, one of the survey items explored whether the amount of the fee changed following the transformation of the counselling and prevention system. In 84% of cases (see Figure 16.), fees remained unchanged, meaning the services were either free or the pricing stayed the same. Six percent of respondents indicated that fees had decreased. Another 6% reported that fees had increased by more than 20%, and 4% (3 facilities) indicated an increase of less than 20%.
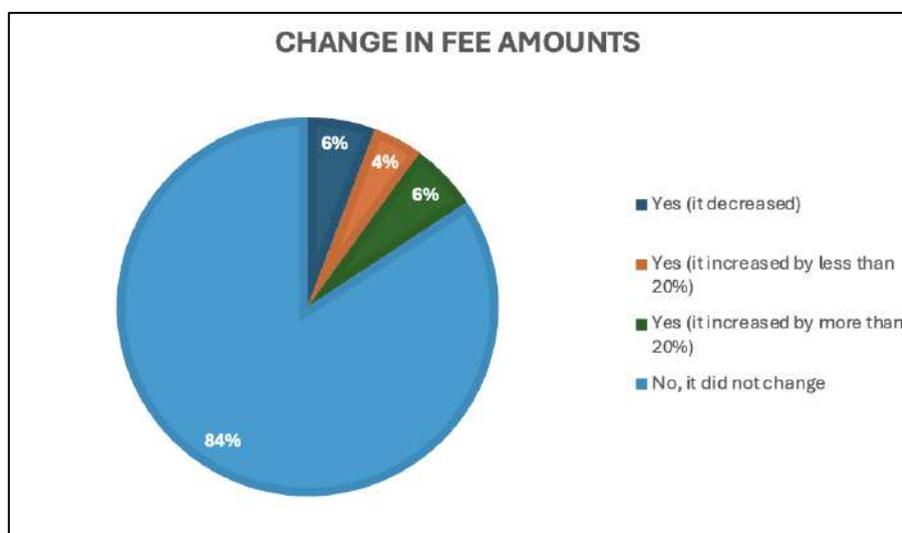
Figure 16. Change in Fee Amounts

Client satisfaction with counselling and prevention institutions is one of the most relevant determinants of service quality in early childhood intervention. That is why the final items of the questionnaire focused on the satisfaction of the respondents with the state of early childhood intervention services from the perspective of the professionals themselves. When asked whether the transformation of the counselling and prevention system had led to a significant improvement in early childhood intervention services, the responses were clear: 83% of respondents reported no improvement in service quality, while only 17% responded affirmatively (see Figure 17.).
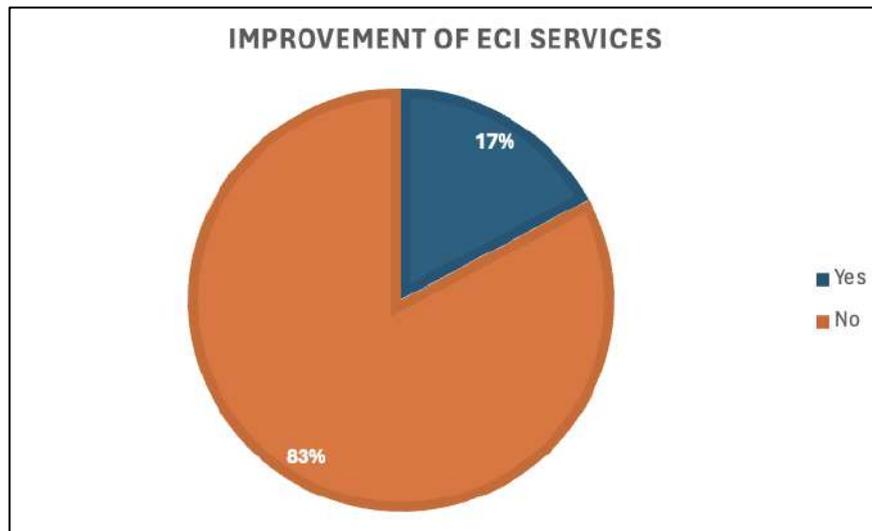
Figure 17. Satisfaction of the Respondents with The State of ECI Services

Respondents who answered positively were presented with an open-ended question to explain where they perceived improvements. Their answers varied and included more frequent therapies, better service availability, increased capacity due to more staff, improved equipment tailored to the children's needs, full-time employment, and funding. Others highlighted the expansion of expert teams with specialists in ASD, rapid and targeted multi-expert care in one place, and the ability to adapt facility conditions (both material and staffing) to specific disabilities. The establishment of centers for children up to age seven was also seen as a significant advancement, allowing a stronger focus on early years and the provision of methodological guidance to other facilities. This, according to respondents, raised awareness of the importance of early childhood and improved understanding of how to work with children and families during this crucial period. Thus, the 17% of respondents who viewed the transformation positively appeared to be largely satisfied and saw it as beneficial for their facility.

Discussion

Early childhood intervention plays a key role in the comprehensive care of individuals with disabilities. High-quality early childhood intervention services can adequately meet and satisfy the needs of both the family and the child. In our research, we focused on examining the current state and quality of services following the transformation of the counselling and prevention system and its impact on the quality of early childhood intervention services, which are an integral part of this system.

Our first focus was on the staffing and material-technical equipment of counselling and prevention institutions, as these two areas were also affected by the changes brought about by the transformation. In terms of staffing, a predominance of the most common professions in counselling and prevention institutions was observed – special education teachers and psychologists. This is logical, as their roles are indispensable in the counselling and prevention system. However, a shortage of selected professionals, such as speech and language therapists, therapeutic pedagogues, and social pedagogues, continues to persist. On a positive note, based on the research findings, we acknowledge the presence of other professionals in counselling and prevention institutions who are not mandated by

legislation but can significantly contribute to child development and improving the quality of life for the entire family. These included physiotherapists, administrative staff, and career counsellors (even though not directly related to early childhood intervention services). The overall research results indicate a lack of qualified professional staff, as well as an increased need for these professionals to better meet client needs. Our findings align with Motiejunaite (2021), who identifies the availability of qualified staff in centres as one of the key factors influencing the quality of early childhood intervention services. We also agree with Sapiets et al. (2021), who similarly emphasize the need for a broader spectrum of professionals in early childhood intervention facilities. High professional competence among staff can meet the diverse needs of a wide range of clients and their families. This is further supported by Irvine et al. (2023), who state that increasing the qualifications and professionalism of staff is a key strategy for improving the quality of counselling services.

Material-technical provision was rated predominantly positively by respondents, with some exceptions. Toys and diagnostic materials were most often rated in the range from excellent to good. Conversely, the provision of stimulation materials in counselling and prevention institutions received the lowest ratings. We are concerned that if a counselling and prevention institution does not have a sufficient amount of stimulation materials differentiated for stimulating specific areas of child development or for addressing the effects of various disorders/disabilities/limitations, the quality level of services and the effectiveness of support for children and their families may be significantly compromised. Our findings are in accordance with Anaby et al. (2023), who, like us, emphasize the importance of adequate material-technical equipment and its impact on the quality of services provided. Quality material equipment enables professionals to carry out more effective diagnostics and implement intervention procedures, thereby increasing the overall effectiveness and outcomes of working with clients. Technical equipment in counselling and prevention institutions was not rated as favourably as material provision, as we recorded more negative responses in this area.

We believe that in today's era of rapid expansion of digital and assistive technologies, virtual reality, AI, and other technical and technological innovations, it is standard and essential for institutions to be equipped with computers, laptops, and printers. This should also apply analogously to software equipment and the availability of various applications that support child development. Respondents rated the area of computer and mobile applications for children and the use of multimedia most critically. This deficiency may represent a limiting determinant and a significant inhibitor of implementing innovative approaches and modern methods in working with clients in the centres. Our findings partially align with Hatzigianni et al. (2023), who consider the use of digital and assistive technologies and relevant software to be one of the pillars of quality. Furthermore, in the provision of early childhood intervention services, such aids can serve as means for alternative and augmentative communication for children with disabilities, as well as the use of alternative communication systems. The research findings in these two areas thus highlight the importance of a comprehensive approach to staffing and material-technical provision in counselling and prevention institutions.

In addition to staffing and material-technical aspects, the availability of early childhood intervention services – whether geographical, financial, or temporal – also plays a crucial role.
Regarding geographical accessibility, the directory of the Slovak Centre of Scientific and Technical Information

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(CVTI SR, 2024) lists a total of 161 counselling and prevention institutions in Slovakia. According to the map of the Ministry of Education, Research, Development, and Youth of the Slovak Republic (Ministerstvo školstva, výskumu, vývoja a mládeže SR, 2023), these institutions are primarily located in regional and selected district towns. These data may suggest a lack of such institutions outside of major cities and thus pose challenges in terms of geographical accessibility. We concur with Akgündüz et al. (2015) and Vanegas and Abdelrahim (2016), who note the concentration of early childhood intervention centres in larger urban areas (regional and capital cities), creating transportation challenges for families residing in remote or rural areas.

Another important attribute of early childhood intervention services is their availability in terms of time. Our research focused on several time-related characteristics of these services. After considering various factors, waiting times at counselling and prevention institutions could be evaluated as relatively acceptable, as most clients access services within 3–8 weeks. While some centres had shorter waiting periods, such as 1–2 weeks, others reported very long waiting times exceeding 3 months, indicating a limited but existing capacity burden in certain institutions. The frequency of sessions was most commonly biweekly or monthly, while some clients had weekly sessions, which we consider excellent. Institutions strive to adapt to client requirements and offer visit options and frequencies based on individual needs. In some cases, however, institution capacity may be limited (due to time constraints), which can hinder the timeliness of the required care. Several studies (Motiejunaite, 2021; Sapiets et al., 2021; Costanzo & Magnuson, 2024) concur on the importance of sufficient capacity in institutions and the timely provision of services.

The final component of accessibility we examined was the financial affordability of early childhood intervention services. Services in counselling and prevention institutions are mostly provided free of charge, with 76% of respondents reporting that clients pay no fees. Nevertheless, 24% of institutions provide paid services, which may limit access for low-income families with lower socio-economic status. The funding of early intervention services has long been a sensitive issue in Slovakia. A parent whose child is born with a disability typically seeks to help the child to the greatest extent possible. In some families, this disproportionate financial burden can trigger and intensify numerous additional problems.

As part of our investigation, we were also interested in whether fees for early childhood intervention services had changed. In 10% of cases, there was an increase in fees, while 6% of institutions reported a decrease. In addition to counselling and prevention institutions, various specific interventions, therapies, or rehabilitations targeted at young clients are often offered by private facilities. These services tend to be fee-based and are typically available only in private institutions. This fact also points to the higher financial demands of early childhood intervention services and consequently, to their limited accessibility for families with lower socio-economic status. The findings of our research thus align with the results of several studies (Costanzo & Magnuson, 2024; Sapiets et al., 2021; Ünver & Nicaise, 2016), which highlight the financial demands of early childhood intervention services. The authors of these studies also identify costs (service fees, transportation expenses) as one of the major barriers to the provision of high-quality early childhood intervention services. Vanegas and Abdelrahim (2016) also describe the consequences of the financial burden of early childhood intervention, which may lead to parental job loss (as well as conflicts, divorce, and mental health deterioration), thereby exacerbating the negative impact on the family's socio-economic situation.

The areas discussed above significantly influence the quality of early childhood intervention services. Within the research, we also focused on evaluating the quality of early childhood intervention services following the transformation of the counselling and prevention system, as perceived by the staff of the counselling and prevention institutions themselves (critical reflection/self-evaluation of professional staff). A notable finding for us was that, according to 83% of respondents, there was no significant improvement in the provision of early childhood intervention services. This leads us to consider whether, according to the respondents, the services had already been of high quality prior to the transformation, or whether the transformation had no impact on service quality. Given that we obtained relatively positive evaluations of the current state through the research, we can presume that the respondents considered early childhood intervention services to have been of high quality even before the transformation and that the transformation had no impact on them. However, this remains a consideration that requires further verification in next research. Nevertheless, 17% of respondents believe that early childhood intervention services have improved following the transformation (e.g., more frequent interventions for clients, better service accessibility, funding, expansion of the professional team with specialists, and the establishment of centres for children up to the age of seven). Additionally, our research identified several "risk" areas that were not evaluated positively (e.g., lack of therapeutic pedagogues, speech and language therapists, social pedagogues, and other specialists; dissatisfaction with the availability of stimulation materials, specialized child applications, and multimedia tools; some institutions offer fee-based services). These findings and considerations highlight the need for further research, particularly in-depth investigation, into this issue.

Limitations

In the context of our research, we are also aware of certain limitations. One such limitation is the relatively low number of respondents (due to the voluntary nature of participation), which prevented us from obtaining a representative research sample. The research findings may also be subject to bias, given that the questionnaires were completed by managerial staff of counselling and prevention centres, where we might detect a degree of "embellishment" in their responses in an effort to present their institutions in a more favourable light. Another potential limitation is the time that has passed since the mandatory transformation of counselling and prevention centres. We are fully aware that a period of approximately 1.5 to 2 years is relatively short; however, according to the literature on management and institutional governance, if significant changes are not implemented at the outset, their later implementation—while potentially more systematic—may be considerably slower.

Conclusion

As part of our investigation into the current state of the counselling and prevention system following its transformation—with an emphasis on the quality of early childhood intervention services—we obtained a broad range of insightful data. In terms of staffing, special education teachers and psychologists logically dominate, while speech and language therapists, therapeutic pedagogues, and social pedagogues are represented to a lesser extent. Material resources were predominantly evaluated positively, while technical equipment, particularly applications for children and multimedia devices, received more critical assessments.

Regarding accessibility, geographical availability remains limited; however, waiting times for services were generally rated positively. Some institutions face capacity constraints. Services in most counselling and prevention institutions are provided free of charge, whereas private institutions require payment for services, which may limit accessibility for families with lower socio-economic status—especially when the private institution is the most geographically accessible option. Private institutions offer certain specialised services for a fee; however, according to 83% of respondents, the transformation of the counselling and prevention system has not significantly improved the quality of early childhood intervention services.

Our findings also point to a lack of professionals in certain roles, insufficient technical equipment, and financial barriers. These areas may hinder the effective functioning of early childhood intervention services within the counselling and prevention system. Based on our results, we consider it important to continue research in this area and to explore the issue in greater depth, with a focus on identifying relevant causalities and interconnections.

Recommendations

Based on our findings and research results, we propose the following recommendations for practice:

- **Increase the number of professional staff**, particularly speech and language therapists, therapeutic pedagogues, social workers/pedagogues, physiotherapists, and other specialists. This recommendation is made in the context of improving the quality of services and enabling the provision of comprehensive support to families with young children with disabilities.
- **Equip counselling and prevention institutions with the necessary technical resources**, especially child-focused applications and multimedia devices. This recommendation aligns with the ongoing digital transformation of the education system and other related systems.
- **Ensure that early childhood intervention services are provided free of charge, including in private institutions (particularly for low-income groups).** We acknowledge that this would require a systemic change. However, it would be beneficial to explore alternative funding mechanisms, such as insurance reimbursements, support from other institutions, sponsorships, donor contributions, or self-initiated educational activities aimed at broader audiences (including awareness-raising efforts) to support families of children with disabilities.

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Inclusive Education in England: Policies, Challenges, and Effective Interventions

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Abstract: Focusing on primary school teachers' experiences in mainstream environments, this paper looks at how inclusive education policies are being implemented in England. Using a mixed-methods approach, the study aggregates qualitative comments from ten teachers alongside quantitative survey results. Results show a strong dedication to inclusive values; teachers report confidence in helping students with Special Educational Needs and Disabilities (SEND) and regular application of structured interventions, including Lego Therapy and colourful semantics. Effective realisation of policy goals is hampered, nevertheless, by ongoing obstacles including limited training, time limits, and uneven resource allocation. While school leadership and institutional support are areas needing improvement, cooperation with colleagues and outside experts turns out as a main enabler of inclusion. The report underlines the discrepancy between policy and practice, emphasising the need of ongoing investment in inclusive infrastructure and professional growth. Although small in scope, the study adds important new perspectives on classroom-level practices and supports current debate on fair education in England.

Keywords: Inclusive Education, Special Educational needs, Policy Implementation, Teacher Perceptions, Classroom Interventions

Introduction

Aiming to ensure that all students, regardless of their abilities, backgrounds, or needs, have meaningful access to quality learning experiences within mainstream settings, inclusive education is a central tenet of equitable schooling (UNICEF, n.d.; The Oxford Review, n.d.). In English education, inclusion goes much beyond physical integration into classrooms; it also includes a systematic dedication to removing obstacles to participation, modifying pedagogical approaches, and creating a school environment that celebrates diversity, equity, and shared belonging (Ainscow, 2005).

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England has evolved a strong legislative and policy basis for inclusive education over the last two decades. Important laws, including the Children and Families Act 2014, the Equality Act 2010, and the Special Educational Needs and Disability (SEND) Code of Practice (DfE, 2015), set unambiguous requirements for non-discrimination and proactive support of students with SEND. Education, Health and Care Plans (EHCPs), which provide children with complex needs coordinated, individualised support, have been among the most important policy changes. These models together support the idea that, with suitable adaptations and supports, most students with SEND should be educated in regular schools.

Inclusive education at the level of the school depends on a mix of professional knowledge, group practice, and strategic intervention use to satisfy different needs of students. Adaptive teaching, peer-assisted learning, and other evidence-based strategies that honour individual differences yet uphold high standards for all students are expected of teachers. Among the several ways schools operationalise inclusion are assistive technologies, flexible instructional design (e.g., Universal Design for Learning), and careful deployment of teaching assistants. These methods seek to guarantee fair participation and promote both academic success and social integration, to be corrective.

Notwithstanding this progressive policy framework, there remain notable implementation difficulties. Teachers all around England say they have trouble finding sufficient training, controlling workloads, and getting timely support for students awaiting tests or EHCPs (Warnes, Done, & Knowler, 2021). In the literature, the policy-practice gap—a gulf between legislative intent and daily reality in schools—remains a regular source of concern (Webster, 2022). Further complicating inclusive delivery are structural limitations including funding restrictions, staffing shortages, and variance in local authority provision.

Moreover, teachers sometimes negotiate these obstacles with little preparation. Many people are philosophically committed to inclusion, but they also often express a need for more practical direction and ongoing professional growth. The success of inclusive education depends not only on what policies exist but also on how teachers and school leaders understand, resourced, and apply them (Florian & Black-Hawkins, 2011; Ainscow, Dyson, & Weiner, 2013).

Beyond improving academic results, inclusive education is extremely important for fostering social cohesiveness, lowering stigma, and helping every student to be emotionally healthy. Inclusive settings promote empathy, mutual respect, and cooperative learning—qualities far outside of the classroom. Studies keep confirming the wider social advantages of inclusive education, so positioning it as both an ethical and educational need (Armstrong, Armstrong, & Spandagou, 2011).

With a focus on the experiences of teachers, this study looks at how inclusive education is carried out in English elementary schools. Using a mixed-methods approach comprising a critical literature review, policy analysis, and survey data from practitioners, this study investigates the pragmatic reality of inclusive teaching, highlights successful classroom interventions, and identifies the systematic obstacles teachers face. As tools to support student involvement and achievement, special focus is on the use of peer-mediated learning, assistive technology, teaching assistant deployment, and differentiated instruction. This study advances knowledge of the elements that either support or impede inclusion in practice by examining how inclusive strategies perform at the classroom and policy levels. It aims

to persuade not only teachers and school leaders but also legislators and researchers committed to transforming inclusive education into a sustainable, fair, and empowering reality for all students in England and beyond.

Literature Review

Policy Context and Inclusive Education Frameworks

Strong policies and a legislative framework stressing the rights of every student to engage in mainstream education support inclusive education in England. Key laws include the Children and Families Act 2014 and the Equality Act 2010, which assert that children with special educational needs and disabilities (SEND) should be educated in mainstream environments wherever possible (Department for Education [DfE], 2015) and mandate non-discrimination. The Special Educational Needs and Disability (SEND) Code of Practice 2015 offers local authorities and schools' thorough statutory direction on spotting and helping pupils with SEND in inclusive classrooms (DfE, 2015). Introduced to guarantee tailored support across education, health, and social care, Education, Health and Care Plans (EHCPs) were one major policy innovation. These laws, which align with international frameworks including the UN Convention on the Rights of Persons with Disabilities, show a national will for inclusion. Strong policy foundations notwithstanding, implementation differs among schools partly in response to different conceptions of inclusive education. Göransson and Nilholm (2014) pointed out the need for more conceptual clarity by noting four different interpretations that the literature offers. Although the idea of mainstream placement with support is supported, how inclusion is carried out mostly relies on the educational setting.

Implementation-Challenges

Practicing inclusive policies still presents a difficult task. Schools frequently name as obstacles inadequate funding, limited specialist support, and long assessment waiting times (Warnes, Done, & Knowler, 2021). Particularly without enough help from teaching assistants or outside services, teachers regularly report challenges juggling the needs of students with SEND and their peers.

Funding cuts have aggravated inequality and resulted in different inclusion policies throughout educational institutions. Teacher attitudes and confidence were found by Warnes et al. (2021) to be much influenced by institutional support and resource availability. The continuation of a policy-practice gap points to the need of better systematic support and more defined implementation strategies (Webster, 2022).

Teacher Training and Professional Development

In England, initial teacher education (ITE) does not always equip teachers to help SEND-affected children. Many early-career teachers claim little practical knowledge of inclusive strategies (Ewing, Monsen, & Kielblock, 2017). Thus, constant professional development (CPD) is crucial but is sometimes underfunded or given differently (Warnes et al., 2021). With its induction and mentoring clauses providing a basis that can be used to improve inclusive teaching competencies (DfE, 2019), the Early Career Framework presents potential by including organised support for new

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teachers. Ainscow, Dyson, and Weiner (2013) stress the need for whole-school approaches and leadership in helping inclusive professional learning.

Effective Classroom Interventions

Evidence-based interventions form the foundation of successful inclusive education. Often advised are differentiated instruction, peer-mediated learning, and cooperative group projects. For students with SEND, structured peer interactions and group activities, as identified by Garrote, Sermier Dessemontet, and Moser Opitz (2017), improved both academic and social outcomes. When well trained and incorporated, teaching assistants can improve inclusion. Research by Webster, Norwich, and Grey (2021) cautions against depending too much on TAs for tailored support, though, which might unintentionally cause segregation. Many times, students create personal coping mechanisms, including fidget tools or headphones (Office for National Statistics [ONS], 2022). Schools that meet these needs with adaptable classroom designs foster more inclusive settings.

Student Outcomes in Inclusive Settings

socially from inclusive education (Webster et al., 2021). Including non-SEND colleagues does not harm them and can help to build empathy and teamwork. Parsons and Platt (2017) confirmed the need for tailored interventions by showing that student progress was more dependent on focused help than on socioeconomic background. Furthermore, helping to lower social stigma and improve student well-being are inclusive environments (Ainscow, 2005).

School Leadership and Inclusive Culture

Effective inclusion requires strong leadership. Effective resource allocation, setting the tone for school culture, and guaranteeing continuous staff development—of which inclusive leaders guarantee—of which Ofsted, 2021 Leaders, according to Ainscow et al. (2013), have to be deliberate in removing obstacles to learning and advancing fairness. As mentioned in previous sections, sustainable inclusion is much enhanced by whole-school approaches that give teamwork, shared responsibility, and celebration of diversity top priority. The effectiveness of inclusive practices can be much enhanced by leaders who support professional learning and model inclusive values.

Bridging the Policy-Practice Gap

Policy goals and school-level reality are mismatched, as Nnamani and Lomer (2024) point out. Policies sometimes stress responsibility and results without addressing the support teachers need to properly apply inclusion (Department for Education, 2022). Adoption may be hampered and innovation limited by this conflict. Acknowledging these difficulties, the 2022 SEND Review suggested better training, standardising, and clearer responsibility. To propel change at the school level, bridging the gap calls for funding in training, improved definition of inclusive practices, and empowerment of Special Educational Needs Coordinators (SENCos).

Classroom Based Approaches for Inclusion

Many classroom-based approaches have been developed and honed to support inclusive education in regular classrooms. Among the most successful are Universal Design for Learning (UDL) concepts, cooperative learning, and differentiated instruction. Differentiating lets teachers modify materials, approaches, and assessments to fit different learning needs inside one lesson, so lessening the need to remove students with SEND from regular classroom environment (Florian & Black-Hawkins, 2011). By providing several ways of engagement, representation, and expression—so enabling lessons accessible to all students—UDL promotes flexibility in teaching.

To help with sensory or emotional difficulties, students themselves often create personal coping mechanisms including noise-reducing headphones, visual timetables, or sensory tools (Office for National Statistics, 2022). Schools that embrace these approaches help SEND students to develop autonomy and lower stress levels. Lastly, especially for students with dyslexia or communication difficulties, the increasing importance of assistive technology, such as speech-to-text software or reading apps, has made inclusion more possible. When included in whole-class instruction, these tools help a wider spectrum of students—not only those with identified SEND (Education Endowment Foundation [EEF], 2021).

Methodology

With an eye towards teacher opinions, policy-practice alignment, and the use of successful interventions, this mixed-methods research project looked at the introduction of inclusive education in England. The study sought to fully grasp the experiences and difficulties faced by teachers serving students with Special Educational Needs and Disabilities (SEND) in mainstream environments by combining quantitative and qualitative methods.

Research Design

Through a structured Likert-scale questionnaire, the mixed-methods approach allowed one to quantify teacher attitudes and perceptions, while also providing in-depth insights through open-ended qualitative responses. By allowing cross-valuation between numerical trends and descriptive narratives, this triangulation of data raised the validity and richness of the conclusions (Creswell, 2013). Although the original study plan called for semi-structured interviews, the data collection approach was changed to favour a digitally distributed questionnaire sent via Google Docs, enabling quick, effective, flexible participation.

Participants

Ten female primary school teachers from one English mainstream school made up the study sample. Choosing participants from the same educational environment helped to preserve consistency in demographic and institutional variables, enabling a focused study of inclusive education policies under rather consistent circumstances. The participants occupied different teaching positions, allowing the gathering of several points of view on both more

general   institutional   policies   regarding   SEND   implementation   and   classroom-level   strategies.

Data Collection Tools

A custom-made questionnaire with both closed and open-ended questions made up the data collection tool: Ten Likert-scale questions covering teacher confidence, policy familiarity, leadership and peer support, collaboration, use and effectiveness of interventions, access to resources, professional development, and time constraints define the quantitative section. On a five-point rating system, responses fell from 1 (strongly disagree) to five (strongly agree). Ten open-ended questions meant to provoke thoughtful answers on inclusive practices, judged policy effectiveness, professional learning needs, intervention results, and institutional challenges. This enabled richer contextualising of the quantitative results.

Advantages of the Method

Among the several methodological benefits the Google Docs format presented were participant convenience, cost-efficiencies, and accessibility. The internet environment allowed a degree of anonymity that might have encouraged more honest answers. Furthermore, the combination of quantitative and qualitative data helped to provide a comprehensive knowledge of the complicated dynamics affecting inclusive education.

Study Limitations

The study involved a small number of teachers and was carried out inside a single school. The results might thus not be typical of the larger teacher population in England. Although quick, the use of Google Docs questionnaires may have brought prejudices, including self-selection and limited the depth of responses when compared to face-to-face interviews. Different interpretations of the questions by participants could have also influenced the consistency of answers. Lack of Interviews: Time limits prevented conducting interviews. Richer, more complex information from interviews would have let one better grasp the experiences and viewpoints of teachers. Restricted generalisability: The results might not completely reflect the variety of inclusive education strategies used in many English schools since the study was carried out at only one. Different experiences and viewpoints might arise from variances in administrative support, funding, and school policies.

Ethics Section

This study followed ethical standards to guarantee the moral behaviour and integrity among every participant: Every participant was advised on the goal of the study, their involvement, and their rights as such. Approval was obtained before involvement. All the participants maintained their identities under confidentially. Data was anonymised in order to guard personal privacy. Voluntary Participation: One participated in the study entirely on choice. Participants were free to stop the study at any moment without facing repercussions. Data Security: Only the researchers engaged in the study could access the safely kept data. Steps were done to guard the information from illegal access. The study guaranteed that throughout the data collection process, the participants were not harmed, uncomfortable, or disturbed.

Descriptive Statistics

The descriptive statistics for every survey question are compiled in a table here. On a 5-point Likert scale, 1 = Strongly Disagree, 5 = Strongly Agree, participants graded every statement.

The Summary of Descriptive Statistics

Table 1. Summary of Survey Responses

Question	Focus Area	Mean	Median	Mode	Std. Dev.
Q1	Confidence in supporting SEND	4.2	4	4	0.42
Q2	Familiarity with national policies	3.8	4	4	0.63
Q3	Implementation of inclusive policy	3.5	3	3	0.67
Q4	Training/professional development	3.1	3	3	0.74
Q5	Leadership support	3.6	4	4	0.52
Q6	Collaboration with staff/specialists	4.0	4	4	0.47
Q7	Resource accessibility	3.4	3	3	0.7
Q8	Use of structured interventions	3.9	4	4	0.57
Q9	Effectiveness of interventions	4.1	4	4	0.6
Q10	Impact of time/workload barriers	3.2	3	3	0.65

Interpretation of Descriptive Statistics

With high mean scores (4.0 and above), Q1, Q6, and Q9 show great confidence in helping SEND students, consistent professional development, and intervention effectiveness. This implies that inclusive approaches in use help teachers feel competent and experience real advantages. With moderate mean scores (between 3.6 and 3.9), Q2, Q5, and Q8 indicate that teachers generally feel familiar with national inclusive education policies, get moderate leadership support, and regularly apply organised interventions. Still, responses point to some fluctuation in consistency and access across settings. Lower mean scores for Q3, Q4, Q7, Q10 point to difficulties in the real-world application of inclusive policies, limited professional development opportunities, unequal access to resources, and the effect of time and workload constraints. These areas clearly pose major practical obstacles to complete policy implementation. Standard deviations span 0.42 to 0.74, so reflecting different degrees of agreement among the respondents. The highest variability shows in Q4 (training) and Q3 (policy execution), implying different school environments or access to support, so influencing how inclusivity is carried out on the ground.

T-Test Analysis for Key Survey Items

Whether the mean responses noticeably deviated from the neutral score of 3 (neither agree nor disagree) was ascertained by means of a one-sample t-test.

T-Test Results (One-Sample, Compared to Neutral Score of 3)

Question	t-value	df	p-value (2-tailed)	Significant (p < 0.05)?
Q1	6.04	9	0.0002	Yes
Q2	3.63	9	0.005	Yes
Q3	2.08	9	0.068	No
Q4	0.43	9	0.678	No
Q5	2.95	9	0.016	Yes
Q6	5.43	9	0.0005	Yes
Q7	1.79	9	0.105	No
Q8	3.98	9	0.003	Yes
Q9	4.26	9	0.002	Yes
Q10	1.12	9	0.294	No

T-Test Interpretation:

For every survey item, a one-sample t-test was performed to find whether the mean responses of participants notably deviated from the neutral midpoint score of 3.0 on the 5-point Likert scale (1 = Strongly Disagree, 5 = Strongly Agree). The study sought to evaluate whether teachers' opinions differed either favourably or negatively from a neutral standpoint about different facets of inclusive education. Every comparison started with a significance threshold of p <.05.

Six of the ten items showed statistically significant positive variations from the neutral value, according to the results. These comprised items pertaining to teacher confidence (Q1), familiarity with national policies (Q2), perceived leadership support (Q5), colleagues and professional collaboration (Q6), use of structured interventions (Q8), and perceived efficacy of those interventions (Q9). These results imply that generally, educators have good opinions about their ability to apply inclusive education and acknowledge the need of well-organised support systems.

Particularly, responses to Q1 (Confidence in supporting SEND students) produced a mean score of 4.2 (t(9) = 6.04, p =.0002), so reflecting a strong degree of self-efficacy among respondents. Likewise, Q6 (collaboration with colleagues and experts) showed a strong positive deviation (M = 4.0, t(9) = 5.43, p =.0005), so indicating general cooperation as a major enabler of inclusive practice.

Significant familiarity with national inclusive education policies (Q2) (M = 3.8, t(9) = 3.63, p =.005) was also reported by teachers, so underlining effective policy framework distribution including the SEND Code of Practice. Moreover, Q5 (Leadership support) was statistically significant (M = 3.6, t(9) = 2.95, p =.016), implying that school leaders significantly help to create an inclusive school environment.

Crucially, the use of structured interventions (Q8) was also rated significantly above neutral (M = 3.9, t(9) = 3.98, p =.003); teachers felt such strategies were effective in practice (Q9). These results highlight the importance of evidence-based strategies including Lego Therapy and Colourful Semantics in meeting the several needs of SEND students.

On the other hand, although their means changed, four items did not show statistically significant variations from the neutral value. With a mean score of 3.5 (t(9) = 2.08, p =.068), Q3 (Implementation of inclusive policies) shows a modest but non-significant trend towards positive view. Reflecting areas where teacher experiences were more either neutral or mixed, Q4 (Training and professional development) (M = 3.1, t(9) = 0.43, p =.678), Q7 (Resource accessibility) (M = 3.4, t(9) = 1.79, p =.105), and Q10 (Impact of time/workload barriers) (M = 3.2, t<

The lack of statistical significance in these domains could indicate systematic difficulties limiting the complete realisation of inclusive practices including unequal access to resources, inconsistent training, and workload pressures. These results line up with the more general body of research, which notes structural limitations as main obstacles to inclusive education that is sustainable.

Overall, the t-test results show that although teachers usually show great commitment and practical competence in implementing inclusive strategies, more work is needed to improve professional development opportunities, guarantee consistent resource provision, and handle practical constraints such time and administrative burden.

Qualitative Analysis of Open-Ended Responses

Open-ended questions meant to probe teachers' experiences, viewpoints, and thoughts on inclusive education gathered qualitative data to go along with the quantitative results. Thematic analysis of the responses helped to spot trends, issues, and best practices. Five main themes emerged from the study: policy-practice disconnect, resource and training constraints, successful interventions in use, cooperative support, and time and workload related barriers.

Policy Awareness vs. Practical Application

Although most participants said they knew about national inclusive education policies including the SEND Code of Practice, many pointed out that these ideas were not regularly followed at the school level. While some educators mentioned clearly defined policies and supportive leadership, others noted uncertainty about how policy applied in the classroom:

"We are informed inclusion is a priority, but the actual resources and systems to support it are not always in place." This discrepancy between policy and practice emphasises the need of more ordered school-level direction and consistent application across environments.

Need for Ongoing, Practical Training

The value of constant professional development was underlined by participants. Although first instruction was said to be beneficial, many expressed a need for useful, hands-on seminars emphasising techniques they could apply right in the classroom:

"Most of what I know has come from experience rather than official instruction. More practical case studies would be fantastic.

This supports quantitative results showing one of the lowest mean scores for training received, so indicating a systematic need for continuous capacity-building initiatives.

Use and Impact of Structured Interventions

Teachers repeatedly found that highly effective in helping children with SEND were structured interventions including Colourful Semantics, Lego Therapy, visual aids, and sensory breaks. Many said they routinely apply these techniques with obvious benefits. One of my nonverbal students started building simple sentences, thanks in part to colourful semantics. These results match the quantitative data, in which the perceived efficacy of interventions as well as their usage scored highly and significantly.

Collaboration as a Strength

One big enabler of inclusive education turned out to be cooperation with colleagues, teaching assistants, and outside experts. Teachers said team teaching and informal peer support improved their confidence and effectiveness:
"I regularly go to our SENCO for guidance; she is quite outstanding. It makes a significant difference simply having someone else generate ideas."

This theme supports the statistically significant favourable answer to the survey questions concerning cooperation.

Workload and Time Constraints as Persistent Barriers

Several participants pointed out that although they are committed to inclusion, heavy schedules and little planning time make it challenging to regularly apply inclusive strategies. Teachers spoke of difficulty juggling the demands of differentiated instruction with the more general classroom needs:
"I want every student the help they need, but occasionally I simply lack the time. It is a continual juggling act."

This theme matches the lower average ratings and non-significant t-test findings for items connected to resources and time availability.

Discussion

Focussing on their confidence, available resources, teamwork, and perceived benefits and challenges in helping students with Special Educational Needs (SEN), this study sought to investigate teachers' views and experiences of inclusive education inside a primary school in England. From the standpoint of practitioners actively present in the classroom, the results, derived from both qualitative and quantitative data, offer a well-rounded picture of the present situation of inclusive education. A strong theme running across the answers was the respect of equity. Teachers underlined the need of giving every student, regardless of ability, equal chances to engage in learning. This is consistent with more general scholarly work that notes equity as the fundamental idea behind inclusive education (Ainscow, 2005). Teachers' use of tailored approaches, including differentiated instruction, one-on-one support, and structured classroom interventions such as Lego therapy and colourful semantics, clearly demonstrated their dedication to inclusion. These strategies not only meet intellectual demands but also encourage social inclusion, supporting earlier studies on successful inclusive policies (Garrote et al., 2017).

Even with this dedication, several noteworthy difficulties were documented. Teachers mentioned as ongoing challenges limited resources, inadequate time for planning and implementing inclusive activities, and heavy workloads. These issues reflect those found in national research (Warnes et al., 2021; Office for National Statistics, 2022), implying that although inclusive values are generally supported, structural and logistical obstacles still impede efficient application even if More focused professional development would also help teachers equip them with modern tools and strategies, in line with demands from academics for continuous training as a vital component in maintaining inclusive education (Ewing et al., 2017). The study also underlined the value of cooperation between schools and families as well as among teaching staff. Although peer cooperation was usually seen as strong and encouraging, parental involvement varied; some teachers expressed worry over uneven participation. Teachers underlined that good relationships with families depend on honest communication and consistent updates, so highlighting the fact that inclusive education is most successful when supported by the larger community (Department for Education, 2015). Another striking result relates to attitudes. Particularly in cases when adults consistently modelled inclusive behaviours, teachers saw both their colleagues and students as generally positive towards inclusion. This observation captures current studies stressing the need for school culture, leadership, and modelled behaviour in promoting inclusive mindsets (Webster et al., 2021).

In essence, the conversation shows that although teaching staff welcomes inclusive education in theory, its success mostly depends on sufficient training, tools, time, and systematic support. The results support the need of a whole-school strategy and consistent expenditure in inclusive infrastructure. These revelations help to clarify areas of success in inclusive education as well as areas where focused improvements still need to be done.

Conclusion

In this paper, the opinions and experiences of English primary school teachers are explored regarding inclusive education for children with Special Educational Needs (SEN). The study presents new angles on current inclusive policies, teacher confidence, and perceived barriers to inclusion in one primary school. The findings reveal that,

overall, teachers appreciate the concepts of equity and participation that are the basis of inclusive education, and they are quite assured in their ability to assist SEN students. To accommodate the different needs of students, teachers reported that they employed various inclusive strategies, such as using differentiated instruction, small group interventions, and structured frameworks, including Colourful Semantics. These strategies show a strong commitment to creating inclusive classrooms where every student feels supported and engaged.

Notwithstanding these advantages, some difficulties surfaced. Key obstacles to effective inclusion mentioned by teachers as limited access to resources, time restrictions, and the necessity of more focused professional development. While staff members worked closely, administrative and systemic support was seen as uneven, which increased teaching staff stress. These results reflect more general issues in the literature regarding the sustainability of inclusive education due to a lack of sufficient structural support and investment.

Although parental involvement was acknowledged as crucial, its impact changed based on degree of participation and communication. To improve support for SEN pupils, teachers said they would like more consistent and cooperative relationships with families. Likewise, although students' opinions of their peers with SEN were generally favourable, teachers underlined the need of continuous modelling and education to preserve an inclusive peer culture.

The results cannot be applied to all educational environments since the research was carried out in single institution with a small sample size. Still, they provide a good window into present events and highlight areas needing focused development. Future studies should consider increasing the sample size, including several school environments, and including classroom observations or interviews to have a more complex understanding of inclusive practices. Ultimately, this study emphasises teachers' great dedication to inclusive education as well as unambiguous demands for improved training, efficient use of resources, and institutional support. Meeting the needs of every student and promoting long-term success in inclusive education depend on ongoing investment in professional development, teamwork, and inclusive school cultures.

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Appendix

Quantitative Questions

The Likert scale survey contained the following statements. A 5-point rating system, with 1 denoting "strongly disagree" and 5 denoting "strongly agree," was used to ask respondents to rate their degree of agreement:

I have confidence that I can help SEN students in my classroom.

The school offers sufficient resources to carry out inclusive education.

The administration of the school is in favour of inclusive teaching methods.

To help SEN students, I frequently work with other educators and experts.

My class's students embrace and help their SEN classmates.

I have ample time to incorporate inclusive teaching methods into my lessons.

I am well-prepared for inclusive education thanks to the professional development I have received.

SEN students' parents take an active role in their education.

I believe that all students, not just those with special education needs, gain from inclusive education.

Qualitative Questions

The Google Docs form contained the following open-ended questions to investigate teachers' perspectives and experiences with inclusive education:

Tell us about your experience helping SEN students in your classroom.

Which tools do you think are most useful for putting inclusive education into practice, and why?

In what ways does the administration of your school help or hinder your efforts to provide inclusive education?

Could you give instances of how you work with other educators and experts to help students with special education needs?

What reactions do the pupils in your class have to their SEN peers? What obstacles do you encounter when trying to find enough time to successfully implement inclusive practices?

What impact has professional development had on your capacity to advocate for inclusive education?

Based on your experience, describe how parents of SEN students contribute to their kids' education.

What are the general advantages of inclusive education for all students, in your opinion?

Navigating Intercultural English as a Foreign Language Learning: Georgian Students' Insights

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Abstract: Nowadays, English as a Foreign Language (EFL) learners emanate from linguistically and culturally diverse heritages in a multicultural society. Intercultural EFL learning fosters cultural awareness, increases motivation, and social integration via authentic experiences. Efficacious EFL learning requires culturally sensitive teachers to understand students' cultural norms, values, and communication styles to create an inclusive learning environment. Intercultural foreign language teaching embraces, on the one hand, teaching about lowbrow and highbrow culture and, on the other hand, providing a culture-sensitive environment while teaching. The higher education sector in Georgia is increasing steadily, with the number of international students growing. Besides, the cultural landscape of Georgian citizens learning at higher education institutions (HEIs) has always been diverse. However, research on intercultural EFL learning among Georgian HEIs has been scarce. Considering this, an inquiry on multicultural EFL learning is vital. The current research aimed to explore the impact of intercultural EFL learning on language learners. A mixed approach was applied, comprising interviews and thematic analysis. The 30 participants were language learners enrolled in diverse educational programs at private and public HEIs in Georgia. The findings confirm the necessity of immersion in intercultural learning environments to achieve higher learning outcomes in EFL settings.

Keywords: Intercultural Language Learning, Multicultural Society, Inclusive Learning Environment, English as A Foreign Language, Higher Education

Introduction

Across various disciplines, multiculturalism represents the complex nature of diversity, identity, and social interactions. It is relevant to many study domains, including sociology, anthropology, psychology, education, and cultural studies. Multiculturalism is characterized by the coexistence of various cultural groups within a society. English as a Foreign Language (EFL) learners in a multicultural society come from linguistically and culturally diverse backgrounds, bringing unique perspectives, experiences, and knowledge to the classroom. Multicultural EFL

mastering highlights the significance of inclusive, culturally responsive approaches to teaching and learning that recognize and value every student's linguistic and cultural diversity. The impact of multiculturalism on EFL learners makes sense in shaping their cultural identity. Multicultural EFL learning provides opportunities for enhanced cultural awareness, which is crucial for EFL learners, as language learning is connected to the cultural context (Baker, 2015). These diverse environments influence students' motivation, which they perceive as a bridge between understanding and connecting with their peers (Ushioda, 2017). The interaction between peers from diverse linguistic heritages promotes language learning through authentic experiences and fosters social integration (Cummins, 2000). Effective intercultural EFL learning requires educators to be culturally sensitive and responsive, understanding students' cultural norms, values, and communication styles. Educators working in multicultural EFL learning environments must be culturally competent to assist effectively students from diverse cultural backgrounds (Gay, 2010). Educators should be aware of their learners' cultural backgrounds, beliefs, and communication styles to create inclusive learning environments that cater to their diverse needs. Furthermore, multiculturalism plays a vital role in shaping an EFL curriculum by encouraging a rich diversity and a culture of inclusivity. Curricular materials reflecting EFL learners' cultural backgrounds and experiences facilitate students' engagement and meaningful learning experiences (Banks, 2016). Consequently, multiculturalism has a significant impact on EFL learning. To establish inclusive learning environments that support equality and academic success among EFL learners, it is essential to embrace students' multicultural viewpoints and practices.

A multitude of studies have concentrated on multiculturalism and its effect on EFL. The research by Lucido et al. (2024), Parker (2019), and Ziegler (2013) examines the impact of multiculturalism on EFL learning. The study by Doghonadze and Zoranyan (2018) analyzes the multicultural challenges in the Georgian higher education system. Tabatadze and Gorgadze (2017) investigate teachers' educational programs for delivering multicultural instruction to students. Dundua (2016) observes the potential perspectives and existing obstacles in Georgia. Subsequently, there is a deficiency in renewed research on multiculturalism, particularly on its impact on EFL learning among Georgian higher education institutions (HEIs), to identify its strengths and weaknesses.

Georgia has been a multicultural country for centuries. Nowadays, Georgian educational space and workforce are becoming increasingly heterogeneous. Multicultural education serves as a critical framework, which, according to Banks and Banks (2016), fosters mutual tolerance, understanding, and respect among learners from different heritages and unique cultures. Considering this, research on multicultural EFL learning is vital for preparing individuals to communicate effectively in higher educational and professional settings that require cultural sensitivity and multilingual abilities. It is essential to handle students' diverse needs in a timely course. It should be clear how multiculturalism impacts EFL learning in progressive educational settings, and it is vital to tailor instructional methods, resources, and support systems to ensure the success of students from various cultural backgrounds.

Literature review

The theoretical frameworks of the concepts of 'culture' and 'multicultural'

Tylor (1871) defines the meaning of 'culture' as a "complex whole which includes knowledge, belief, art, morals, law, custom, and any other capabilities and habits acquired by man as a member of society" (p. 1). White (1959) asserts that 'culture' serves as a principal idea for all anthropological empirical knowledge. Matusov and Marjanovic-

Shane (2017) emphasize the connection between the concepts of 'culture' and 'education'. Education is a reproduction of culture when novices join it. Through newcomers joining the existing cultural practices, culture rejuvenates, spreads, and maintains itself. In this regard, education is often viewed as a purposefully organized process designed to revitalize culture. Culture is a trait acquired through education, whether formal, informal, or non-formal. It is transmissible from one generation to the next through practical educational tools. The importance and utility of culture become known to individuals through education. Culture influences education and institutions by determining and formulating educational aims and objectives, constructing curriculum, organizing co-curricular activities, selecting teaching methods and textbooks, and creating a social environment rich in good teacher-taught relationships. According to Ertuğruloğlu et al. (2024), culture transmits education, while education expresses cultural norms and values. Culture and education impact each other. The concept of 'culture' plays a crucial role in understanding and implementing multiculturalism. Banks (1979) emphasizes that a human group's unique attainment distinguishes it from other human groups. Exploring the concept of 'culture' within multiculturalism is crucial for understanding how culture is understood and negotiated in diverse and pluralistic societies (Parekh, 2001).

The concept of 'multiculturalism' permeates various disciplines, reflecting the complexities of diversity, identity, and social dynamics. Numerous disciplines, including sociology, anthropology, psychology, education, and cultural studies, find it highly significant. Parekh (2001) acknowledges the importance of cultural diversity, social inclusion, and equal citizenship rights for all individuals and communities. From an anthropological perspective, multiculturalism emphasizes cultural diversity, identity formation, and cultural exchange among diverse communities. It includes exploring how cultural practices, beliefs, and values shape individual and collective identities and processes of cultural adaptation and change (Appadurai, 1996). In the psychological context, issues such as individuals' navigation of cultural differences, negotiating their multiple cultural identities, and adapting to multicultural environments are determined (Chirkov et al., 2003). From the educational perspective, Gay (2010) emphasizes that multiculturalism promotes cultural awareness, reduces prejudice, and fosters academic success among students from diverse cultural backgrounds. Cultural studies scholars analyze multiculturalism as a cultural phenomenon shaped by historical, political, and economic factors (Hall, 1992). Multiculturalism is one of the dominant learning aspects. The transformation of cultural perspectives into educational practices results in an engaging and enjoyable experience for all students, extending beyond helping them comprehend and value social justice, equality, and diverse cultures (Banks & Banks, 2016).

The Brief Review of Multicultural Education

Over the past several decades, the concept of 'multicultural education' has been given various definitions. In the 1980s and 1990s, the definition of multicultural education expanded to encompass concerns of many additional groups, including women, individuals with special educational needs, and people from various age groups, such as the very young and the elderly. Some authors have limited the definition to specific populations, such as ethnic groups (Belle, 1994).

The leading figure in multicultural education is James A. Banks, who describes it as a field of study and an emerging discipline with a significant aim of creating equal educational opportunities for students from diverse racial, ethnic,

social-class, and cultural backgrounds. Its aim is the eradication of racism and discrimination in all spheres of life, including the system of education. As culture is the root of multiculturalism, multicultural education is a type of education that encompasses many cultures, aiming to educate students to acquire knowledge about a range of cultural groups and develop the attitudes, skills, and abilities necessary for functioning in different cultural environments (Banks, 1979). According to Geneva (1990), multicultural education is an educational reform movement and a process intended to change the structure of educational institutions so that all students have an equal chance to achieve academic success. At the same time, it is a philosophy that stresses the importance, legitimacy, and vitality of ethnic and cultural diversity in shaping the lives of individuals, groups, and nations.

Fraizer (1977) defines multicultural education as policies and practices that show respect for cultural diversity through educational philosophy, staffing compositions and hierarchy, instructional materials, curricula, and evaluation procedures. Banks (2001) emphasizes that multicultural education is "an idea, an educational reform movement, and a process." Multicultural education encompasses theories and practices that promote equitable access for students from diverse backgrounds. It encourages them to work together toward social change. Multicultural education affirms the multiple identities that students bring to their learning. According to Marshall (2002), multicultural education is a vision of education that relies on the democratic principles of justice and equality. Sleeter and Gant (2009) state that multicultural education is a field of study and an emerging discipline with the primary aim of creating equal educational opportunities for students from diverse racial, ethnic, socioeconomic, and cultural backgrounds. The studies by Banks (2009) and Nieto (2010) aimed to highlight the importance of integrating multicultural perspectives into educational practices to promote positive attitudes and a sense of belonging among students from diverse backgrounds. A primary goal of multicultural education is to reform schools, colleges, and universities so that students from diverse racial, ethnic, and social-class groups will experience educational equality (Banks, 2016).

The Impact of Multiculturalism on EFL Learning Experiences

Due to globalization, the representation of educational classrooms has become increasingly diverse, influencing various issues, including teaching methods, curriculum design, and student interaction. Enhanced cultural awareness among students is significantly influenced by multiculturalism in English as a Foreign Language context (Baker, 2015). Cultural awareness is a crucial element for EFL learners, as the process of learning English is deeply connected to its cultural context (Byram, 2008). Furthermore, a diverse learning environment can boost students' motivation (Ushioda, 2017). Interaction between peers who represent different languages and cultural backgrounds facilitates language learning through authentic communication experiences (Cummins, 2000). Despite the assets, multiculturalism in EFL learning can also create cultural conflicts and misunderstandings. Different cultural norms and values lead to student miscommunication and pressure (Cortazzi & Jin, 1996). Students in a multicultural environment often have diverse learning styles and expectations, which can make teaching challenging. Hall and Ramirez (1993) state that rote memorization is appropriate for one culture's representations and inappropriate for another. Therefore, different approaches should be balanced to create a cohesive learning experience for absolutely every student. Fantini (2009) asserts that an insufficient level of teachers' preparedness to integrate multiculturalism into their teaching practice effectively is an obstacle to multicultural EFL learning.

Method

This study illuminates the impact of a multicultural society on EFL learning, corroborates the challenges presented in the existing scientific literature, and identifies potential perspectives on EFL learning in a multicultural environment by employing both qualitative and quantitative modes of inquiry, aiming to capture the nuanced experiences and perceptions of ESL learners in multicultural settings.

The thematic analysis method was employed in the qualitative part of the current research to identify recurring patterns and themes within the collected data. The analysis was iterative, constantly comparing emerging themes with existing literature. Descriptive analysis was applied for the qualitative section of the research.

The qualitative data were collected through semi-structured interviews, which provided participants with the flexibility to share their experiences, challenges, and perceptions of the benefits of learning a language in a multicultural setting.

The quantitative data were assembled via Google Forms in 5-point Likert scale questions format (including points from 1 to 5, where 1 - Strongly Disagree, 2 - Disagree, 3 - Neutral, 4 - Agree, 5 Strongly Agree). The questionnaire link was sent to the participants, and no discrepancy was found between the sent and received answers. Descriptive statistics results were analyzed via IBM SPSS Statistics 29.0.2.0.

Sampling

A purposive sampling approach was employed to ensure a varied representation of cultural experiences, language proficiency levels, and backgrounds (Campbell et al., 2020). The participants for the current research were drawn from language learners enrolled in diverse educational programs at private and public HEIs in the Imereti region of Georgia. The universities were selected prior to the commencement of this research operation. Table 1 presents the demographic data of the thirty participants.

Table 1. The demographic Data of The Participants

Total number of universities	Public universities	Private universities	Age	Culture		
				dominant	ethnic minorities	international students
2	1	1	20-30 years	22	3	5

Research Ethics

The research was conducted with consideration for the participants' cultural norms, values, and beliefs. Students received translated consent forms to ensure they fully understood the research purpose, procedures, and potential risks. Robust data protection measures were implemented, and the participants were informed about how information was handled and stored. By incorporating the aforementioned considerations into the current research, the study

adhered to established ethical standards. It contributed to advancing knowledge in multicultural EFL contexts while respecting the rights and dignity of students.

Limitations

The limitations of the current research included the sample size and geographical issues, as this study was conducted only in the Imaret region of Georgia.

Results

Qualitative Research Findings

To explore the significance of immersing oneself in a diverse society for successful EFL learning and its impact on outcomes, the following five questions were designed for the interviewees: 1. Can you share your thoughts on multicultural societies? Is it acceptable for you to coexist with diverse groups of people and gain experience from them? 2. From your perspective, does being involved in a diverse learning environment matter for successful EFL learning? 3. Can you explain how communication in a multicultural environment impacts English as a foreign language learning? 4. Tell me about the last time you were involved in a multicultural atmosphere while practicing your English language. Does it influence your learning outcomes? 5. Can you tell me about your experience with EFL learning? How did you reach the results?

Research Question 1.

The analysis of the first research question provides evidence that a multicultural society is acceptable to all respondents. Emphasis was placed on its benefits and importance. A diverse climate provides EFL learners with the opportunity to be immersed in a unique atmosphere that encompasses different nationalities, races, cultures, traditions, and experiences. A multicultural setting contributes to personal development, enabling individuals to become fully-fledged members of society, and culturally enriches and promotes innovation and creativity. The thematic analysis for the first research question was made in the following way and is presented in Table 2. The tables related to the 2nd, 3rd, 4th, and fifth research questions are not included in this article for brevity reasons (although the analysis was conducted in the same manner).

Table 2. Sample of thematic Analysis for The First Research Question

Interviewee	Transcript	themes	№	Keywords (sub-themes)	№
1	A multicultural society consists of *various groups* of people with different *traditions, races, and nationalities*, and I concur with coexisting and getting *experience* from them because it plays an essential role and *enriches* the social structure.	definition benefits	2	various/diverse/diversity (7) traditions (3) races (1) nationalities/nations (4) coexist (4) inclusive (1) dynamic (1) experience (4)	34

	Coexisting with *diverse* groups of people allows for an *exchange of ideas and understanding. It helps break down any barriers and build bridges between people*. After all, living in a multicultural society can lead to becoming a *full-fledged member of society* and pave the way for a *brighter future.*		cultures (3) aspects/sides (1) interests (1) languages (2) unique (1) learning outcomes (1) interact/interaction (1) different backgrounds (1) enrich/enrichment (3) exchange of ideas (1) understanding (1)
2	The modern world always paves the way for all the *nations and cultures existing within it.* There is no point that declines and rejects the existence of a multicultural society. Since it has several *advantages.* Therefore, I personally believe that the only result of living in such societies may have been the *experience* itself. *Various cultures, nations, interests, traditions, languages,* etc., prevent our lives from being monotonous; they lead us to *explore the nations naturally.*	benefits definition	breaks down the barriers (1) builds bridges (1) being a full-fledged member of society (1) brighter future (1) avoids monotony (1) explore in a natural way (1) innovation (1) social cohesion (1) creativity (1) personal growth/development (3) professional growth (1) learning from one another (1) experiencing different (1) bringing new/different perspectives (2) makes life interesting (1)
3	A multicultural society offers numerous *benefits for foreign language learners, such as cultural enrichment, innovation and creativity, social cohesion and creativity, and personal growth.* It is not only acceptable but highly beneficial to *coexist* with *diverse groups of people* and I confirm this statement completely. The *experience* gained from such interactions contributes to *personal development* and fosters a more *inclusive and dynamic society.*	benefits	
4	I think a multicultural society is a beautiful thing. It allows people *to learn from one another, experience different traditions,* and see the world from *new perspectives*. Diversity *makes life more interesting* and *helps us grow as individuals.*	benefits	

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5	For me, *co-existing* with people from *different backgrounds* is not just acceptable—it is something I genuinely appreciate	definition
6	A multicultural society is acceptable to me and especially *important for language learners*. It provides us with an excellent opportunity to be immersed in diverse cultures with unique aspects that align with our *learning outcomes*.	benefits
7	I believe a multicultural society brings together diverse perspectives and experiences. I find it enriching to *interact with diverse groups*. It helps me *grow personally and professionally*.	benefits

The most interesting answer to question 1 was

I1: A multicultural society consists of various groups of people with different traditions, races, and nationalities, and I concur with coexisting and getting experience from them because it plays an essential role and enriches the social structure. Coexisting with diverse groups of people enables an exchange of ideas and fosters understanding. It helps break down any barriers and build bridges between people. After all, living in a multicultural society can lead to becoming a full-fledged member of society and pave the way for a brighter future.

The thematic analysis of the answers yielded 2 themes (definition and benefits) and 34 sub-themes, the most popular of which were 'various/diverse/diversity' (7 mentions by 5 interviewees), 'nationalities/nations' (4 mentions by 2 interviewees), 'experience' (5 mentions by 5 interviewees), 'coexist' (4 mentions by 3 interviewees), 'traditions' (3 mentions by 3 interviewees), 'personal growth/development' (3 mentions by 3 interviewees), 'enrich/enrichment' (3 mentions by 2 interviewees), and 'culture' (3 mentions by 2 interviewee).

To sum up, the respondents define a multicultural society as one that is inclusive and dynamic, where people of diverse races, nationalities, cultures, and backgrounds, speaking different languages and having distinct traditions and interests, coexist. Their perceptions regarding multicultural society are positive, emphasizing its advantages/benefits, including bringing new/ different perspectives (2), enrichment with various experiences (1), exchange of ideas and understandings (1), breaking down barriers and building bridges (1), being a full-fledged member of society (1), providing a brighter future (1), avoiding monotony (1), exploring the society in a natural way (1), innovation (1), social cohesion (1), creativity (1), personal growth (3), professional growth (1) experiencing different traditions (1), and learning from each other (1).

Research Question 2

Analyzing the second research question, it is evident that the respondent's involvement in a diverse learning environment is crucial for successful EFL learning. All respondents emphasized the importance of being involved in an intercultural learning environment for adequate EFL mastery, as it contributes to enhancing speaking skills, extending cultural experiences, and improving communication skills.

The most interesting answer to question 1 was:

> I 2: From my point of view, yes, being involved in a diverse climate is highly beneficial for successful learning. A diverse climate offers ESL learners the opportunity to practice English in real-life situations. A multicultural environment motivates ESL learners. Moreover, in a diverse classroom, students can learn from each other's linguistic and cultural experiences. Peer interactions offer insights into various accents, dialects, and language usage, thereby broadening learners' understanding of English.

The thematic analysis of the answers yielded 1 theme (benefits) and 28 sub-themes, the most popular of them being 'various/diverse' (10 mentions by 6 interviewees), 'climate' (5 mentions by 4 interviewees), 'environment' (4 mentions by 4 interviewees), 'accents' (4 mentions by 4 interviewees), 'cultural' (3 mentions by 3 interviewees), 'success of EFL/ learning process' (3 mentions by 3 interviewees), 'language' (4 mentions by 3 interviewees), 'experience' (4 mentions by 3 interviewees), 'practice/practiced' (2 mentions by 2 interviewees) and 'speaking'(3 mentions by 2 interviews). In a nutshell, according to respondents' injoins, it is meaningful to be involved in a culturally diverse climate for successful EFL learning. It is represented by alternative dialects and accents, which facilitate the acquisition of successful language mastery. English language learners practice their language skills in an authentic learning environment, gaining experience from peers with diverse cultural and linguistic backgrounds while enhancing their speaking skills, building confidence, and increasing fluency.

Research Question 3

Analyzing the third research question, we can conclude that communication in a multicultural environment has primarily a positive effect on EFL learning; however, in some cases, it has a negative influence.

The most interesting answer to question 1 was:

> I3: It affects positively. In a multicultural environment, EFL learners face different accents and dialects of English. It helps them to become more adept at understanding and interpreting various ways English is spoken, improving their listening skills. Learners have access to a broader range of vocabulary and engage in conversations with people from diverse backgrounds, which helps them practice their speaking and listening skills in real-life scenarios.

The thematic analysis of the responces yielde 3 themes (impact, strengths, weaknesses) and 38 sub-themes, the most popular of them being 'multicultural' (6 mentions by 6 interviewees), 'environment' (6 mentions by 6 interviewees), 'communication' (5 mentions by 4 interviewees), 'impact/affect' (4 mentions by 4 interviewees), 'listening skills' (4 mentions by 3 interviewees), 'accent' (3 mentions by 3 interviewees), 'fluency/fluently' (3 mentions by 3 interviewees), 'speaking skills' (3 mentions by 2 interviewees), 'speaking" (3 mentions by 2 interviewees), 'various' (2 mentions by 2 interviewees), 'diverse' (2 mentions by 2 interviewees) 'interpreting/interpret' (2 mentions by 2 interviewees), 'vocabulary' (2 mentions by 2 interviewees), 'confidence' (2 mentions by 2 interviewees), and 'diverse' (2 mentions by 2 interviewees).

In summary, a culturally heterogeneous educational environment influences the development of communication, listening, and speaking skills, increases motivation, helps overcome self-consciousness, enhances fluency and confidence in English, impacts students' relationships, and facilitates their adaptation to diverse communication styles. Despite these considerations, there are occasionally circumstances in which being involved in a multicultural environment hurts EFL learning. It may occur when EFL learners engage in communication with non-native language speakers, facing various accents and dialects, which can lead them astray in the learning process.

Research question 4

Analyzing the 4th research question, we can gather evidence that the intercultural habitat and practicing English in this setting impact the outcomes, as all respondents emphasized their immersion in culturally diverse learning environments and its positive and contributory effect on the outcomes.

The most interesting answer to question 1 was:

> I4: The last time I was involved in a multicultural setting was at a university event where I served on the organizing team. I had to communicate with the international guests for organizational questions during the event. I confirm that a multicultural atmosphere has a positive effect on my English practice.

The thematic analysis of the answers yield 1 theme (effect of practice in a multicultural environment on outcome) and 20 sub-themes, the most popular of them being 'atmosphere' (8 mentions by 6 interviewees), 'multicultural' (6 mentions by 6 interviewees), 'English practicing/practice English' (6 mentions by 4 interviewees), 'communicative practice/ communication (5 mentions by 5 interviewees), 'experience' (4 mentions by 4 interviewees), 'experience' (4 mentions by 4 interviewees), and 'international guests' (2 mentions by 2 interviewees),

In summary, immersion in English as a Foreign Language (EFL) learning environments has a significant impact on EFL learning outcomes. The outcomes are achieved through direct communication in English, adapting to various communication styles and accents, and gaining experience from authentic interactions.

Research question 5

Analyzing the fifth research question, we can affirm that involvement in an intercultural medium is a crucial component of EFL learning.

The most interesting answer to question 1 was:

> I5: I utilize different types of books, websites, articles, and listening tasks to improve my English language skills. The most practical way is to understand the context, new words, and phrases. I also try to engage in dialogue with learners from multicultural societies, identifying and correcting any significant mistakes and updating my knowledge with current information.

The thematic analysis of the replies yields 1 theme (assisting tool) and 38 sub-themes, the most popular of them being 'formal education/study' (3 mentions by 3 interviewees), 'watching' (3 mentions by 3 interviewees), 'practice' (3 mentions by 3 interviewees), 'book' (2 mentions by 2 interviewees), 'listening tasks/listening stories' (2 mentions by 2 interviewees), 'material' (2 mentions by 2interviewees), 'read/reading" (2 mentions by 2 interviewees), 'multicultural' (2 mentions by 2 interviewees, 'speaking practice/speak' (2 mentions by 2 interviewees), and 'communication" (2 mentions by 2 interviewees).

Analyzing the responses, it is possible to confirm the existence of a sufficient number of tools that help students achieve their goals, including books, articles, journals, video and audio materials, and learning apps. Learning by heart, practicing speaking in front of a mirror, and being familiar with the materials in original English are some additional methods used by the respondents during their EFL journey. The component that united all the responses was the experience of living in a multicultural society, outlining its beneficial effects on EFL learning. Therefore, gaining experience in a multicultural setting and communicating with native English speakers, as well as others, are determining components of EFL learning.

To summarize, immersing EFL learners in a multicultural environment has a significant impact on learning outcomes, mainly through English practice and communication. Getting experience through the abovementioned techniques directly impacts not only learning outcomes but also students' future careers.

Quantitative Research Findings

The first question asked participants to rate how communication with English native speakers affects EFL learning using a 5-point Likert scale, ranging from 1 (the lowest) to 5 (the highest) points. For 3.3 % of the respondents, communication with English native speakers did not affect English language acquisition in any way, 3,3 %view it at the medium level, 30% mentioned quite a strong influence of communication with English native speakers on EFL learning, and 63.3% stated the direct influence of communication with English native speakers on EFL learning.

Table 3. Effect of Communication with English Native Speakers on EFL Learning

Answers (percentage and number)					Measure of central			Dispersion	Distribution	
1	2	3	4	5	mean	median	mode	St. Deviation	Skewness	Kurtosis
3.3%	0	3.3%	30%	63.3%	4.5	5.0	5.0	0.86	-2.64	8.77

The mean, median, and mode are close to each other. The standard deviation is 0,86 (<1). Skewness is –2,64 (between -3 and 3), and kurtosis is 8.77 (>3, meaning that the preponderance of high responses occurs here). Overall, we deal with a normal distribution, and our results are reliable.

The second question aimed to measure agreement with the statement that gaining experience from peers during intercultural EFL learning is an excellent idea. According to the results, 3.3% of respondents rated this statement neutrally. 26.7% agreed, and 70% strongly agreed, indicating that 96.7% of respondents agree or strongly agree with the allegation, which suggests a high consensus that learning from peers in intercultural EFL contexts is beneficial.

Table 4. Impact of getting Experience from Peers on Successful EFL Learning

Answers (percentage and number)					Measure of central			Dispersion	Distribution	
1	2	3	4	5	mean	median	mode	St. Deviation	Skewness	Kurtosis
0%	0%	3.3%	26.7%	70%	4.6	5.0	5.0	0.5	-1.4	1.2

The mean, median, and mode are close to each other. The standard deviation is 0.5 (<1). The skewness is -1.4, and the kurtosis is -1.2 (both are within the range of -3 to 3). Therefore, we are dealing with a normal distribution, and our results are therefore reliable.

The third question was posed to respondents to gauge their agreement with the statement that being immersed in a multicultural environment is essential for successful English as a Foreign Language (EFL) learning. Consequently, 13.3% of the respondents strongly disagreed with the statement, and 26.7% disagreed, indicating that being involved in a diverse environment to learn English as a foreign language (EFL) is not considered important. 13.3% maintained a neutral position, 33.3% agreed, and 13.3% strongly agreed with the mentioned statement. Correspondingly, based on the responses we received, we can state that being immersed in a multicultural environment is crucial for learning English as a foreign language (EFL) successfully. The results mirror heterogeneous perspectives, with no overwhelming consensus. Some EFL learners value multicultural immersion, while others do not consider it essential to EFL success.

Table 5. Significance of being Involved in A Multicultural Habitat for Successful EFL Acquisition

Answers (percentage and number)					Measure of central			Dispersion	Distribution	
1	2	3	4	5	mean	median	mode	St. Deviation	Skewness	Kurtosis
13.3%	26.7%	13.3%	33.3%	13.3%	3.1	3.0	4.0	1.31	-0.1	-1.2

The mean, median, and mode are close to each other. The standard deviation is 1.31(>1), meaning that the results much more different are from the mean). Skewness equals -0.1, and kurtosis is – 1.2 (both are within the range of -3 to 3), which connotes that we deal with a normal distribution and our results are reliable.

The fourth question was given to respondents to confirm or reject the statement that independent learning is an excellent way to attach EFL learning results. 10 % of the respondents strongly disagreed, meaning that they preferred supported or guided learning. 40% disagreed with autonomy-only learning. 33.3% stated a neutral position, meaning that they appreciate both independent and supported learning. 10% agreed, indicating that they advocate for independent learning, and 6.7% strongly agreed, signifying strong support and acceptance of self-learning. Based on responses, a sufficient number of respondents disagree with the statement that autonomy learning is the best approach to language learning. As 10% strongly disagreed and 40% disagreed, we can infer that the majority recognize the significance of guidance and external support.

Table 6. Language learning Without External Support

| Answers (percentage and number) | | | | | Measure of central | | | Dispersion | Distribution | |
1	2	3	4	5	mean	median	mode	St. Deviation	Skewness	Kurtosis
10%	40%	33.3%	10%	6.7%	2.4	2.0	2.0	0.81	0.2	-0.2

The mean, median, and mode are close to each other. The standard deviation is 0.8 (<1). The skewness is 0.2, and the kurtosis is -0.2 (both are within the range of -3 to 3), indicating that we are dealing with a normal distribution with reliable mean results.

The fifth question was asked based on respondents' perceptions of a multicultural society and its impact on English as a Foreign Language (EFL) learning. The statement was that living in intercultural settings does not influence language acquisition. 13.3% strongly disagreed or rejected the statement, 33.3% disagreed, viewing it as influential, 23.3% expressed a neutral position, 20% agreed, and 10% strongly believed that there is no influence. The results indicate that many respondents believe that intercultural settings do play a role in EFL learning.

Table 7. Impact of multicultural Settings on EFL Acquisition

| Answers (percentage and number) | | | | | Measure of central | | | Dispersion | Distribution | |
1	2	3	4	5	mean	median	mode	St. Deviation	Skewness	Kurtosis
13.3%	33.3%	23.3%	20%	10%	2.8	3.0	2.0	1.24	0.2	-0.82

The mean, median, and mode are close to each other. The standard deviation is -1.24, indicating that the results differ significantly from the mean. The skewness is 0.2, and the kurtosis is -0.921, which falls within the range of -3 to 3. Therefore, we deal with a normal curve with reliable mean results.

Discussion

The quantitative and qualitative key findings of the current research strongly indicate that immersion in a multicultural environment has a significant positive impact on learning English as a Foreign Language. The findings align with a previous study by LaScotte and Peters (2021), which states that immersion in a multicultural environment enables EFL learners to practice language skills in real-life contexts. Multicultural environments not only encourage but also enhance students' speaking, listening, and language proficiency. Interaction with native speakers and peers from diverse cultural backgrounds fosters a deeper understanding of culture, enhances communication skills, and broadens cultural awareness. Immersion in an intercultural learning environment enhances students' engagement and positively influences peer communication and relationships, aligning with the study by Abacioglu et al. (2023). The results of Saharani's (2023) study align with those of the current study in terms of the enhanced cultural awareness of learners in multicultural environments. The quantitative data revealed that most respondents viewed communication with native English speakers as highly beneficial for learning English as a Foreign Language. This is consistent with the study that emphasizes the role of native-speaker interaction in enhancing language acquisition (LaScotte & Peters, 2021). The current research highlights the importance of peer interactions in multicultural settings, emphasizing the value of learning from peers' linguistic and cultural experiences for EFL learners. Interestingly, a small percentage of respondents believed that learning English as a foreign language independently, without external support, was preferable. Finally, the current research confirms the necessity of immersing EFL learners in multicultural environments to maximize language learning outcomes. A similar concept is shared in Amiri and El Karfa's (2021) study. The studies by Chaika (2024) and Fantini (2009) confirm that teachers' preparedness deficiency effectively restricts the successful integration of the language learning process into diverse learning environments. Future research should explore strategies to better prepare educators for multicultural classrooms, especially in higher education.

Conclusion

This study aimed to investigate the impact of intercultural environments on learning English as a Foreign Language (EFL) in Georgian HEIs. Based on the study findings, evidence suggests that intercultural language learning settings impact EFL acquisition. Numerous Georgian students share this perspective. The findings corroborate that immersion in culturally diverse environments and communication with native English speakers have a positive influence on language acquisition. The research is based on the view that peer communication in a multicultural atmosphere predominantly fosters the acquisition of experience and knowledge.

Importantly, our results provide evidence to support the assertion that being immersed in culturally diverse environments is extremely important for successful English as a Foreign Language (EFL) acquisition. These findings enhance the comprehension of the importance of immersion in a multicultural environment for successful and thriving EFL learning. The number of respondents limited the current investigation; therefore, further research is urgently needed to understand how the coexistence of diverse cultural groups impacts EFL learning, and it would help us establish a greater degree of accuracy on this matter.

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Georgian Teachers' Attitude Towards Soft Skills Development at Higher Education Institutions

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Abstract: Nowadays, employers are seeking candidates who, besides professional knowledge, possess soft skills. While 'hard skills' are related to more measurable competencies, such as writing, reading, typing, mathematical skills, printing, etc., 'soft skills' are not directly related to the profession, but are associated with values and habits, empathy, communication and many other personal characteristics which humans use regularly. However, they impact success at work, too. The priority of teaching soft skills in tertiary education has increased in the 21st century for students to become successful in the job market, to handle life challenges, and to provide their psychological wellbeing. At higher education institutions, there exist two different soft skills development approaches – parallel and embedded models. The parallel model implies additional courses to the program for the development of soft skills. These activities are: workshops, seminars, research projects, laboratory activities, group work, project work, etc. The embedded approach offers students the development of soft skills integrated into the curriculum. The goal of the study was to reveal what lecturers think about soft skills development at higher education institutions. 64 lecturers participated in an online questionnaire. It was found that the majority of the respondents believe that universities should develop their students' soft skills. Also, more than half of the respondents agree that teaching soft skills should be part of a "hidden curriculum", while almost half prefer soft skills to be taught by somebody else in special courses. According to the respondents, the most important soft skills to be developed at universities are: connecting existing knowledge with new ideas, critical thinking, creativity, problem-solving, honesty and ethics, teamwork and collaboration, and effective communication (oral presentation, discussion, reporting). It was concluded that soft skills should be taught at universities both in parallel and embedded regimes. The study might be useful for education field representatives, as it gives insights into how to connect universities with the job market efficiently.

Key words: Higher Education, Soft Skills, Development, Parallel Model, Embedded Model.

Introduction

The priority of teaching soft skills in tertiary education has increased in the 21st century for students to become successful in the job market, to handle life challenges, and to have psychological wellbeing. Nowadays, employers

are seeking knowledgeable candidates who, besides professional knowledge and skills, possess the so-called soft or transferable skills – the ability to interact effectively and harmoniously with other people in order to achieve success in their work.

At first, when mentioning soft skills, it is worth focusing on the definitions of hard and soft skills and realising the distinctions between them. Hard skills are related to more measurable competencies, such as writing, reading, typing, mathematical skills, printing, etc. (Sá & Sepra, 2022), whereas soft skills are associated with values and habits, empathy, communication and many other personal characteristics which humans use regularly.

The Nobel laureate in economics James J. Heckman (Hechman & Krautz, 2012) defines soft skills as personality traits, goals, motivations and preferences that nowadays have value in the job market, schools, and many other spheres of life. Heckman finds a cause-effect correlation between soft skills and the prediction of success in life and personal achievements. Another author, Robles (2012), also emphasises that soft skills are intangible, non-technical, personality-specific skills that define a leader, facilitator, mentor, negotiator, and mediator. According to Verma (2019), soft skills are related to emotional intelligence, while hard skills - to intelligence quotient.

Mostly soft skills are related to human and social dimensions and imply human personality characteristics, behavior, and interactions. Andrews and Higson (2010) conducted research in four European countries in order to name a list of soft skills which is crucial for employment. According to them, individuals must attain several personality characteristics and soft skills to become successful in the job market – the ability to cope with uncertain situations, to communicate, and to interact with others, written and oral verbal communication, creativity, and self-confidence.

The importance of developing soft skills is defined by the fact that employers are looking for candidates who possess strong interpersonal skills. Employers emphasise the importance and value of teaching university students' soft skills. Nowadays, executives complain that job candidates do not have soft skills and this gap should be addressed by the educational field. The survey by Robles (2012) included 400 leaders of American corporations and 70% of the respondents indicated that job candidates lack professionalism and work ethics.

The novelty of the study deals with the fact that teaching soft skills at Georgian higher education institutions has been little investigated. In particular, the issue whether they should be developed with the help of a parallel or embedded model. How soft skills are integrated in the educational system, what the attitudes of teachers using these methods are, what the results of teaching them are and to what degree the two approaches are effective should be evaluated. The article tries to fill the gap in line with teachers' opinions.

Literature Review

The pioneering studies with regards to soft skills were conducted in the nineties by the World Health Organization (1996), which identified the following life skills: decision-making, problem-solving, creative and critical thinking, communication and interpersonal skills, self-awareness, empathy, and coping with emotions and stress. After a few years, a program was launched by the Swiss Federal Statistical Office, with OECD support (Salganik et al., 1999).

Soft skills were divided into interacting with different groups – the ability to relate well to others, cooperate and manage, and resolve conflicts. Also acting autonomously was named which includes such competencies as forming and conducting life plans and personal projects, defending one's rights, interests, and the need for autonomy.

There exist several answers to why soft skills are so important in higher education. First of all, the modern market demands competitiveness from job seekers and soft skills are crucial for employment. Moreover, soft skills shape university graduates' personalities and are critical for tackling everyday life challenges (Schulz, 2008). Soft skills are important for career progression and development – it is essential to develop soft skills to find a job and maintain or upgrade one's position at work. Modern workforce has become interpersonal, nowadays not only hard skills but also soft skills matter, especially communication skills which are needed while interacting with different people and teams. Soft skills are demanded from customers and recruiters (Chavan, 2018).

Mostly soft skills are related to human and social dimensions and imply human personality characteristics, behaviour, and interactions. Andrews and Higson (2010) conducted research in four European countries in order to name a list of soft skills which is crucial for employment. According to them, individuals must attain several personality characteristics and soft skills to become successful in the job market – the ability to cope with uncertain situations, the skill of communication and interaction with others, written and oral communication, creativity and self-confidence.

In different countries, in political, journalistic and popular scientific discourses there exists different terminology regarding soft skills. In the United Kingdom, are applied the terms 'life skills', 'core skills' and 'key skills', while in Australia and New Zealand, the terms 'employability skills', and 'generic skills' are used. The term 'life skills' emphasises the fact that these skills are used continuously, during life (Cratty & Noble, 2022). According to Lawson (2022), the term 'core skills' was introduced in the Core Skills Project of 1982 to 1985 which developed a list of 103 skills needed to be employed. The Centre for International Research on Education Systems reviewed the skills required by Australian employers, policy-makers and researchers and tried to define the most important of them, providing a list including critical thinking, creativity, metacognition, problem-solving, collaboration, motivation, self-efficacy, conscientiousness, and perseverance (Lamb et al., 2017). Pool and Sewell (2007) conducted a study of the generic skills which are important to enter the job market and get employed successfully. These soft skills involve imagination-creativity, adaptability-flexibility, willingness to learn, learner autonomy, teamwork, ability to manage others, ability to work under pressure, effective oral and written communication, attention to detail, time management, sense of responsibility, decision-making skills, planning, coordination and organisational skills. Then Pool and Sewell added entrepreneurship skills – the ability to create a profitable business.

The Council for the Advancement of Standards in Higher Education (Mitstifer, 2012) categorised specific skills into six large categories: knowledge acquisition, cognitive complexity, intrapersonal development, interpersonal development, civic engagement, and personal competence. Knowledge acquisition, construction, integration, and application are underscored in the document. They include understanding knowledge from a range of disciplines, connecting existing knowledge to other knowledge, ideas and experiences, constructing knowledge, and relating knowledge to daily life skills. Cognitive complexity as a category implies critical and reflective thinking, effective reasoning, and creativity skills. Another soft skills field is interpersonal development: realistic self-appraisal, self-

understanding, and self-respect, identity development, commitment to ethics and integrity, spiritual awareness, interpersonal competence, interdependence, collaboration, effective leadership skills. The category humanitarianism and civic engagement consist of understanding and the appreciation of cultural and human differences, global perspective, social responsibility, and a sense of civic responsibility skills. Practical competence implies the following soft skills: pursuing goals, communicating effectively, technological competence, managing personal affairs, managing career development, demonstrating professionalism, maintaining health and wellness, and living a purposeful and satisfying life.

The most important skills, according to business owners (Robles, 2012), are integrity, communication, courtesy, responsibility, social skills, positive attitude, professionalism, flexibility, teamwork, and work ethics. The change from an industrial economy to an information society revealed the importance of integrity, communication and flexibility skills. According to Robles (2012), years ago, technical skills, also called hard skills, were crucial for the workplace, while nowadays soft skills are becoming essential for career success. As soft skills are critically important for productive performance, business leaders are emphasising that they should be taught. While technical skills are a part of many excellent educational curricula, soft skills need more attention to be included in university curricula. This also proves the important role of soft skills in the modern workplace world and the need to reform the educational system (Robles, 2012).

According to the study by Goldberg and Rosenfeld (2014), there exist 7 major soft skills: communication, conflict resolution and negotiation, adaptability, creativity, problem-solving, work ethic, and time management. The Malaysian Institute of Higher Learning defines soft skills as combining aspects of generic skills such as non-academic skills such as communication, critical thinking, problem-solving, teamwork, lifelong learning and information, entrepreneurship, ethics and professional morals, and leadership (Ngang et al., 2015).

In the higher education field, there exists a concern about the ways to develop soft skills at universities. The development of soft skills at universities ensures the psychological preparedness and wellbeing of students. At higher education institutions, two different soft skills development approaches are applied – parallel and embedded models. The parallel model implies additional courses to the program for the development of soft skills. These activities are: workshops, seminars, research projects, laboratory activities, group work, project work, etc. The second model, the embedded approach, offers students soft skills teaching that is integrated into the curriculum so that soft skills cannot be separated from the processes of acquiring knowledge. The methods supporting the development of soft skills are different, for example, teachers' support, students' autonomy, coaching, tutoring, discussions, debate, cooperative learning, and solving open-ended problems (Cinque et al., 2023). Ragland et al. (2024) call the embedded model a 'hidden curriculum' which does not overtly state the goal of soft skills development, however, it implies such tasks as presentations, projects, etc. that require soft skills.

Russel et al. (2005) mention that the majority of universities do not integrate soft skills into their curriculums. This especially concerned technical and natural science programs. On the other hand, according to Russel and his co-authors, an industry would prefer a graduate with communication and teaming skills demonstrated in the process of interview to a graduate with high academic scores. In information systems curricula they did not discover either

special courses designed to develop soft skills or syllabi which integrated hard and soft skills development – only two out of 5760 hours of classes were dedicated to "mock interviews, stand up presentations, or panel discussions" (Russel et al., 2005, p. 4). This is why they developed a course which aimed at conducting mock data collection and interviews, teamwork, choosing a team leader, proposal presentation for the project (in their specialty), a final demonstration of project results, communication skills (asking open-ended, close-ended and probing questions; using body language and eye contact, and positive rapport with the audience), ability to solve conflicts arising in teams, and organising the project (functions distribution in the team, monitoring the process). While the project dealt with their profession and developed students' hard skills, the assessment of the course results included also the soft skills demonstrated during the project). Role play was applied to develop communication skills. The course revealed that students were happy with it and they more easily were employed than students from the same university who did not take such a course.

To sum up, the operational definition of the soft skills essential in higher education applied in this paper is as follows: soft skills are the skills not related directly to the particular future profession of students but useful in both their professional and personal lives. They involve the skills dealing with knowledge acquisition, construction, integration, and application, cognitive skills, intrapersonal and interpersonal characteristics, social engagement and some practical competencies. They can be measured with self-assessment questionnaires, with the help of teacher observation, and some psychometric tests.

Method

The survey was conducted with higher education institution (HEI) teachers: a questionnaire was placed on social media with a request to fill out and share. It was online for 10 days, and any Georgian HEI teachers who were interested in the research could participate. 64 teachers participated in the online study. The questionnaire in the 5-point Likert scale format included the following items:

- I agree that soft skills should be purposefully developed at university.
- The development of soft skills will help university graduates be employed, maintain their positions and develop their careers further.
- The development of soft skills will help university students and graduates in their personal lives.
- I support the parallel model of soft skills development (offering special courses for the development of soft skills) at universities.
- I support the embedded model of soft skills development (when the teaching of soft skills is integrated into the curriculum/syllabi)
- Which soft skills are important to your mind.

Results

64 HEI lecturers participated in the online survey. The study results revealed that 73, 5% of the lecturers think that soft skills should be taught purposefully at university. Probably, the lecturers who gave negative or neutral answers

need more information on the role of soft skills in increasing the quality of students' preparedness for future lives (to be sure, additional research is needed).

Also, the majority of the respondents, 76.6% answered that soft skills will help alumni to be employed, maintain their jobs and develop their careers in the future, while 15.6% answered negatively, and 4.7% neutrally. The same comment is relevant in this case as well.

Moreover, the majority of the respondents, 75% said that soft skills will help alumni in their private lives, while 12.5% answered negatively, and 6.3% neutrally. The same comment is relevant in this case as well. 53.1% of the respondents believe that a better way to develop soft skills is a parallel model - providing special course(s) for their development (10.9% were against its application) and 62.6% of the respondents prefer the embedded model, according to which the development of soft skills should be included in curriculum and syllabuses as a part of a "hidden curriculum" (7.8% were against its application). Therefore, both models were supported by many respondents, however, the embedded model was preferable.

Lecturers named the most important skills such as: critical thinking – 80.2%, cooperation and team work - 69,4%, protection of ethical norms/honesty - 69,4%, problem solving - 62,9%, relating new knowledge to existing knowledge, skills and experience - 61,3%, empathy - 61,3%, effective communication (presentations, debates, reporting) - 56,5%.

Discussion

The paper represents that the higher education system should have an important role in bridging students with employers. Also, the soft skills development at universities raises the chances of students to get employed, tackle life challenges effectively and have psychological wellbeing. According to the study, the lecturers support teaching soft skills at universities and they think that both parallel and embedded models should be used to develop soft skills in higher education.

Other studies (Andrews & Higson, 2010; Ngang et al., 2015; Ragland et al., 2024) conducted with university academic staff imply that soft skills development is crucial for students for their employment. They are in line with our study stating that soft skills should be taught, it should be included in curriculum as selective courses and/or be part of hidden curriculum. The big picture of the topic is that soft skills development have a great importance for employment, as employers are seeking candidates who possess soft skills, and higher education should be actively involved in the process of their development.

The study has its limitations, as it was conducted with few respondents, moreover, it covered only Georgia. Also, it would be beneficial for the development of the topic to conduct some qualitative and quantitative research with lecturers, students, program heads, university administration and employers. Filling these parts would be beneficial to see a bigger picture of the theme. Our study is an effective starting point for further study of soft skills development at universities.

Conclusion

In conclusion, it can be said that the majority of the respondents think that universities should develop their students' soft skills. They view soft skills as important for both students' further careers and private lives. Also, more respondents agree that teaching soft skills should be part of a 'hidden curriculum', while quite many of them prefer soft skills to be taught by somebody else in special courses. Therefore, pursuing a mixed approach seems to be the best outcome: providing an elective (or extra-curricular) course for students who feel that they could not sufficiently develop soft skills in the process of university education and trying to persuade lecturers to purposefully develop some soft skills within their courses. This, in turn, requires teacher training explaining what soft skills are, why they are needed, and how they can be developed.

The tertiary education system should serve as the bridge between students and employers, so it is crucial to teach students soft skills which are so demanded by employers. Teaching and developing soft skills at universities will fill the existing gap between students' employment and demands from employers. This innovative approach will also benefit the students' psychological wellbeing, as developing different soft skills will give students more self-confidence and self-esteem.

Recommendations

According to studies conducted regarding soft skills development, the first recommendation could be to improve soft skills development evaluation process. Secondly, it would be more effective if universities used both models of soft skills development (parallel and embedded).

It would be more efficient to have a global, as well as country approach regulated by the related organisations, for example, the Ministry of Education. Thirdly, it could be recommended that university teachers are trained in the development of soft skills, in the ways they integrate this component in their teaching process. Considering these recommendations would bring the educational system more in line with employers' needs and bridge the gap between higher education and employment.

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Determinants Of Academic Success Among Students With Special Educational Needs In Higher Education

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Abstract: The aim of this study is to present the findings of research focused on identifying and describing the determinants influencing the academic success of students with special educational needs during their higher education. In contemporary educational discourse, increasing emphasis is placed on inclusive education and equalizing opportunities between the general student population and individuals with disabilities by eliminating barriers through targeted support. From a theoretical perspective, the authors analyze various factors that may affect the educational outcomes of students with special educational needs. The empirical section of the study presents research results confirming that each identified determinant can impact academic success and student progress to varying degrees. These factors may include the type and degree of disability, health condition, treatment or rehabilitation methods, digital competencies, availability of assistance and support services, and the implementation of adequate institutional measures. Based on the collected data, the authors suggest specific recommendations for higher education institutions to improve conditions for students with disabilities. These recommendations focus on implementing inclusive strategies and specialized programs designed to foster their academic and personal development. The findings of this research are not only relevant to university educators but also to professionals involved in supporting students with disabilities and addressing issues of educational equity.

Keywords: Special Educational Needs, Higher Education, Determinants of Academic Success.

Introduction

Currently, increasing emphasis is being placed on inclusive education and the equalization of opportunities between the general population and individuals with disabilities through the use of various strategies, the elimination of barriers, and the provision of targeted special education, psychological, social, and other forms of support. However, inclusive education is accompanied by a number of determinants that either positively or negatively influence the outcomes of higher education for students with specific needs (Brewer, 2022; Zenelaga et al., 2024). Each of these determinants may affect a student's academic success and progress to varying degrees and intensities.

In some cases, a single significant factor may influence the course of study, while in others, multiple factors may act simultaneously in a multifactorial manner (e.g., type and degree of disability, student's health condition, treatment or rehabilitation methods, level of digital literacy, availability of assistance or support, reasonable accommodations, etc.).

Determinants Influencing Academic Success of Students

In the following section, we present the most significant determinants that, to varying extents, impact the educational process and outcomes for students with disabilities.

Type and Degree of Disability

Each type of disability entails specific educational needs for students. Therefore, it is essential to understand the implications of a disability on a student's functionality and to provide early support and appropriate educational adjustments. A crucial role is played by the strategies employed by educators during the teaching process, particularly in connection with their pedagogical tact and competence.

Mental and Physical Health of Students

Disabilities often bring about additional complications that manifest in both the psychological and physical domains of students (Al-Shaer et al., 2024). Mental and physical health, along with the student's emotional disposition, significantly influence their motivation to study, ability to overcome educational and other obstacles, concentration on performance, and more. When a disability is compounded by short- or long-term illness —especially mental illness (Bartz, 2020) — academic progress may be severely jeopardized, possibly leading to interruptions or premature termination of studies.

Motivation

Motivation, particularly intrinsic motivation, plays a key role in the success of every student. For students with disabilities, it may be even more critical. It substantially contributes to perseverance in overcoming challenges, more effective coping with stress and potential frustration, greater engagement in academic activities, a more positive self-image, and the belief that, despite deficits in physical, psychological, communicative, social, or other areas, they can succeed. However, all of this is only possible with appropriate support and an individualized approach from educators.

Self-confidence

Self-confidence, alongside self-esteem and belief in one's own abilities, is one of the most important psychological factors influencing academic success in students with disabilities. A student with adequate self-confidence is capable of constructive communication, engaging in academic discussions, presenting ideas, and participating actively in group work. They can also formulate and ask questions and assertively seek answers. Self-confident students are less

afraid of failure, more independent, and more likely to ask for help when needed. Most importantly, such students are able to openly communicate their needs, visions, self-perception, and future aspirations.

Level of Communication and Use of Alternative Communication Methods

Communication plays a crucial role in all areas of life for students with disabilities, including education. This determinant affects not only social relationships (the ability to initiate and maintain social contacts), but also the educational process (communication with educators, understanding of assignments, discussing educational content, argumentation, presenting independent work, expressing opinions and needs, etc.).

If suitable communication conditions are not ensured—for example, provision of an interpreter, textual and other educational materials, or alternative means of communication—students cannot study effectively, collaborate with peers, or achieve academic success. The use of alternative communication methods (e.g., sign language, pictograms, communication apps, electronic devices) can significantly impact the success of students with disabilities in higher education and their full participation in learning, but only if educators are also proficient in these methods.

Social Factors

Another important determinant in the education of students with disabilities in higher education is the influence of various social factors (Arsyad et al., 2025), such as family and peer support, the student's or their family's financial situation, peer group dynamics and relationships, educators' attitudes and empathy, access to social networks, mentorship opportunities, assistance, buddy support, social counseling, student organizations, the pro-inclusion stance of the institution, as well as the presence of prejudice and discrimination.

Information Accessibility

Information accessibility is one of the determinants that reflects the level of advancement of a society and its inclusiveness towards individuals with disabilities. Access to information - its quality and quantity - is a necessary condition for the academic success of all students (Chien & Wu, 2024). Information accessibility increases the chances of successful study completion, promotes equality of opportunity, contributes to the acquisition of effective learning strategies, and supports the development of competencies necessary for future employment. Ultimately, this enhances the independence and autonomy of students with disabilities.

Digital and Assistive Technologies

Digital and assistive technologies are essential tools for improving opportunities in inclusive education and are an integral part of the educational experience for students with disabilities in higher education. These technologies provide students with means and tools to eliminate or reduce barriers in education (Sánchez et al., 2024). Through digital or assistive technologies, students gain access to necessary educational materials, can share lecture

notes, seminar papers, experiences, and information. They also enable students to communicate and share successes or challenges. Assistive technologies help overcome sensory, physical, or communication deficits and barriers (McNicholl et al., 2020). Common tools include screen magnifiers, screen readers, voice recognition software, scanners with voice output and OCR technology, Braille displays, Braille printers, and many others.

In addition to the determinants mentioned above, the process of higher education is influenced by numerous other factors, including socio-political determinants. These encompass, for instance, societal attitudes and opinions, the legislative framework of the country, the amount of financial resources available both to students and higher education institutions, public policies, internal institutional systems, the university's index of inclusion, the quality of academic programs and student support services, among others.

Method

Determinants Influencing the Academic Success of Students with Disabilities at the Faculty of Education, Comenius University in Bratislava – Selected Findings from Empirical Research

In November 2024, we conducted a study at the Faculty of Education, Comenius University in Bratislava, aimed at identifying and describing the determinants that influence the academic success of students with specific needs during their higher education studies. A total of 24 students with disabilities were invited to participate—8 students enrolled in part-time programs and 16 in full-time programs. Of these, 10 students responded positively and completed an electronic questionnaire administered via MS Forms.

The questionnaire consisted of semi-closed questions, where students could choose one or more responses, and open-ended questions allowing students to provide unrestricted answers. Additionally, the questionnaire included items based on Likert scales, where students indicated their level of agreement or disagreement with given statements, or evaluated specific phenomena and processes related to their university experience.

Results

On a scale from 1 to 5, students were asked to indicate the level of their mental health during their studies at university (see Figure 1.). Two students rated their mental health as excellent, three as very good, and four as good. One student rated their mental health as very poor.

Figure 1. Mental health of Students with Disabilities

In terms of physical health, the results were slightly less favorable. Two students rated their physical health as excellent, another two as very good, four students as good, and two as poor (see Figure 2.).
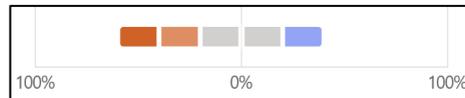
Figure 2. Physical Health of Students with Disabilities

Emotional support from family, close persons, or friends was rated as excellent by one student, very good by four students, and good by five students (see Figure 3.).
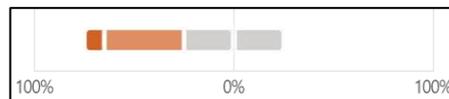
Figure 3. Emotional Well-Being of students with Disabilities

When it comes to social relationships (see Figure 4.), six students with disabilities evaluated their social relationships as excellent, one as very good, two as good, and one as poor.
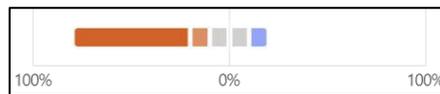
Figure 4. Social Relationships of Students with disabilities

In line with inclusive university policies and internal quality assurance systems, students with disabilities should be beneficiaries of adequate support services and reasonable accommodations, such as the services of a coordinator, assistance from academic offices, teaching staff, and other professionals. According to our findings, five students who have been granted support measures expressed a high level of satisfaction with the support provided. Two students reported being somewhat satisfied, two rated the support as average, and one student rated the support as very weak (see Figure 5).
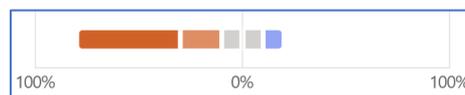
Figure 5. Support Services for Students with Disabilities

We also asked students what types of support would help improve their well-being during their studies. The responses varied (see Figure 6.). The most frequently mentioned forms of support included psychological support and communication or emotional support. Students also identified academic support, social support, and spiritual support as beneficial. Finally, support related to sports and cultural activities was also considered significant.

For students with disabilities, the sense of well-being is an important factor for their academic success at university. The interviewed students indicated that their academic well-being is most positively influenced by clear instructions and assignment guidelines; proactive peers; an individualized approach from teachers and understanding of students'

special educational needs; a positive classroom atmosphere; support from the Center for Students with Specific Needs; caring, kind, and humorous classmates; and a friendly atmosphere during classes.
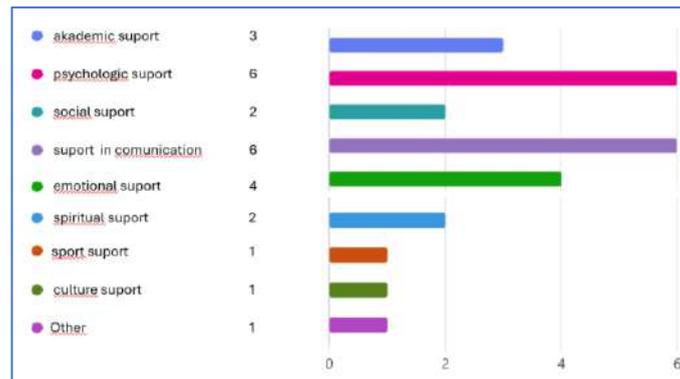
Figure 6. Types of Support Needed to Enhance Student Well-Being

Conversely, their sense of well-being is negatively affected by the high volume of continuous assessments and assignments required for course evaluation; the fast pace of lectures; the overall workload and number of subjects; as well as delayed delivery of study materials by lecturers.

University studies represent a particularly demanding period. Students are expected to demonstrate sufficient resilience and the ability to cope with stress and challenging situations. When asked how they deal with stress and difficulties during their studies, the students responded as follows:

- With great difficulty, I push myself beyond my limits to meet expectations.
- Talking with friends;
- Use of medication;
- Breaking down complex assignments into simpler tasks and scheduling their completion;
- Evening relaxation and conversations with classmates;
- Prayer;
- Practicing mental hygiene;
- Using concept maps.

Students also derive a sense of well-being from engaging in various leisure activities such as dancing, reading, sport shooting, spending time with friends or partners, painting, sports, family time, wandering through the city and discovering new cafés, playing video games, going to the cinema, watching movies, listening to music, daydreaming, prayer, watching interesting videos or series, assembling miniatures, spending time with family and pets, going on trips, playing board games, among others.

The time devoted to these activities varies among students (see Figure 7.). Five students engage in leisure activities 2–3 times per week, three students every day. However, one student participates only once per week, and one less than once per month.
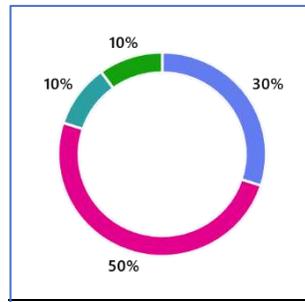
Figure 7. Perceived Well-Being During Studies

As previously mentioned, despite the pro-inclusive efforts of higher education institutions, students with disabilities still face numerous barriers during their studies. We asked students to identify which physical, psychological, communicative, informational, social, digital, or other types of barriers they encounter.

The research revealed several problematic areas:

- Physical barriers, such as outdated classroom equipment;
- Social barriers, including difficulties in communication among peers during group assignments and lack of acceptance or tolerance from classmates;
- Communication barriers, especially noisy or distracting environments;
- Informational barriers, such as difficulty understanding course content or being unable to take comprehensive notes;
- The impact of mental health conditions;
- Post-pandemic challenges, including reduced communication and expression skills, impaired critical thinking and problem-solving abilities, loss of time management skills, and deteriorated health.

On the other hand, students acknowledged that most university instructors demonstrate understanding toward their specific needs. They generally perceive the university environment as safe, stimulating, creative, and motivating. Students with disabilities, similar to that reported by Carballo et al. (2022), would recommend to their peers the importance of engaging in a hobby they enjoy, talking to a close friend or family member in times of need, avoiding unnecessary stress, participating in sports, practicing meditation, engaging in self-care, integrating into social groups, and paying attention to sleep quality and duration. Psychologically, they recommend not perceiving their disability as a burden but rather embracing it as part of who they are. They express gratitude for the opportunity to receive individualized support from the faculty. They also emphasize the importance of prioritizing health and maintaining faith that any challenge can be overcome.

Through the questionnaire, students were also asked what they believe contributes to a positive student well-being. The responses were insightful and are presented in full, along with the number of students who expressed each sentiment, in Table 1.

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Table 1. Factors Contributing to Positive Student Well-Being

n5 - Creativity	n3 - Social values	n3 - Self-confidence
n6 - Problem solving	n5 - Social relations	n4 - Healthy lifestyle
n5 - Critical thinking skills	n3 - Relationship with spouse	n7 - Sleep
n4 – Feeling satisfied with your knowledge and skills	n6 - Relations with relatives	n3 - Ability to cope with negativity emotional situations
n6 - way of processing	n3 - Good communication skills	n3 - Mental health
n4 - attitudes and ethical principles	n3 - Interpersonal relationships	n2 - Healthy eating
n3 - Traditions	n7 - Empathy	n6 - Physical activity
n7 - Intrinsic motivation		n4 - Value beliefs

Negative Determinants of Student Wellbeing and Related Findings

Conversely, students with disabilities most frequently identified the following negative determinants of wellbeing: economic situation (n=2), surrounding environment (n=3), information overload (n=4), digital overload (n=2), poor interpersonal relationships (n=3), peer prejudice (n=5), lack of interest from lecturers (n=5), environmental stressors (n=6), personal limitations and constraints (n=6), dietary habits (n=2), mental health issues (n=4), irregular sleep patterns (n=2), lifestyle (n=2), lack of self-confidence (n=4), difficulties in managing emotionally demanding situations (n=7), lack of motivation (n=3), family relationships (n=2), social relationships in general (n=4), and societal values (n=2).

The subsequent questions in the study specifically aimed to identify the factors contributing to students' satisfaction or dissatisfaction and their wellbeing during their academic studies. Factors positively influencing wellbeing included the opportunity to talk to someone when facing difficulties, the possibility to rest between lectures, the ability to negotiate extended time for assessments, access to enjoyable sports activities, and engagement with young, motivational, and practically oriented lecturers who provide sufficient study materials. Students also appreciated the provision of accommodation by the university and valued the supportive and individualized approach of faculty members. One female student expressed enthusiasm regarding her university experience, noting that she had not encountered any negative attitudes from academic or support staff and felt fully supported throughout her studies.
On the other hand, dissatisfaction was most commonly linked to time-related stress, strictness of faculty members, excessive academic workload, high expectations from some teachers, personal limitations, mental health challenges, lack of self-confidence, and decreased motivation, among other factors.

At the conclusion of the questionnaire, students were asked what would improve their wellbeing during their academic journey. Responses highlighted the importance of lecturers understanding the fluctuating nature of students' health conditions, focusing more on the development of practical skills rather than merely theoretical knowledge, demonstrating respect, using appropriate and inclusive communication or alternative communication formats, and ensuring students have access to learning materials and educational opportunities.

Discussion

In this paper, we presented the key findings of our empirical investigation aimed at identifying and describing the determinants that influence the academic success of students with specific needs in higher education. Our results indicate that the wellbeing of students with disabilities is significantly shaped by a variety of internal and external factors, which may either support or hinder their academic achievement. Although the majority of respondents reported their health status as satisfactory, experience suggests the necessity of providing systematic psychological support that reflects individual needs and allows for early detection of warning signs such as burnout, diminished motivation, decreased self-esteem, and other psychosocial challenges that could deteriorate students' physical or mental health.

Social relationships within the university setting were perceived very positively—most students rated them as excellent. This highlights the potential of the academic environment to serve as a protective factor for wellbeing, particularly when educators and peers demonstrate empathy and support. In line with the principles of inclusive education, the provision of support services emerged as a crucial component. Students who received and utilized support measures expressed high levels of satisfaction, indicating that these mechanisms are largely effective. However, the fact that some students assessed the support as average to very poor suggests potential gaps in faculty preparedness—for instance, a lack of knowledge regarding specific strategies, unfamiliarity with alternative forms of communication, or insufficient proficiency in using digital and assistive technologies. This points to a pressing need for systematic monitoring of the quality and accessibility of support services, as well as the implementation of targeted professional development for educators focused on inclusive pedagogical strategies and effective engagement with students with disabilities.

Students with disabilities identified key positive determinants of wellbeing at university, including quality sleep, physical activity, engagement in leisure activities, high intrinsic motivation, empathy, and strong social relationships. In contrast, negative influences on wellbeing included stress, prejudice, financial insecurity, lack of engagement from educators, and information overload. The findings of this study suggest that positive experiences among students with disabilities are shaped not only by personal characteristics but primarily by the quality of the academic and social environment, which can either foster or undermine their wellbeing. Therefore, an inclusive university must strive to create conditions that are not merely outlined in policy documents but are genuinely embedded into daily academic practice. We argue that both positive and negative determinants identified in this research should serve as foundational elements for developing institutional policies, strategies, and objectives aimed at supporting inclusive education for students with disabilities.

Conclusion

Based on empirical data from recent scientific studies (e.g., Al-Shaer et al., 2024; Kuriakose & Amaresha, 2023) and selected findings from research conducted at the Faculty of Education, Comenius University in Bratislava, we can conclude that the academic success of students with disabilities is conditioned by a wide array of determinants. These comprise complex and often interconnected factors that significantly influence students' academic progression, study

experience, and subjective wellbeing in the academic environment (AlTaleb et al., 2024). The type and degree of disability are key determinants that define an individual's specific needs and the necessity for timely, personalized educational approaches. Motivation—particularly intrinsic motivation—emerges as a crucial mechanism for overcoming barriers and sustaining engagement in studies. Likewise, self-confidence, self-esteem, and self-efficacy play a vital role in students' ability to actively participate in learning and to communicate their needs openly.

Another significant determinant is communicative competence, including access to alternative modes of communication. Without appropriate conditions for communication, a student may be substantially limited in their academic participation and success. Social environment, socio-economic factors, and information accessibility also play an important role. Digital and assistive technologies provide practical tools that help eliminate barriers and foster autonomy and social inclusion for students with disabilities.

Our empirical findings underscore the necessity for consistent application of individual approaches and personalized support, which are essential for improving the quality of inclusive higher education. Furthermore, it is vital to address not only the specific needs of students but also systemic changes within institutions - this includes legislation and the inclusive design of internal educational systems. We believe that the findings of our research will not only enrich the field of special and inclusive education but will also contribute to the development of pro-inclusive higher education environments. Moreover, these findings aim to support the creation of conditions that positively influence the well-being of students with disabilities in tertiary education.

Recommendations

- Establish a functional system for identifying students' mental health concerns, for example, through the use of anonymous surveys conducted during the semester.
- Enhance the availability of psychological services, including opportunities for individual counseling sessions.
- Provide professional development for academic staff focused on inclusive educational practices and understanding the specific needs of students with disabilities.
- Ensure the accessibility of study materials in alternative and user-friendly formats.
- Initiate the formation of peer support groups for students with disabilities.
- Systematically eliminate barriers within the higher education environment.

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Application of UDL Principles in the Akaki Tsereteli State University Child Rights Course

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Abstract: A significant paradigm in education, Universal Design for Learning (UDL) focuses on building inclusive and productive learning environments for all students. UDL principles give educators a flexible approach to curriculum design, instructional practices, and assessment methodologies since they are based on the awareness of various learning requirements. The incorporation of UDL is especially essential at Akaki Tsereteli State University, where a focus on child rights adds a distinct dimension to the application of these principles, as education continues to change. Four essential elements of the ATSU Child Rights syllabus—goals, objectives, materials, and assessment—with related UDL principles are addressed in the presented paper. Since child rights education is intrinsically multidisciplinary, developing curricula that suit a wide range of learners requires careful consideration.

Keywords: Universal Design for Learning, Teacher Preparation Syllabus. Child Rights

Introduction

Using recent research about how people learn, the Universal Design for Learning (UDL) framework aims to improve and maximize the teaching and learning process for every individual. A growing understanding of the significance of inclusive pedagogical approaches is shown in the amount of research conducted on the integration of Universal Design for Learning (UDL) principles in educational environments. The presented article aims to bridge the gap in knowledge by examining the implementation of UDL concepts in the context of the Akaki Tsereteli State University Child Rights Syllabus. The intersection of UDL and child rights education is a relatively new topic of investigation. Utilizing knowledge from foundational works, the study seeks to offer a nuanced comprehension of how UDL might improve the inclusion and effectiveness of child rights education.

In Georgia, we recognize the crucial role of quality education in fostering a thriving democracy, lifelong learning, and a dynamic economy. To meet its purpose of providing all students with an excellent education, the ATSU Pedagogical Faculty must implement innovative methods for teacher preparation. Educators must also dedicate their

careers to ongoing professional development if they are to foster a creative learning environment for upcoming generations.

The Child Rights syllabus at ATSU was created and put into place with substantial support from UNICEF Georgia. The procedure comprised preparing Child Rights educators through a comprehensive six-month professional development course. Furthermore, there was a careful collaboration on the syllabus with experts from a range of fields, including educators, psychologists, lawyers, public servants, media representatives, and others.

Literature Review

Noteworthy contributions to this field include the seminal work of Rose and Meyer (2002), who laid the foundation for UDL by emphasizing the need for flexible instructional practices that cater to diverse learner needs. Their book, "Teaching Every Student in the Digital Age: Universal Design for Learning" serves as a fundamental reference in understanding the core principles of UDL. They emphasize the fact, that achieving the same high standard of learning "would be much easier for students if you could quickly and easily customize lesson plans and curriculum materials to each student's needs, interests, and skills level".

Studies have shown that applying UDL principles can improve educational outcomes in both K–12 and higher education settings. For example, Katz (2013) demonstrated that the Three-Block Model of UDL implementation led to increased engagement and academic success among students in inclusive classrooms in Canada. Similarly, in a study conducted by Rao, Ok, and Bryant (2014), postsecondary instructors reported that integrating UDL strategies helped better meet the needs of students with disabilities while also benefiting the general student population.

In the context of teacher education, Spooner et al. (2007) found that preservice teachers trained in UDL principles were more effective in designing lesson plans that accommodated diverse learning needs. This suggests that embedding UDL into teacher preparation curricula—as in the ATSU Child Rights syllabus—has the potential to shape more inclusive and reflective future educators.

Moreover, McGuire-Schwartz and Arndt (2007) highlighted how the application of UDL in higher education led to improvements in student satisfaction and learning efficiency, particularly when faculty adopted accessible technology and flexible assessment methods. Their findings reinforce the role of institutional support and professional development in sustaining successful UDL adoption.

Additionally, the UDL Guidelines, developed by the Center for Applied Special Technology (CAST), provide a comprehensive framework for educators to apply UDL principles in practice. These guidelines, encompassing multiple means of representation, engagement, and expression, have become instrumental in shaping UDL implementation across various educational contexts (CAST, 2018).

The UDL Guidelines serve as a valuable resource for educators, curriculum developers, researchers, parents, and anyone seeking to integrate the UDL framework into various learning environments. These guidelines provide

specific recommendations applicable to any subject or field, ensuring that all learners have access to and can engage in meaningful and challenging learning experiences.

The first UDL principle is *Engagemen*t, the "why" of learning. Emotions play a crucial role in the learning process, and individuals exhibit diverse preferences for engagement and motivation. Recognizing the diversity of learners, it is essential to acknowledge that there is no universal approach to engagement suitable for all learners in every context; thus, providing multiple options for engagement becomes imperative.

The second principle involves offering diverse means of *Representation,* addressing the "What" of learning. Individuals vary in how they perceive and grasp presented information. Utilizing multiple representations in learning and transfer enhances the process, facilitating connections within and between concepts. In essence, no single method of representation is universally optimal for all learners; hence, the provision of options for representation is crucial.

The third principle emphasizes the provision of multiple means of *Action and Expression*, focusing on the "How" of learning. Learners exhibit differences in navigating a learning environment and expressing their understanding. In practice, there is no one-size-fits-all approach for action and expression that suits every learner; thus, offering alternatives for action and expression becomes imperative.

Research by Edyburn (2010) delves into the application of UDL principles, emphasizing the need for aligning instructional methods with diverse learning preferences and the significance of technology in facilitating UDL. His work, particularly the article "Would You Recognize Universal Design for Learning if You Saw It?" offers insights into the practical aspects of UDL adoption.

Furthermore, studies such as Meyer, Rose, and Gordon's (2014) "Universal Design for Learning: Theory and Practice" provide an in-depth exploration of UDL, discussing its theoretical underpinnings and practical applications. Their work extends beyond the classroom to consider UDL in the broader context of educational policy and systemic change.

Recent studies underscore the strong relationship between Universal Design for Learning (UDL) principles and cognitive development in diverse learners. UDL frameworks, particularly the use of multiple means of engagement, representation, and action/expression, align with cognitive neuroscience research that emphasizes differentiated instruction and the activation of various brain networks. Neuroeducational research shows that when students are provided with options for how they access content (e.g., text, video, hands-on learning), they engage more deeply, retain information better, and make stronger cognitive connections (CAST, 2018). Moreover, embedding choice and autonomy into the learning process increases intrinsic motivation, which in turn enhances executive function and metacognition (Hehir et al., 2016). This is particularly important in complex subjects like child rights education, where critical thinking and ethical reasoning are integral.

Within the specific realm of child rights education, the literature reveals a scarcity of studies explicitly examining the integration of UDL principles. However, the work of Shier (2001) on the Participation Model, emphasizing the active involvement of children in decision-making processes, offers a conceptual foundation for aligning UDL with child

rights education. Shier (2019) suggests that although participation and student voice processes may contribute to the growth of empowerment among students, this can subsequently lead to expressions of protagonismo—an autonomous, student-led mobilization that may be organized independently or with or without adult support and approval.

Methodology

This study employed a qualitative case study approach to analyze the integration of Universal Design for Learning (UDL) principles within the Child Rights syllabus implemented at Akaki Tsereteli State University (ATSU). The research relied on document analysis of the current syllabus, course materials, and student project samples. Additionally, semi-structured interviews were conducted with instructors and course developers who participated in the syllabus design process.

The semi-structured interviews involved five faculty members and two curriculum experts who had directly contributed to the development of the syllabus. These interviews explored participants' perspectives on the rationale for adopting UDL principles, the specific ways these principles were embedded in course content and instructional practices, the challenges encountered during implementation, and the perceived impact on student engagement and learning outcomes. Each interview lasted approximately 45–60 minutes and was audio-recorded with the participants' consent. Thematic analysis was applied to the transcribed interviews to identify recurring patterns and insights relevant to UDL integration. Quotes form interviews were the following:

> "We realized that students learn best when they feel represented and heard. UDL gave us the language and structure to design for that intentionally." *(Instructor 1)*
>
> "UDL helped us think beyond printed materials. We started incorporating podcasts, blogs, and videos to meet learners where they are." *(Course Developer)*
>
> "The diversity in how students chose to complete their assessments surprised us—in a good way. It showed us they were more engaged and thoughtful." *(Instructor 3)*

The researchers used CAST's UDL Guidelines (2018) as an analytical framework to identify the presence and application of UDL principles in four core instructional components: goals, methods, materials, and assessments. The alignment between UDL checkpoints and actual course elements was systematically coded and evaluated for consistency and effectiveness. To ensure validity, triangulation was achieved through the use of multiple data sources (syllabi, instructor feedback, and project evaluations).

This methodological design allowed for an in-depth exploration of how theoretical UDL frameworks are translated into practical pedagogical strategies in a specific teacher preparation context focused on children's rights education.

Child Rights and UDL Principles

We attempted to investigate the main areas of connection between the Akaki Tsereteli State University Child Rights Syllabus and UDL. Since child rights education is intrinsically multidisciplinary, developing curricula that suit a wide range of learners requires careful consideration. According to the research, UDL presents a viable framework for

addressing this issue because it places a strong emphasis on adaptability, customisation, and the availability of several channels for expression, participation, and representation. The syllabus designed with UDL principles presents an excellent chance to assist and guide all new learners, illustrating that there exist various paths for learning and accomplishment within the curriculum.

UDL can be used to address the abilities and concepts indicated in an academic standard in connection to the four lesson components—goals, assessments, methods, and materials, according to Rao and Meo (2016). These common elements, which correspond to the four lesson components—identifying lesson goals and objectives that align to standards (goals), developing instructional strategies (methods), selecting resources and materials (materials), and evaluating student progress and outcomes (assessment)—are typically included in lesson planning processes, regardless of the various formats used.

Creating instructional methods is crucial for offering diverse choices that cater to different learners' needs in terms of perception, understanding, cognitive processing, communication, and involvement. The integration of strategies that inspire and captivate students throughout their learning journey is vital, as it aids in the development of both skills and knowledge among students (ibid.). Once the standard has been unpacked, a specific goal has been articulated, and the assessment methods have been determined, teachers have various ways to incorporate Universal Design for Learning (UDL) into their instructional approaches for a lesson. Several UDL checkpoints offer explicit recommendations for supportive measures that can enhance instruction. Therefore, our analysis of the Child Rights syllabus will prioritize objectives while considering how to apply UDL principles.

Below are four key components (goals, objectives, materials and assessment) of the ATSU Child Rights syllabus along with corresponding UDL considerations. Each component is displayed in a comparative format. The initial column outlines UDL considerations, while the second column provides an example from an ATSU Teacher Preparation Program Child Rights class.

Table 1. UDL Syllabus components and ATSU Child Rights Syllabus

UDL Syllabus Components	ATSU Child Rights Syllabus
Course Description/Goals Highlight the goal(s) of the course and include a note from the instructor about why the course material is relevant to students.	The goal of the course is to: ➢ Provide in-depth theoretical and practical knowledge about children's rights. ➢ Develop expertise in safeguarding children's rights and professional ethics, including the identification, analysis, documentation, handling, and assessment of documents related to children's well-being, investigations, and relevant accounts. ➢ Prepare educators oriented towards children's rights. ➢ Equip students with skills to advocate for children's rights.
Course Objectives State in your syllabus that objectives will be connected directly to assignments each week to increase understanding of the purpose. These can be outlined further in a separate learning guide or on the course web	**Upon completion of the course, participants will have:** ➢ Acquired a comprehensive understanding of the theoretical and practical aspects of children's rights. ➢ Developed skills in analyzing and interpreting regulatory documents pertaining to children's rights, as well as their historical context and significance. ➢ Gained expertise in advocating for children's rights in various

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site.	settings, including educational, social, and legal environments. ➤ Enhanced their ability to identify and address issues related to children's rights violations. ➤ Strengthened their critical thinking and analytical skills in evaluating information and formulating arguments related to children's rights protection. ➤ Equipped themselves with the knowledge and skills necessary to actively contribute to the protection and promotion of children's rights.
Materials Include a variety of materials, beyond printed text, to increase the options of representation and increase engagement. Invite students to contribute to the collection of the materials to increase ownership of the course. Be sure that any materials included in the course are accessible to all learners, including links to outside resources and tools. ➤ YouTube videos for extension activities ➤ Blogs ➤ Accessible slide presentations ➤ Accessible and downloadable PDFs ➤ Web sites that feature real-world applications of content	There are a variety of materials for the course, each designed to meet the objectives a of teaching children's rights and increase awareness in the environment around us: *Textbook* Ghassan Ghalil, Child Rights: The Historical Evolution, ATSU University Publishing, 2021. *Accessible PDFs* This is a collection of handouts that are connected to the syllabus. https://matsne.gov.ge/ka/document/view/4613854 *Slide Presentations* Accessible slide presentations are posted on the course web site and used to highlight critical lessons for the week. *Multimedia Resources* On the course website there is a collection of YouTube videos, instructor-created videos, audio recordings of interviews of people in the field, and other related material. https://www.youtube.com/results?search_query=child+rights+atsu+khasan+khalil *Related Web Sites* UNICEF's work is grounded on empirical data, independent evaluation, rigorous research and thoughtful analysis. https://www.unicef.org/georgia/ *Student Contributions* Some of the best materials come from students. They send the instructor any type of resources, web site URLs, books, videos, etc., that might be of value to this course and classmates.
Assignments and Assessment Provide assignments and assessments that provide choices for physical actions, expression and communication, and executive functions. In planning assignments and assessments, consider possible barriers and construct irrelevant factors.	*Assignments* Assignments include weekly homework activities and in-class activities, including group work and discussions. Details of assignments are provided on a weekly basis. Students have the choice of video recording themselves in authentic setting evaluating information and formulating arguments related to children's rights protection, or writing a paper to identify and address issues related to children's rights violations. *Role Play:* Title: "Negotiating Children's Rights in the Classroom: A Teacher-Parent Conference Scenario" Scenario: You are a teacher in a primary school setting, and you have recently noticed that one of your students consistently comes to school with bruises and appears withdrawn in class. After some investigation, you discover that your pupil's home environment is potentially abusive, and you suspect her parents may be violating her rights. You decide to schedule a meeting with his/her parents to address your concerns and

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advocate for her rights.

The class will be divided into three groups, the teacher, the parents, and observers. Each group will prepare for the role play by discussing and assigning specific characteristics and attitudes to their assigned roles. After the role play, each group will debrief and reflect on the experience. Discuss the challenges faced, effective communication strategies used, and potential ways to improve future interactions with parents in similar situations.

Finally, each group will present their reflections to the class, highlighting key insights and lessons learned from the role play.

Project – Title: "A Successful Practice in the Field of Child Rights". Students will collaborate in pairs/groups to create a presentation. They will research and document an initiative or project they deem successful, pioneering, or innovative in safeguarding and fulfilling children's rights, summarizing their findings in written (essay) from.

- Students have the flexibility to choose any country of focus, which they will determine through online or desk research.
- Students have flexibility to video record their project and show it to the class.
- Students can create the blog dedicated to the issue and present it to the class.

Case Study - Title: "Ensuring Education for Every Child: A Case Study on Access to Education Rights". Students conduct a comprehensive analysis of the current state of education access for children in the community; identify key barriers preventing children from accessing education, such as poverty, lack of infrastructure, cultural norms, etc.; select a specific case of a child or group of children who are facing challenges in accessing education. Provide details about their background, circumstances, and the specific barriers they encounter.

Students are supposed to propose potential solutions or interventions to address the identified barriers and improve access to education for the selected case study.

Students present findings and recommendations in a written report format, including supporting evidence and references to relevant laws, policies, or international conventions on children's rights.

Grade Distribution

- Role Play
- Project
- Case Study
- Midterm and Final
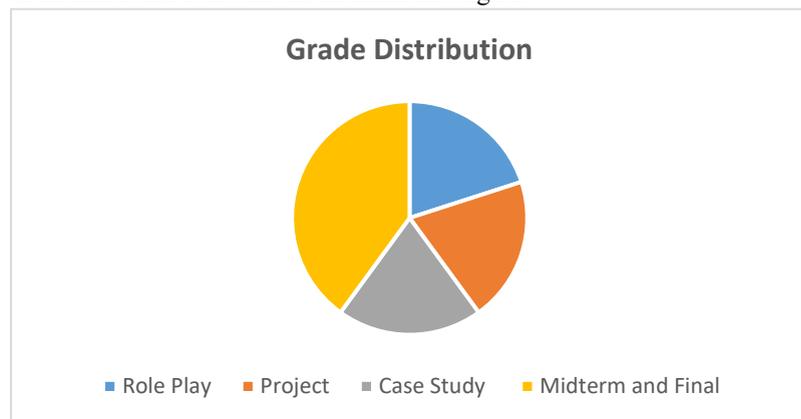
Conclusions

In summary, Universal Design for Learning (UDL) is a collection of guidelines for creating curricula that ensures everyone has an equal chance to learn. UDL offers a framework for developing learning objectives, strategies, resources, and evaluations that are effective for all students—rather than offering a rigid, one-size-fits-all answer, but rather adaptable methods that can be tailored and changed to meet the needs of each person.

The integration of UDL in the ATSU Child Rights syllabus demonstrates that inclusive design can promote meaningful participation, cognitive engagement, and academic success among diverse student populations. This aligns with global educational goals advocating for equity, access, and inclusive education as outlined by UNESCO and the United Nations Convention on the Rights of the Child (UNCRC).

By documenting a practical model of UDL implementation in teacher training, the study provides a replicable framework that can be adapted by other institutions aiming to foster inclusivity in higher education settings. Furthermore, this research supports the case for systemic curriculum reform guided by UDL principles, positioning ATSU as a leader in innovative pedagogical practices in the region.

Previous research has indicated that the effectiveness of UDL is not only evident in traditional academic subjects but also in areas that involve the understanding and application of legal and ethical principles, such as child rights. By embedding UDL principles into the syllabus, educators at Akaki Tsereteli State University can create an environment that caters to the diverse needs of students, fostering a deeper understanding of child rights and encouraging active participation in the learning process.

We strongly believe in the importance of collaboration between educators, curriculum developers, researchers, and other stakeholders in implementing UDL effectively. By incorporating UDL concepts into the Child Rights Syllabus, the Akaki Tsereteli State University syllabus reflects this collaborative spirit. It acknowledges the varied character of education and the necessity for collaboration among educators and learners in developing inclusive learning experiences.

In summary, the application of UDL principles in the Akaki Tsereteli State University Child Rights Syllabus holds promise for creating an inclusive and effective learning environment. The flexibility and adaptation that UDL offers complements the complex and interdisciplinary character of child rights education, highlighting the significance of identifying and meeting the various requirements of students in this niche academic field.

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AI-Driven Strategies for SQL Server in Azure Hybrid Cloud Environments: Enhancing Cloud Agility

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Abstract: With the increasing adoption of hybrid cloud architectures, effectively managing SQL Server databases has become a significant challenge for organizations. These hybrid models allow for the seamless integration of on-premises infrastructure with cloud services, with Microsoft Azure emerging as a robust platform for database management. The incorporation of Artificial Intelligence (AI) into SQL Server administration facilitates automation, predictive analytics, and intelligent optimization, thereby minimizing manual intervention and enhancing operational efficiency. AI-driven results dynamically tune SQL queries, recognize abnormalities, impose security protocols automatically, and optimize resource allocation, all of which contribute to improved system performance. This paper delves into the strategies powered by AI that bolster SQL Server efficiency, security, and cost-effectiveness within hybrid cloud environments, providing empirical evidence of organizational benefits derived from these innovations. Additionally, it addresses the key challenges encountered during implementation and outlines the future landscape of AI-enhanced cloud computing

Keywords: SQL Server, Azure, Hybrid Cloud, AI-driven Optimization, Cloud Agility, Database Performance

Introduction

Implementing hybrid cloud computing has renovated how enterprises disciplined large-scale SQL Server databases. It proposes elasticity in infrastructure management while equalizing cost and performance. Microsoft Azure has become a preferred cloud platform for SQL workloads due to its high availability, scalability, and integration with AI-based tools (Gupta, 2023; Tanaka, 2024; Smith, 2023; White et al., 2023; Microsoft Azure, n.d.; Verma, 2022; Zhao, 2022; IBM Cloud, 2022; Mehta, 2023).

As demands for database performance and operational efficiency continue to grow, AI-driven approaches have become essential for optimizing SQL workloads. AI enhances cloud agility by automating database administration, improving security monitoring, and predicting system failures before they impact operations (Smith, 2023; White et al., 2023; Kumar, 2022; Williams, 2024).

However, incorporating AI within hybrid environments comes with issues, including worries about data privacy, potential latency issues, and the need for a well-structured governance model. This paper explores the role of AI in

SQL Server hybrid cloud setups, providing insights into best practices, challenges, and future developments (Gupta, 2023; Tanaka, 2024; Smith, 2023; White et al., 2023; Verma, 2022; Zhao, 2022).

SQL Server in Azure Hybrid Cloud: Key Considerations

Deploying SQL Server in a hybrid cloud setup requires a choice between Azure SQL Managed Instance and SQL Server on Azure Virtual Machines (VMs), each offering unique benefits. Managed instances come with built-in AI-powered optimizations that reduce administrative workload, while SQL Server on Azure VMs provides greater control and customization options Gupta, 2023; Tanaka, 2024; Smith, 2023; White et al., 2023; Microsoft Azure, n.d.; Verma, 2022; Zhao, 2022).

Hybrid connectivity solutions, such as Azure Arc, VPN, or ExpressRoute, facilitate secure data exchange between cloud and on-premises environments. AI-enhanced high availability and disaster recovery solutions improve failover mechanisms, ensuring business continuity during disruptions. Additionally, AI-driven insights assist organizations in optimizing workload distribution between on-premises infrastructure and cloud resources, striking a balance between cost-effectiveness and performance (Smith, 2023; White et al., 2023; Microsoft Azure, n.d.; IBM Cloud, 2022; Mehta, 2023).

The careful selection of hybrid deployment models plays a crucial role in determining the efficiency of database operations: efficiency and agility.
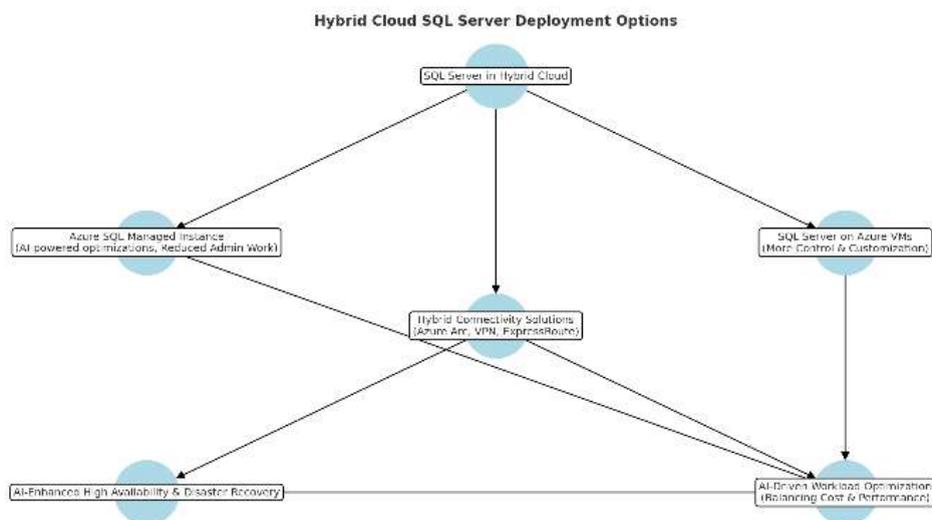
AI-Driven Strategies for SQL Server in Hybrid Cloud

AI-driven methodologies are fundamentally transforming database management paradigms by automating repetitive tasks, forecasting performance bottlenecks, and enabling dynamic resource optimization. Leveraging machine

learning models for in-depth analysis of usage patterns allows for proactive adjustments that significantly minimize downtime and boost system efficiency. The integration of AI within SQL Server operations enhances security protocols, effectively mitigates risks, and facilitates adherence to industry compliance standards (Gupta, 2023; Tanaka, 2024; Smith, 2023; White et al., 2023; Kumar, 2022; Williams, 2024).

With AI-powered monitoring solutions, organizations gain critical real-time insights into system health, enabling them to preemptively tackle issues before they escalate into major problems (Smith, 2023; White et al., 2023).
The following outlines the primary areas where AI markedly advances SQL Server optimization in hybrid cloud ecosystems:
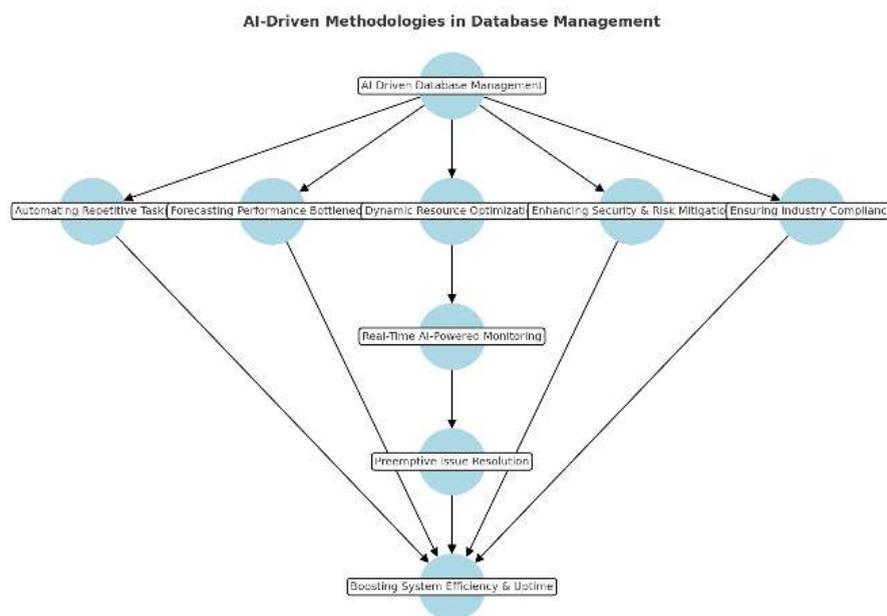
Automated Performance Optimization

AI-driven solutions such as SQL Server Intelligent Query Processing (IQP) and Azure SQL Database Advisor enable sophisticated dynamic workload optimization by meticulously analyzing database execution patterns. These tools deliver critical insights for enhancing query execution strategies, optimizing indexing mechanisms, and fine-tuning memory utilization (Gupta, 2023; Tanaka, 2024; Smith, 2023; White et al., 2023; Microsoft Azure, n.d.).

The AI-enhanced Adaptive Query Processing utilizes historical performance data to continually refine optimization approaches, facilitating significant advancements in query efficiency. Furthermore, features like automatic indexing and intelligent workload balancing operate autonomously to maximize resource utilization, eliminating the need for manual intervention (Smith, 2023; White et al., 2023; Gupta, 2023; Tanaka, 2024).

The result is a marked improvement in query execution times, a reduction in infrastructure costs, and an overall enhancement of user experience, underscoring the efficacy of these advanced capabilities in modern database management.

Predictive Analytics & Anomaly Detection

AI-driven predictive analytics harness historical data patterns to anticipate workload variations, allowing for strategic database scaling. Advanced machine learning algorithms are employed to detect anomalies in query performance, effectively pinpointing issues like extended response times and possible unauthorized access attempts. The implementation of automated anomaly detection tools equips IT teams to proactively mitigate security vulnerabilities, averting escalation into critical incidents. Moreover, AI-based monitoring systems significantly enhance system uptime by forecasting hardware failures, which enables prompt preventive maintenance. This capacity for early detection and resolution of performance issues substantially improves operational reliability and system stability (Smith, 2023; White et al., 2023; Kumar, 2022; Williams, 2024; Smith, 2023; Kim, 2023).

Security & Compliance with AI

AI significantly bolsters database security by continuously monitoring access patterns. This allows for the rapid identification of anomalous behaviors that may indicate potential security breaches. Advanced threat detection systems driven by AI can scrutinize authentication trends and access control configurations to effectively thwart unauthorized database entry (Smith, 2023; White et al., 2023; Kumar, 2022; Williams, 2024).

Automated compliance auditing processes are implemented to ensure that databases are aligned with industry regulations, including GDPR, HIPAA, and ISO standards. Moreover, AI-driven data encryption and masking techniques protect sensitive information while ensuring authorized users retain necessary access (Smith, 2023; White et al., 2023).

As cybersecurity threats evolve, AI-centric security frameworks become indispensable in enhancing the resilience of SQL Server databases against a wide range of attacks.

Cost Optimization & Cloud Agility

Artificial intelligence significantly enhances operational cost efficiency within cloud environments by accurately identifying underutilized resources and recommending optimal configurations for deployment. AI-driven auto-scaling algorithms dynamically adjust resource allocation in real-time, responding effectively to variations in workload, which helps to reduce unnecessary spending. In addition, AI-enhanced cost management tools promote strategies such as reserved instances and spot pricing, thereby optimizing cloud resource utilization while ensuring consistent performance levels. Moreover, AI-powered workload migration methodologies streamline the transition processes with minimal downtime. By assessing resource interdependencies and automating migration workflows, these strategies not only achieve considerable cost savings but also maintain the necessary elasticity in database operations. Collectively, these innovations lead to enhanced operational efficiency and financial prudence in cloud resource management (Smith, 2023; White et al., 2023; IBM Cloud, 2022; Mehta, 2023).

Real-World Case Studies

Retail Enterprise: AI-Driven Query Optimization

A leading retail organization adopted advanced AI-driven query optimization techniques, resulting in a 40% decrease in query execution times and a substantial boost in overall database performance. This enhancement utilized sophisticated algorithms to evaluate historical query patterns, enabling dynamic adjustments to execution plans based on real-time data usage and workload characteristics (Smith, 2023; White et al., 2023; Gupta, 2023; Tanaka, 2024).

Financial Institution: AI-Enhanced Security Measures

The implementation of AI-driven security monitoring systems allowed the financial institution to mitigate unauthorized access attempts proactively. This forward-looking strategy enhanced the resilience of their hybrid cloud architecture and significantly improved compliance with rigorous banking regulations through real-time threat detection and automated response mechanisms (Smith, 2023; White et al., 2023; Verma, 2022; Zhao, 2022; Kumar, 2022; Williams, 2024).

Manufacturing Firm: Cost Optimization Through A

By leveraging predictive analytics, a manufacturing company reduced its cloud expenditure by 30%. This was made possible through the optimization of SQL Server workload distribution, which facilitated more efficient resource allocation. As a result, the firm minimized costs linked to underutilized cloud services, ultimately enhancing overall financial performance in its cloud strategy (Gupta, 2023; Tanaka, 2024).

Impact of AI Strategies Across Industries
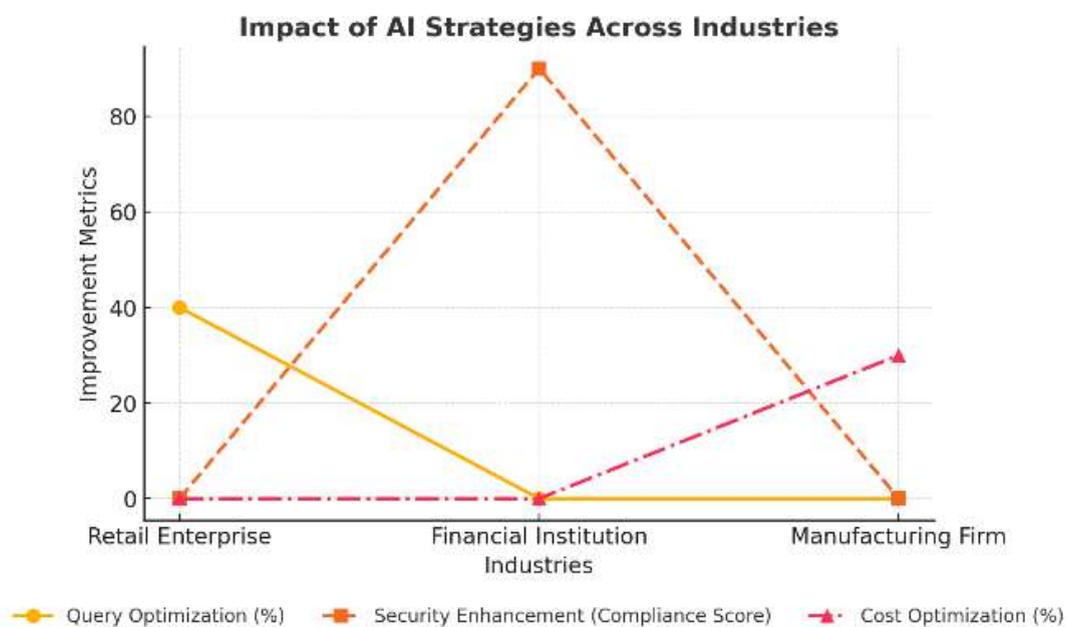
Challenges & Future Directions

Despite the technology's promising capabilities, implementing AI solutions in hybrid cloud environments poses distinct challenges. Data governance is paramount; AI automation must be meticulously designed to adhere to privacy laws and regulatory standards. Additionally, network latency can become a critical factor when synchronizing on-premises and cloud-based SQL workloads, which may hinder real-time analytics and decision-making processes (Smith, 2023; White et al., 2023; Verma, 2022; Zhao, 2022).

The accuracy of AI models and the necessity for continuous training depends heavily on access to high-quality datasets, which are essential for mitigating biases and ensuring the reliability of predictions. The future will likely see developments in AI-enhanced multi-cloud strategies, self-optimizing AI-driven workload management systems, and advancements in quantum computing that will redefine database optimization practices within hybrid cloud architectures (Smith, 2023; White et al., 2023; Verma, 2022; Zhao, 2022; Gupta, 2023; Tanaka, 2024).

Organizations must embrace an iterative approach to AI implementation, continuously refining their strategies to keep pace with rapid technological advancements.
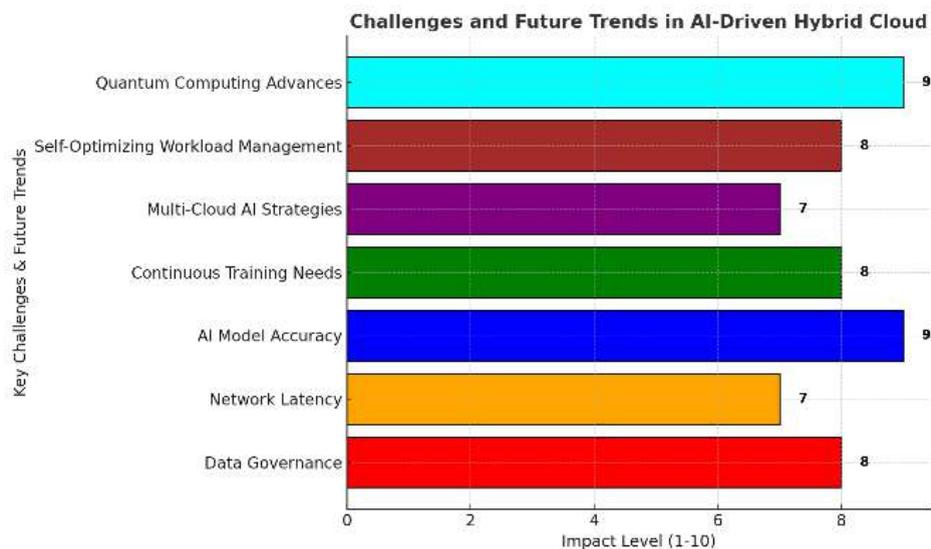
Conclusion

AI-driven strategies fundamentally transform the management of SQL Server in Azure hybrid cloud environments, facilitating more efficient, secure, and cost-effective operations for enterprises. The application of artificial intelligence automates performance tuning processes, enhances compliance with security frameworks, and optimizes cloud expenditures, all of which contribute to improved agility and operational resilience (Gupta, 2023; Tanaka, 2024; Smith, 2023; White et al., 2023; Microsoft Azure, n.d.; Verma, 2022; Zhao, 2022; Kumar, 2022; Williams, 2024; IBM Cloud, 2022; Mehta, 2023.

As AI technology advances, hybrid cloud architectures are poised for continuous evolution, integrating self-healing and self-optimizing systems that minimize the need for human intervention. Organizations that adopt AI-powered database management solutions will secure a competitive edge by boosting database efficiency and propelling their digital transformation initiatives. In today's landscape, leveraging AI in database management is essential for businesses aiming to unlock the full potential of hybrid cloud computing. (Smith, 2023; White et al., 2023; Verma, 2022; Zhao, 2022

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Student Motivation for Online Learning Through the Learning Management System (LMS)

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Abstract: This study aims to explore students' motivation for learning using a Learning Management System (LMS). Additionally, it seeks to examine the extent to which online learning materials can encourage students to study more diligently. The respondents for this study were students who had been using the LMS platform for one year. The study employs a descriptive method, with quantitative data collected through a questionnaire using Likert-scale statements. The statements were designed for each criterion, and responses were ranked on a 4-point scale: Strongly Agree (SA), Agree (A), Disagree (DA), and Strongly Disagree (SDA). A total of 175 students participated in the study, drawn from the School of Information Systems, School of Computer Science, Faculty of Digital Communication and Hotel and Tourism, and Business School.

Introduction

Modern economies demand a highly educated workforce capable of continuously developing new competencies and acquiring new skills through lifelong learning (Perello-Marín et al., 2018). In this context, digital technology has emerged as a crucial element of 21st-century education, driving students toward learning and innovation. The effective integration of digital technology facilitates faster information retrieval, enhances essential life skills as a foundation for workforce readiness, and streamlines lesson plan development for educators. These advancements support the development of new curricula, the implementation of online learning systems, and the overall progress of educational practices.

Teaching and learning processes are increasingly transitioning toward more flexible and technology-enhanced methods, such as blended learning, distance education, online learning, and smart learning (Adnan & Anwar, 2020; Claps et al., 2020; Fadillah et al., 2020). Online learning, often referred to as e-learning, utilizes network technologies to create accessible and effective learning experiences, enabling the development of essential competencies to meet

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the growing demand for new skills (Krasnova & Ananjev, 2015). E-learning plays a pivotal role in higher education, as it enhances learning outcomes and fosters student motivation (Yahiaoui et al., 2022). Moreover, e-learning technologies have established a robust technical and informational infrastructure that supports the creation of advanced information and learning environments within educational institutions (Kateryna et al., 2019). Globally, higher education institutions are increasingly adopting diverse e-learning modalities (Titin et al., 2023). Institutions that implement e-learning and leverage technological tools experience significant impacts on their educational processes and establish a prominent presence in the field (Sahin & Thompson, 2007; Selim, 2007).

Student motivation plays a fundamental role in facilitating effective learning experiences. Motivation drives students to set learning goals, persist in their efforts, and engage meaningfully with the learning process. This is particularly significant in the context of online education, where self-regulation and independent learning are essential. Motivated learners are more likely to experience meaningful and impactful learning outcomes. This study aims to explore students' motivation to learn using a Learning Management System (LMS). Additionally, it seeks to evaluate the extent to which online learning materials inspire students to engage in deeper, more dedicated study, thereby enhancing the effectiveness of online education.

Literature Review
Role of E-Learning

Learners require an adaptive learning pathway that facilitates continuous knowledge acquisition. For lifelong learners, the objective extends beyond a single course to encompass a structured learning pathway comprising a series of interconnected courses, activities, and resources presented in a coherent and organized sequence. This need has driven the development of recommendation techniques and strategies specifically designed for e-learning environments to support lifelong learning (Qian et al., 2021).

The adoption of e-learning has significantly enhanced and transformed learning methodologies in higher education (Cappel & Hayen, 2004). Research indicates that students engaged in e-learning often demonstrate improved academic performance and maintain a positive attitude toward the learning process (Kirby et al., 2007). E-learning encourages students to explore and experience new learning methods while enabling them to manage their learning schedules more effectively (Ying et al., 2021). With the availability of e-learning materials at their fingertips, students can access educational content at any time and from any location, thereby overcoming traditional constraints related to time and place.

Additionally, e-learning provides educators with ample opportunities to introduce new information in dynamic and engaging ways. The innovative and creative approaches embedded in e-learning platforms have the potential to inspire and motivate students in their academic pursuits (Alenezi, 2020). The quality of online course design plays a pivotal role in shaping students' satisfaction with e-learning outcomes (Nicou, 2023). Furthermore, constructive feedback from instructors has been shown to positively influence students' motivation to engage more actively in online learning (Taghizadeh & Hajhosseini, 2021).

E-Learning for Generation Z

Generation Z exhibits high satisfaction with e-learning course delivery environments, along with moderate satisfaction regarding course design, delivery methods, and preferred modes of instruction. As the "Internet Generation," their strong affinity for and reliance on computer technology significantly influence their learning preferences (Yawson & Yamoah, 2020). The e-learning environment has played a crucial role in increasing their interest in learning.

E-learning has enhanced Generation Z's essential skills, including problem analysis, problem-solving, completing online quizzes, and submitting assignments and projects. The integration of technology has also boosted their confidence in utilizing computers and web-based resources, empowering them to explore new concepts and expand their knowledge base (Encarnation, 2021). Members of Generation Z have emphasized the importance of collaboration, online activities, and discussions as valuable components they intend to incorporate into their learning processes (Khan et al., 2022).

These findings suggest that e-learning aligns with Generation Z's digital fluency, fostering more personalized, collaborative, and engaging educational experiences. Their adaptability to technology-driven education underscores the relevance of e-learning in shaping the future of education for this digitally native generation.

Methodology

This study employs a qualitative research approach, utilizing descriptive analysis for data interpretation. The total number of respondents is 175, consisting of second-year, third-semester students. The respondents are drawn from five distinct departments, namely the Business School, Faculty of Humanities, Faculty of Digital Communication and Hotel and Tourism, School of Information Systems, and School of Computer Science.

Learning materials on the Learning Management System (LMS) platform were uploaded prior to the commencement of the academic semester. Students had the flexibility to download these online learning materials to their personal computers or mobile devices and engage with them at their own pace.

Before distributing the questionnaire to all respondents, the researchers conducted a readability test with 30 participants to ensure clarity and comprehensibility. Once the questionnaire was deemed valid, it was administered to the 175 respondents.

Quantitative data on the role of e-learning in learning motivation was collected through two closed-ended questions. Responses were measured using a four-point Likert scale with the following options: Strongly Agree (SA), Agree (A), Disagree (DA), and Strongly Disagree (SDA). This approach provided a structured means of assessing students' perceptions of how e-learning influences their motivation to learn.

Results

Profile of the Research Participants

A total of 175 respondents participated in this study. Table 1 below presents the profiles of the research participants.

Table 1. Profiles of the Participants

Information	Total
Male	74
Female	101
Business School	25
Faculty of Humanities	86
School of Information Systems	37
School of Computer Science	20
Faculty of Digital Communication and Hotel and Tourism	7

Quantitative data were analyzed using Excel to provide meaningful interpretations. The respondents comprised 42.29% male and 57.71% female participants. The distribution of respondents by department is as follows: 14.29% from the Business School, 49.14% from the Faculty of Humanities, 21.17% from the School of Information Systems, 11.43% from the School of Computer Science, and 4% from the Faculty of Digital Communication and Hotel and Tourism.

LMS Interface

The following is the display of the Course Outline (CO) available on the Learning Management System (LMS), which can be downloaded by both teachers and students. The CO materials are developed by teachers who serve as Subject Content Coordinators (SCC) or Subject Content Specialists (SCS). Each CO outlines the learning outcomes of the respective course. The language used in the CO is primarily English, except for foreign language courses, where the CO is presented in two languages — English and the target foreign language being studied, such as Mandarin (see Figure 1 and Figure 2).
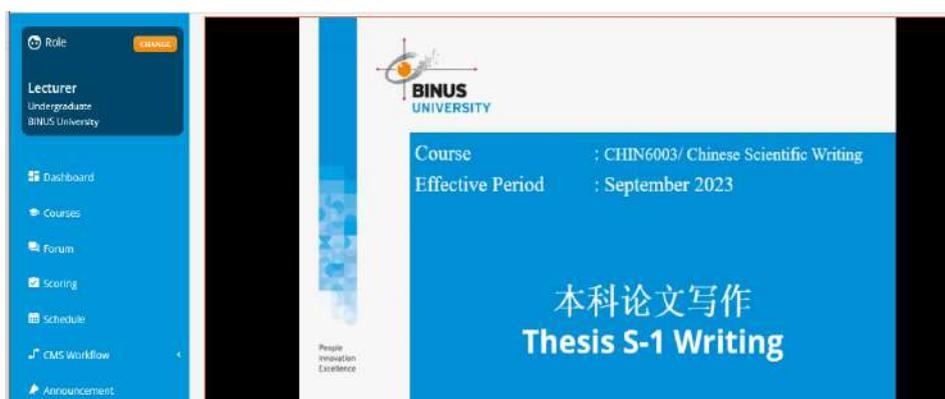
Figure 1. Course Outline

Figure 2. Learning Objectives

Agreement on Learning Motivation

Although online learning, e-learning, or distance learning is often limited by a lack of direct human interaction (Khan et al., 2022), students remain motivated to learn. This motivation is driven by the availability of engaging learning materials that allow students to prepare in advance before attending lectures. As a result, students can identify areas of confusion and seek clarification from instructors when needed, fostering more active participation in classroom discussions.

This study measures students' perceptions of learning motivation through the use of a Learning Management System (LMS). Student responses were assessed using a Likert scale with four response options: Strongly Agree (SA), Agree (A), Disagree (DA), and Strongly Disagree (SDA). This approach was used to determine the extent of students' agreement regarding the role of e-learning in fostering learning motivation via the LMS. The analysis also considers variations in responses based on students' gender and academic specialization.
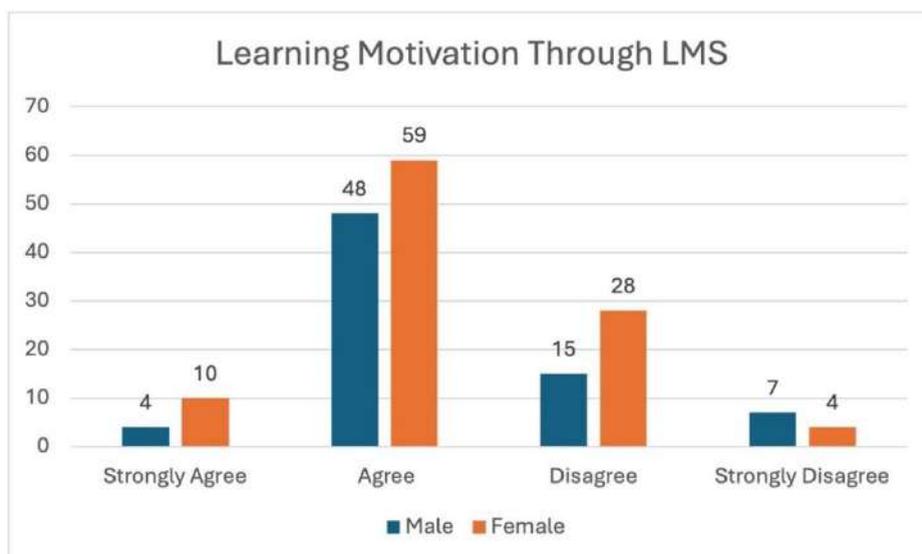
Figure 3. Learning Motivation Using LMS

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Figure 3 shows that, out of a total of 175 students, 74 are male and 101 are female. Among the male students, 5.4% strongly agreed (SA) that they were motivated to learn using the LMS, while 64.86% agreed (A). Meanwhile, 20.27% disagreed (DA), and 9.46% strongly disagreed (SDA). Among the female students, 58.41% strongly agreed (SA) and 10% agreed (A) that they were motivated. Conversely, 27.72% disagreed (DA), and 4% strongly disagreed (SDA). These results indicate that male students are more motivated to learn using E-Learning through the LMS than their female counterparts. This can be attributed to the fact that men are generally more inclined to use technology, while women tend to have fewer capabilities and less interest in using computers compared to men (Sabrina & Nicole, 2020).

A more detailed analysis of student responses based on their field of study is presented in Figures 4, 5, 6, and 7.
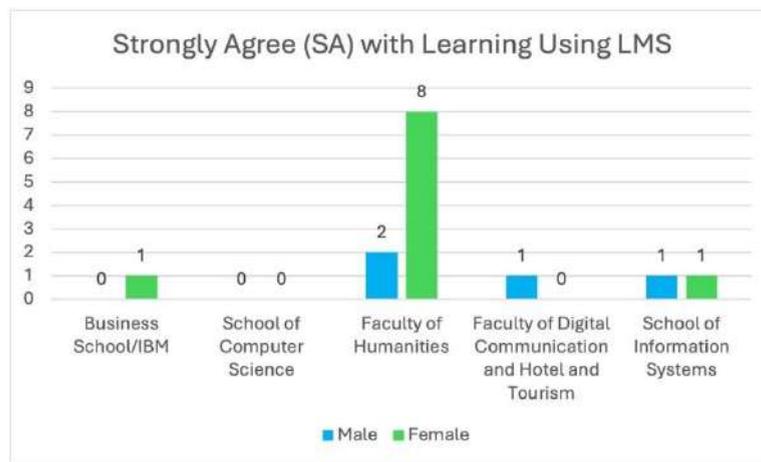
Figure 4. Strongly Agree (SA) with Learning Using LMS

Figure 4 shows the percentage of students who strongly agree (SA) that they are motivated to learn using the LMS, categorized by their field of study. The results are as follows: Business School is 4%, Faculty of Humanities is 8.6%, Faculty of Digital Communication and Hotel and Tourism is 1.43%, School of Information Systems is 5.4%, School of Computer Science is 0%.
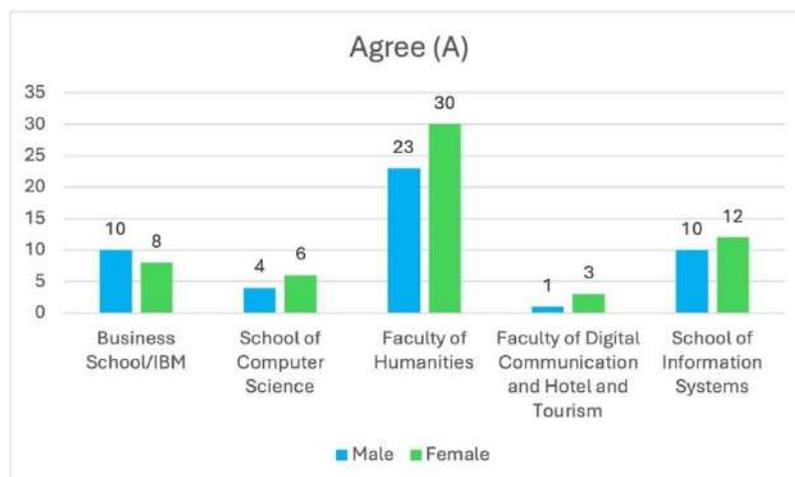
Figure 5. Agreement (A) with Learning Using LMS

Figure 5 illustrates that students' motivation to learn using Learning Management Systems (LMS) varies based on their field of specialization. Specifically, 72% of students from the Business School reported being motivated to use LMS for learning. In comparison, 61.63% of students from the Faculty of Humanities, 57.14% from the Faculty of Digital Communication and Hotel and Tourism, and 59.46% from the School of Information Systems indicated similar motivation levels. Meanwhile, only 50% of students from the School of Computer Science expressed motivation to learn using LMS.

By examining Figures 4 and 5, it becomes evident that students specializing in business are more motivated to utilize LMS compared to students from other disciplines. Conversely, students from the Computer Science field show lower motivation levels for learning via LMS. This discrepancy is attributed to their preference for active learning methods, such as hands-on practice using laptops or desktops, rather than engaging with e-learning platforms (Wang & Nuangjamnong, 2022).
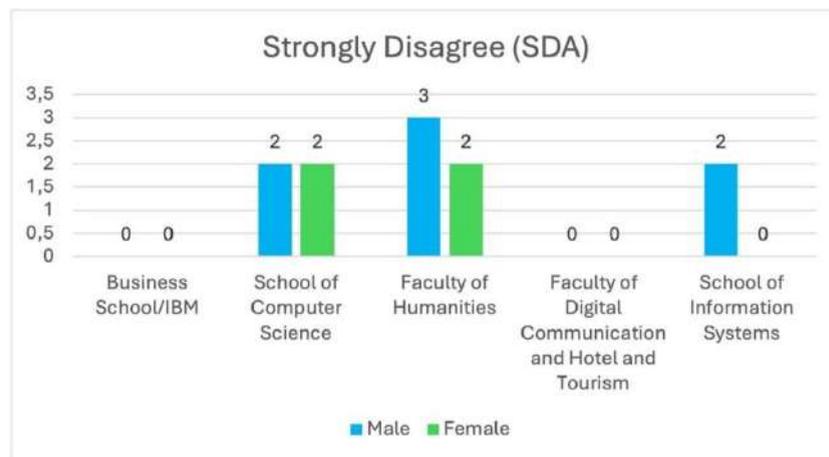
Figure 7. Strongly Disagree (SDA) with Learning Using LMS

Figure 7 illustrates the percentage of students who strongly disagree (SDA) that using a Learning Management System (LMS) motivates their learning, based on their field of specialization. Specifically, 5.4% of students from the School of Information Systems and 20% of students from the School of Computer Science strongly disagreed. In contrast, only 5.81% of students from the Faculty of Humanities reported strong disagreement. Notably, no students from the Business School or the Faculty of Digital Communication and Hotel and Tourism strongly disagreed. The Computer Science (CS) Principles framework aims to increase student participation and diversity in the field by emphasizing the creative and social dimensions of computing. Students perceive CS as a practical discipline, with the CS Principles fostering positive programming experiences that promote interest in learning and engagement with CS as a creative practice (Kara et al., 2016).

Conclusion

The findings indicate that the majority of respondents are motivated to learn through LMS platforms. Male students reported higher motivation levels for using e-learning via LMS compared to female students. Most motivated students came from the Business School, while those from the Computer Science and School of Information Systems shared

a similar perception that e-learning does not motivate them to learn. Among all fields, Computer Science students exhibited the lowest motivation for learning via LMS.ß. This study reveals that e-learning may not always align with the learning needs of all disciplines. Student motivation plays a crucial role in the effectiveness of e-learning. Thus, e-learning content should be designed to align with the characteristics of each field to enhance student motivation. Future research should involve a larger sample size, include a broader range of disciplines, and compare respondents' perspectives based on age.

Author Contributorship

Benny: Data Curation, Supervision, Writing; **Yi Ying**: Writing, Visualization, Formal Analysis, Methodology.

Data Availability

Zenodo: LMS E-Learning [Data set]. https://doi.org/10.5281/zenodo.15049552 (Benny, 2025)

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Analysis of Quantitative Research on Social Studies Education between 2020-2024

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Abstract: The aim of this study is to report the analysis of quantitative research conducted in the field of social studies education between 2020 and 2024. For this purpose, 71 studies on social studies education between 2020 and 2024, in which quantitative research method was used, were taken into consideration. The data source of the research was accessed by searching the databases of ERIC, Google Scholar, CEEOL with keywords such as "social studies, social studies education, social studies education quantitative studies". The studies were first analyzed by document analysis method. These studies were examined according to year, university, data collection tools, data analysis techniques and sample group. The results obtained in the study were continued with the descriptive analysis method and the frequency and percentage values of the study were tabulated. Between 2020 and 2024, it was determined that the most studies on social studies education quantitative research were conducted in 2020 and 2021, the study group consisted mostly of pre-service teachers, the most scales were used as data collection tools, the most t-test was used in data analysis method, and the most studies were conducted at Akdeniz University, Kastamonu University and Sakarya University.

Keywords: Social Studies Education, Quantitative Studies

Introduction

Social studies is a discipline that examines individuals and societies from historical, cultural, geographical and economic aspects. This field aims to enable individuals and communities to understand the social life of individuals and communities and aims to raise them as more conscious and responsible individuals, as well as to make individuals conscious and responsible citizens at both local and global levels (Ciddi, 2025; Coskun, 2025; Çakır, Öztürk, & Ünal, 2019; Gulnar, 2025; Kara, 2020; Kibici, 2025; Kilincer, 2021; Ozdemir, 2022; Ozkan, 2022; Ozturk, 2023; Öztürk, Türe, & Yaglici, 2021; Ünal & Çakır, 2023; Tekin, 2025). Social studies course is a discipline that includes different disciplines such as economics, law, archaeology, anthropology as well as basic models such as history, geography, citizenship (Turan & Karasu Avcı, 2018). By transferring this knowledge to students, this discipline enables them to better understand themselves, their environment and society. Social studies have a broad structure covering various

areas of life (Keskin, 2019). By laying the foundations of citizenship education, social studies course provides important contributions such as gaining and developing democratic values, encouraging citizenship and social participation, and teaching innovations in the field of social sciences (Chapin, 2006).

Social studies generally include disciplines such as history, geography, economics, civics and social sciences. It aims to help students gain analytical thinking, problem solving and social responsibility awareness. In primary and secondary school, social studies education teaches students the structure of the individual and society, the functioning of society, our responsibilities and duties, historical events, chronological time, and the protection of the natural environment. Social studies is an important course that guides a process of learning and enlightenment starting from the individual's self-discovery to the world, and all sections that guide this process are organized as a road map (Köksal, 2016).

In the context of human, society and social studies, the development of human beings as individual and social beings, the structure and functioning of societies are emphasized. The relationship between human and society is better explained through the concept of social studies. Social studies is a field that examines how people interact in society, how societies are organized, how people and societies live, how social components are shaped and how individuals interact with these components. The relationship between people, society and social studies helps people to better understand past social events, relationships and functioning, as well as to better understand current social structure, events, relationships and functioning.

Maxim (2006) defines the social studies course as a course whose main objective is citizenship education, which aims to develop high-level thinking skills by presenting the basic knowledge of social sciences, adopts a multicultural education approach and enables students to gain effective citizenship characteristics. Social studies course aims to raise effective individuals who have individual, social and cultural identity awareness, adopt democratic life style and values, and develop citizenship awareness (Yaşar, 2008). In parallel to this, emphasis is placed on the learning-teaching processes necessary for individuals to identify and analyze both individual and social problems and to develop solutions to these problems (Öztürk, 2009).

Social studies actually provide the link between past, present and future situations. Social studies contribute to individuals becoming more sensitive, responsible and conscious citizens of society. Social sciences play an important role in establishing the balance between those who can live in society and societies, and in providing individuals with the necessary knowledge, skills, attitudes and values (Oruç & Ulusoy, 2008).

When the literature is examined, similar studies have been conducted in the field of social studies education before. These studies were conducted on a general social studies education. Geçit and Kartal (2010) categorized the articles and congress papers published in the field of social studies education between 2000 and 2010 according to their topics. Şahin, Göğebakan Yıldız, and Duman (2011) reached 550 master's theses and 62 doctoral dissertations related to social studies education between 1990-2010 and examined them according to the years, according to the universities where they were conducted, according to whether they were open to the reader in the YÖK National Thesis Center, research themes and these themes according to years.

Dilek, Baysan, and Öztürk (2018) reached a total of 415 master's theses in the field of Social Studies Education in 54 universities in Turkey between 2010 and 2017 and examined them in terms of research type, research method, subject areas, selected sample, sample size, data collection tools, distribution by universities and data analysis methods. Oğuz Haçat and Demir (2018) reached 158 doctoral dissertations prepared in the field of social studies education between 2002-2018 and examined them under 9 headings according to the date of publication, university, researcher gender, field of study, keywords, sample group of the research, research method, data collection tools, and the unit studied in the research.

Sever (2020) examined 125 doctoral dissertations written on social studies education between 2010-2019 in terms of year, university, subject area, method, data collection tools, sampling, data analysis and study subjects. Altay (2020) examined 797 articles published in the field of social studies education between 2010 and 2019 and scanned in ULAKBIM according to the journals in which they were published, the index in which they were scanned, publication year, research method, research method, design used, data collection tool, sample level and research topic. Çelik and Güleç (2022) reached 440 doctoral dissertations and 29 doctoral dissertations in which values were studied between 1998-2021 and examined the dissertations according to year, value subject, method, study group and data analysis.

Arslan and Sungur (2024) reached 32 postgraduate theses in which values education was investigated within the scope of Social Studies and Life Sciences courses between 2008-2023 and examined them according to the variables of thesis type, related course, selected sample, distribution according to universities, research method used, data collection tools and data analysis methods. The analysis of quantitative research in the field of social studies education can guide other studies to be conducted in the field by examining the studies conducted in recent years and determining the dominant sample groups, data collection tools and data analysis methods.

Purpose of the Research

The aim of this study is to provide a general review of quantitative research conducted in the field of social studies education between 2020 and 2024. In this direction, it is aimed to present a systematic review in terms of studies, year, university, sample groups, data collection tools and data analysis techniques. It is planned to provide an overview of the last 5 years of social studies education quantitative research and to help future studies.

Method
Research Model

In this study, quantitative studies in the field of social studies education published in the last 5 years were examined with descriptive document analysis method. In researches using document analysis method, written or visual materials are examined to determine certain facts or contents (Yıldırım & Şimşek, 2013). By examining quantitative and qualitative researches with descriptive document analysis method, general trends in the field are tried to be revealed (Çalık & Sözbilir, 2014). In document analysis, after determining the subject to be researched, documents are accessed, then their contents are determined, these contents are analyzed in accordance with the purpose and finally the data obtained are reported (Glesne, 2013).

Data Collection Process and Data Analysis

The research was started in January 2025. In order to collect data, studies on the subject of social studies education quantitative research analysis between 2020-2024 were accessed with keywords such as "social studies, social studies education, social studies education quantitative studies" in ERIC, Google Scholar, CEEOL's databases.

71 studies that met the appropriate criteria were included in the sample group. The identified studies were first saved as pdf files. The studies were collected in a single file. Then, the studies were analyzed by document analysis method. As a result of the examinations; the year of the study, the selected sample group, their distribution according to universities, data collection tools and data analysis techniques were examined according to the variables. The data were collected in an Excel file. The data obtained as a result of the content analysis were explained through frequency and percentage values. Afterwards, the results obtained were shown in tables.

Results

Table 1 Below Shows the Distribution of Quantitative Studies According to Years.

Table 1. Distribution of quantitative studies by years

Year	f	%
2020	21	29.58 %
2021	21	29.58 %
2022	9	12.68 %
2023	14	19.72 %
2024	6	8.45 %
Total	71	100%

According to the information in Table 1, a total of 71 studies were examined in quantitative research on social studies education between 2020 and 2024. 21 studies from 2020, 21 studies from 2021, 9 studies from 2022, 14 studies from 2023 and 6 studies from 2024 were analyzed. Table 2 below Shows the Distribution of Quantitative Studies According to The Study Group

Table 2. Distribution of quantitative studies by sample group

Sample Group	f	%
Student Teacher	31	43.66%
Student	24	33.80%
Teacher	11	15.49%
Research (thesis, article)	4	5.63%
Parent	1	1.41%
Total	71	100%

According to the information in Table 2; in terms of the study group of the quantitative studies conducted in the field of social studies education between 2020-2024, 31 studies were conducted with pre-service teachers, 24 with students, 11 with teachers, 4 with research in the literature, and 1 study with parents. Table 3 Below Shows the Distribution of Quantitative Studies According to The University in Which They Were Conducted.

Table 3. Distribution of quantitative studies according to the university where they were conducted

University name	f	%
Akdeniz University	4	5.63%
Kastamonu University	4	5.63%
Sakarya University	4	5.63%
Kütahya Dumlupınar University	3	4.23%
Fırat University	3	4.23%
Sivas Cumhuriyet University	3	4.23%
Erzincan Binali Yıldırım University	2	2.82%
Gazi University	2	2.82%
Uşak University	2	2.82%
Kahramanmaraş Sütçü İmam University	2	2.82%
Trabzon University	2	2.82%
Muğla Sıtkı Koçman University	2	2.82%
Boğaziçi University	2	2.82%
Hacettepe University	2	2.82%
Giresun University	2	2.82%
Ordu University	2	2.82%
Aksaray University	2	2.82%
Kırşehir Ahi Evran University	2	2.82%
Bolu Abant İzzet Baysal University	2	2.82%
İnönü University	2	2.82%
Ondokuz Mayıs University	2	2.82%
Nevşehir Hacı Bektaş Veli University	1	1.41%
Atatürk University	1	1.41%
Boğaziçi University	1	1.41%
Manisa Celal Bayar University	1	1.41%
Karabük University	1	1.41%
Çukurova University	1	1.41%
Bursa Uludağ University	1	1.41%
Bartın University	1	1.41%
Amasya University	1	1.41%
Dokuz Eylül University	1	1.41%
Anadolu University	1	1.41%
Eskişehir Osman Gazi University	1	1.41%
Afyon Kocatepe University	1	1.41%
Marmara University	1	1.41%
İstanbul University - Cerrahpaşa	1	1.41%
Adıyaman University	1	1.41%
Ağrı İbrahim Çeçen University	1	1.41%
Atatürk University + Recep Tayyip University	1	1.41%
Ankara Uni. + Gazi Uni. + Aydın Adnan Menderes Uni	1	1.41%
Kastamonu Uni. + Bartın Uni. + Muş Alparslan Uni	1	1.41%
Total	71	100%

According to Table 3, it was determined that the quantitative studies conducted in the field of social studies education between 2020 and 2024 were conducted in 43 different universities. The highest number of studies were conducted at Akdeniz University (f=4), Kastamonu University (f=4) and Sakarya University (f=4), followed by Kütahya Dumlupınar University, Fırat University and Sivas Cumhuriyet University with 3 studies each.

In one study, Atatürk University and Recep Tayyip Erdoğan University collaborated. Another study was conducted at Kastamonu University, Bartın University and Muş Alparslan University. Another study was conducted by Ankara University, Gazi University and Aydın Adnan University.

Table 4 below shows the distribution of quantitative studies according to data collection tools.

Table 4. Distribution of quantitative studies according to data collection tools

Data Collection Tools	f	%
Scale	50	54.35%
Personal Information Form	15	16.30%
Achievement Test	10	10.87%
Survey	6	6.52%
Content Analysis	5	5.43%
Form	4	4.35%
Examination Scores	2	2.17%
Total	92	100 %

According to Table 4, 7 different data collection tools were used in quantitative studies conducted in the field of social studies education between 2020 and 2024. The most preferred instrument in the studies is the scale (f=50). It is followed by personal information form (f=15) and achievement test (f=10). 6 studies used questionnaires and 5 studies used content analysis. In the study, the form was used 4 times and exam scores were used 2 times. In some of the studies, data collection tools were used together.

Table 5 below shows the distribution of quantitative studies according to data analysis methods.

Table 5. Distribution of quantitative studies according to data analysis methods

Data Analysis Methods	f	%
T test	37	21.51%
Anova	33	19.19 %
Mann Whitney U test	17	9.88 %
Descriptive Statistics	15	8.72 %
Kruskal Wallis H test	13	7.57 %
Kolmogorov Smirnov	12	6.98 %

Shapiro – Wilk	6	3.49 %
Pearson Correlation Analysis	5	2.91 %
Content Analysis	4	2.33 %
Kurtosis ve Skewness	4	2.33 %
Levene's Homogeneity Test	3	1.74 %
Games-Howell Post-Hoc Analysis	3	1.74 %
Gabriel Post Hoc Analysis	3	1.74 %
TUKEY test	3	1.74 %
Confirmatory factor analysis (CFA)	3	1.74 %
Spearman's ρ rank correlation coefficient test	2	1.16 %
Scheffe Test	2	1.16 %
Descriptive Analysis	2	1.16 %
Mancova	1	0.58 %
X² (Chi-square)	1	0.58 %
LSD test	1	0.58 %
Sidak Test	1	0.58 %
Principal Component Analysis (PCA)	1	0.58 %
Total	**172**	**100%**

According to the Table, 23 different data analysis techniques were used in quantitative studies conducted in the field of social studies education between 2020 and 2024. The most frequently used method in the studies is t-test analysis (f=37). It is followed by Anova, which was used 33 times. Mann Whitney U test (f=17), descriptive statistics (f=15), Kruskal Wallis H test (f=13) and Kolmogorov Smirnov (f=12) were used 17 times. Other techniques are given in the table in order. Most analysis techniques were used together in most of the study.

Discussion & Conclusion

In this study, it is aimed to present a systematic review of quantitative studies conducted in the field of social studies education in Turkey between 2020-2024 in terms of the year, university, sample groups, data collection tools and data analysis techniques. In line with this purpose, the following results were reached:

According to the results of the research, the distribution of the studies according to the years, in 2020 and 2021, there were 21 studies with the same number of studies, while in 2022, the number decreased considerably and there were 9 studies. The reason for this may be the effect of the pandemic we experienced in 2021 and 2022. In 2023, this number increased slightly and reached 14 studies, and in 2024 this number was limited to 6 studies. The least number of studies was reached in 2024 because the authors did not allow full-text access from the databases and the studies in which qualitative research method and mixed method were used in the studies conducted in 2024 were not taken into consideration.

In the distribution of the studies according to the sample group, 31 studies used pre-service teachers, 24 studies used students, and 11 studies used teachers. 4 studies utilized articles and theses. In 1 study, parents were used. When Arık and Türkmen (2009) analyzed scientific articles, they found that the most common sampling groups were teachers and students. However, according to the results obtained in this study, it seems that teacher candidates and students are more preferred. The reason for this may be that it has changed over the years, and the reason for using pre-service teachers may be that it is easier to reach more people.

In this study, it was determined that the quantitative studies conducted in the field of social studies education between 2020-2024 were conducted in 43 different universities. It was found that the highest number of tests were conducted at Akdeniz University, Kastamonu University and Sakarya University. These universities were followed by Kütahya Dumlupınar University, Fırat University and Sivas Cumhuriyet University, respectively.

In this study, 7 different data collection tools were used in 71 studies in the analysis of quantitative studies in the field of social studies education between 2020-2024. The most frequently used data collection tool in the studies is scale (f=50). It is followed by 15 studies in which personal information form was used. In 10 studies, achievement test was used. In 6 studies, questionnaires were used. Content analysis was used 5 times. Forms were used 4 times and exam scores were used 2 times in the studies. In similar studies in the literature, the results were explained similarly. Toptaş and Gözel (2018) found that achievement tests and attitude-interest scales were the most commonly used data collection tools. There is a similar result here, the studies in which scale, personal information form and achievement test are used intensively. Özaydin Özkara (2019) found that questionnaires and scales were more commonly used as data collection tools in quantitative studies. Erdoğan, Marcinkowski, and Ok (2009) stated that questionnaires and scales were most commonly used in their study in which they analyzed the articles on environmental education.

In 71 studies, t-test (f= 37) was the most frequently used data analysis method. Then Anova was used 33 times. Mann Whitney U test was used 17 times, Descriptive Statistics 15 times, Kruskal Wallis H test 13 times and Kolmogorov Smirnov 12 times. According to these results, more than one analysis method was used together in 49 studies. Mutlu. Bayram. and Taçyıldız, (2020) explained that t-test and ANOVA/ANCOVA, which are inferential data analysis techniques, are more commonly preferred compared to other methods. In the study of Göktaş, Hasançebi et al. (2012), it was observed that t-test and ANOVA test were mostly used in predictive analyses. Similarly, Erdem (2011) stated that these two tests are frequently applied. Yalçın et al. (2016), when they examined the frequency of use of data analysis methods, stated that analysis of variance ranked first. Mutlu. Bayram. and Taçyıldız (2020) observed that in theses where quantitative research methods are used, descriptive analysis is not preferred, instead descriptive elements such as frequency, percentage and graphics are used to support other analysis methods. Hsu (2005) stated that descriptive statistics and ANOVA are most commonly used in educational research.

When the findings obtained within the scope of the study are analyzed, it is observed that the results are consistent with similar studies in the literature. Since this study examined variables such as the year of the study, the sample, the university and the method used, objective results were obtained.

There are many studies in the field of social studies education. In the content studies, a general picture of the theses

was drawn by taking into account the theses in the field of social studies education in general and attention was paid to have a holistic structure. Thesis studies were not included in this study. In this study, quantitative studies on social studies education were carefully analyzed. It is aimed to present a general situation of the quantitative studies conducted in the field of social studies education in the last 5 years. It is intended to provide a basis for future studies.

Recommendations

When I was doing research before starting this study, I did not come across such studies, but I did not come across a single structure. In general, studies have preferred to examine qualitative, quantitative and mixed methods from a holistic perspective. This study examines the quantitative method within itself. Similar to this study, qualitative methods can be examined and compared. In future studies, theses in which quantitative method is used in the field of social studies education in recent years can be examined. Comparison of these studies can be included.

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An Analysis of Qualitative Research Conducted in the Field of Social Studies Education Between 2020 and 2024

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Abstract: This study aims to examine the key characteristics of qualitative research articles published in the field of social studies education in Turkey between 2020 and 2024, and to identify general trends within these studies. A qualitative research approach was adopted, specifically employing the document analysis method. During the data collection process, articles published in academic journals were systematically reviewed. The study analyzes the distribution of qualitative studies by year, the research designs employed, the sample groups selected, the data collection tools used, and the data analysis techniques applied. Content analysis was utilized to interpret the data, and the findings were used to evaluate the methodological tendencies of qualitative studies in the field of social studies education. This research aims to reveal the structural features of existing qualitative studies in the field and to provide guidance for future research.

Keywords: Social Studies, Qualitative Research, Content Analysis

Introduction

Education, recognized as one of the fundamental pillars of a nation's economic, social, and cultural development, primarily aims to help individuals adapt to their environment and society. While education evolves under the influence of societal changes, it also plays a key role in shaping and transforming society itself (Ciddi, 2025; Coskun, 2025; Çakır, Öztürk, & Ünal, 2019; Gulnar, 2025; Kara, 2020; Kaya, 2020; Kibici, 2025; Kilincer, 2021; Ozdemir, 2022; Ozkan, 2022; Ozturk, 2023; Öztürk, Türe, & Yaglici, 2021; Ünal & Çakır, 2023; Tekin, 2025). The sustainability of societies largely depends on the ability of individuals to coexist in harmony. Efforts to ensure such cohesion are often addressed through citizenship education (Sever, 2020). Schools serve as the most effective venues for instilling the principles of citizenship. In addition to socializing individuals and facilitating their integration into society, schools play a significant role in citizenship education (Akdağ & Taşkaya, 2010). They aim to foster the social, cognitive, and emotional development of students. These goals are primarily delivered through subject-based instruction, wherein knowledge, skills, values, and attitudes are transmitted to students (Güven, 2019).

Social studies is one of the core subjects that plays an active role in developing these competencies. It has become a central component of educational processes by offering content and approaches that enable individuals to understand social life and acquire the skills necessary to navigate society effectively (Aslan, 2016). Social studies can be defined as the body of knowledge obtained through a process of evidence-based engagement with social realities. It encompasses various aspects of societal life and includes phenomena that contribute to individuals' well-being, personal growth, and transformation (Sönmez, 2020).

As an educational program, the concept of social studies first emerged in the United States. Immigration to the American continent and the Industrial Revolution led to multiculturalism, which in turn gave rise to various social, cultural, and economic challenges. In response to these issues, American leaders-initiated efforts to use education as a tool for fostering social cohesion. This resulted in the establishment of the National Education Association in 1892 and the creation of the first social studies curriculum (Bilgili, 2009).

In Turkey, the foundations of social studies education date back to the pre-Islamic era (Sönmez, 2005). One of the primary objectives of this subject is to help individuals adapt to the society in which they live. The existence of educational practices aimed at socializing individuals in the pre-Islamic Turkish period indicates that the roots of social studies go back centuries (Safran, 2008). Today, social studies is a core discipline designed to equip students with the knowledge, skills, values, and attitudes necessary to thrive in a constantly evolving global context (Sever, 2015).

Social studies should support individuals in acquiring knowledge and understanding learning processes, thereby enabling them to become active citizens. The knowledge gained through the social studies curriculum is generally regarded as essential by all members of society. The subject is intended to help children become better communicators, critical thinkers, effective users of technology, and individuals with an appreciation for the arts (Tay & Demir, 2016). The central aim of social studies instruction is to foster the development of decision-making and problem-solving skills in individuals who will play active roles in society in the future. Unlike other subjects, the content of social studies is derived from both social and human sciences. The topics, concepts, and content explored often intersect with various disciplines, which are seamlessly integrated into the curriculum (Baysal, 2006). As such, social studies encompass a range of disciplines including history, geography, philosophy, psychology, and anthropology.

A review of the literature reveals that much of the research conducted on social studies education is based on doctoral and master's theses. Furthermore, many studies combine both theses and peer-reviewed articles. This trend indicates that a significant portion of the literature is shaped by academic theses. Geçit and Kartal (2010), in their review of studies conducted between 2000 and 2010, observed that many of the works shared similar topics, methods, and objectives, and that the findings often lacked complementary value. Akçalı and Baş (2020) analyzed 82 studies related to educational technologies in the context of social studies, including 35 journal articles, 38 master's theses, and 9 doctoral dissertations. These studies, evaluated through document analysis, revealed that the most frequently used research design was the survey model, while experimental research also constituted a notable portion. Güneş et al. (2021) examined a total of 136 studies—including theses, articles, and conference papers—finding that quantitative methods were the most commonly used. Kavan, Kaçira, and Kavan (2023) analyzed 35 journal articles published during the COVID-19 pandemic, focusing on research design, sample groups, data collection tools, and data analysis

techniques, noting a clear preference for qualitative methods. Similarly, Dilek, Baysan, and Öztürk (2018) examined 415 master's theses written between 2010 and 2017, analyzing them in terms of topics, research methods, designs, data collection tools, sample groups, and data analysis techniques. These findings suggest that, in addition to thesis-based reviews, the inclusion of published journal articles can further enrich the academic field.

The present study aims to investigate the defining characteristics of qualitative research articles published in the field of social studies education in Turkey between 2020 and 2024, and to identify prevailing trends. To achieve this goal, the following research questions were posed:

1. What is the distribution of qualitative research conducted in the field of social studies education in Turkey between 2020 and 2024?
2. Which qualitative research designs have been employed in studies conducted in Turkey in the field of social studies education during this period?
3. What sample groups are most commonly used in qualitative research conducted between 2020 and 2024 in the field of social studies education in Turkey?
4. What data collection tools are most frequently utilized in these studies?
5. What data analysis methods are employed in qualitative research conducted in Turkey in the field of social studies education between 2020 and 2024?

Method

Research Model

In this study, the document analysis design, which is one of the qualitative research methods, was employed. Qualitative research can be defined as an approach or technique used to collect data, with the aim of deeply analyzing individuals' perceptions, experiences, and attitudes. Through qualitative research, the researcher can gain valuable insights into individuals' behaviors and motivations (Boxill, Chambers & Wint, 1997). This method involves the collection of non-numerical data through techniques such as observation, interviews, focus groups, and document analysis, and the evaluation of this data using qualitative analysis techniques such as content analysis. Such an approach enables the researcher to examine events in their natural settings in a holistic and realistic manner (Creswell, 2012). Document analysis involves the evaluation of written materials related to the subject or phenomenon under investigation. In qualitative research, documents are considered significant sources of information and can be effectively used for data collection. In this context, various written materials may be accepted as sources of qualitative data (Yıldırım & Şimşek, 2018). Document analysis refers to the systematic review of written content that contains information related to the subject being studied (Turgut, 2021).

Data Collection

This research includes qualitative articles published in the field of social studies education between the years 2020 and 2024. Data were obtained using Google Scholar. Searches were conducted using keywords such as "social studies," "social studies education," "social studies course," and "social studies and qualitative research." As a result,

100 qualitative studies published between 2020 and 2024 were identified. These studies are listed in Appendix-1. The selected articles were examined in terms of publication year, research methodology, sample group, data collection tools, and data analysis techniques. Document analysis was the primary method used for data collection. During this process, the data were accessed directly without conducting observations or interviews. Educational materials such as textbooks, curricula, and both internal and external school documents were considered as sources of data (Yıldırım & Şimşek, 2018). Researchers using this method review and synthesize existing studies by scanning the literature, thereby utilizing the obtained information in their own work (Kıral, 2020).

Data Analysis

Content analysis is the process of identifying meanings in texts or discourses and systematically organizing those meanings (Coolican, 2009). This technique aims to summarize and define a phenomenon through concepts and categories. The process typically seeks to create models, conceptual frameworks, maps, or categorizations, and may also provide an opportunity to test theoretical propositions (Elo & Kyngäs, 2008). Content analysis allows researchers to draw accurate, repeatable, and objective inferences from messages conveyed through written materials such as letters, articles, diaries, newspaper columns, short stories, and documents, based on established rules (Prasad, 2008).

Findings

During the data collection process, a total of 100 qualitative articles related to social studies education published between 2020 and 2024 were subjected to content analysis in order to identify trends in postgraduate research in this field. The distribution of the number of qualitative articles published by year, along with their frequency (f) and percentage (%) values, is presented in Table 1.

Findings related to the first research question are as follows:

Table 1 Shows the Distribution of Qualitative Studies by Publication Year.

Year	f	%
2020	39	%39
2021	19	%19
2022	8	%8
2023	29	%29
2024	5	%5
Total	**100**	**100**

When examining 100 qualitative articles published in the field of social studies education between 2020 and 2024, it is observed that the number of articles shows a significant variation by year during this period. The majority of the articles were published in 2020 (39%), marking the most intensive publication period in the research field. Following this, there was a noticeable decline in the number of articles published in 2021 (19%). In 2022, only 8 articles (8%) were published, indicating a considerable decrease compared to previous years. However, in 2023, the number of

publications increased to 29%, showing a rise but still remaining below the peak in 2020. Finally, 2024 stands out as the year with the lowest number of articles published, accounting for only 5% of the total.

Findings related to the second research question are presented below.

Table 2 shows the findings regarding the research designs of the articles included in the study.

Method	Desing	f	%
	Basic Qualitative	9	%9
	Phenomenology	23	%23
	Case Study	24	%24
Qualitative	Document Analysis	34	%34
	Action Research	4	%4
	Survey	5	%5
	Not Specified	1	%1
	Total	**100**	**100**

According to Table 2, 100 qualitative research articles related to social studies education between 2020 and 2024 were analyzed. The largest portion of these articles employed the document analysis design (34%). Document analysis stands out as a common method for examining written sources in the field of social studies. The second most used design was case study (24%), followed by phenomenology (23%).

In addition, basic qualitative research design was preferred by 9% of the studies. Survey design (5%) and action research (4%) were also used, making them the least favored designs in qualitative studies within social studies education. Finally, the research design was not specified in one of the 100 articles. Overall, qualitative research in social studies education mainly relies on methods focusing on examining written materials and participants' experiences.

Findings related to the third research question are presented below.

Table 3. provides the findings regarding the sample groups of the articles included in the study.

Sample Group	f	%
Teachers	33	%56,90
Primary School Students	1	%1,72
Middle School Students	8	%13,79
Undergraduate Students	11	%18,97
Student Parents	1	%1,72
Teachers and Primary School Students	1	%1,72
Teachers and Middle School Students	1	%1,72
Undergraduate and Middle School Students	1	%1,72
Teachers, Primary School Students, and Parents	1	%1,72
Total	**58**	**100**

According to Table 3, 100 qualitative articles published between 2020 and 2024 in the field of social studies education were examined. It was found that 58 of the studies used sample groups, meaning that 58% of the studies involved working with a sample group, while the remaining 42% did not use a sample group. This suggests that a large portion

of research in the field of social studies education is conducted with sample groups, although some studies may have employed different research methods.

When looking at the sample groups in the articles, teachers were the most studied group, constituting 56.90% of the sample groups. Undergraduate students were the second most common group at 18.97%, indicating that social studies education research often targets university-level students. Studies involving middle school students accounted for 13.79%, while primary school students and student parents were the least studied groups at 1.72% each. This indicates that social studies education research primarily focuses on teachers and university students, while primary school students and parent perspectives are less frequently included.

Additionally, some studies used multiple sample groups together. For example, combinations such as teachers and middle school students (1.72%), teachers and primary school students (1.72%), undergraduate and middle school students (1.72%), and teachers, primary school students, and parents (1.72%) were observed. Using multiple sample groups broadens the scope of the research by comparing different perspectives and helps obtain more detailed results.

Findings related to the fourth research question:

Table 4. presents The Findings Regarding the Data Collection Tools Used in The Studies Included in The Research.

Data Collection Tools	f	%
Document Analysis	42	%42
Semi-structured Interview Form	50	%50
Structured Interview Form	1	%1
Semi-structured Interview Form & Audio Recording	2	%2
Semi-structured Interview Form & Observation	2	%2
Semi-structured Interview Form & Document Analysis	1	%1
Semi-structured Interview Form, Document Analysis & Observation	1	%1
Semi-structured Interview Form, Audio Recording & Student Diaries	1	%1
Total	**100**	**100**

According to Table 4, 100 qualitative articles conducted in the field of social studies education between 2020-2024 were examined. The analysis of data collection tools revealed that the most frequently preferred qualitative data collection instrument was the semi-structured interview form (50%). The semi-structured interview form is the most commonly used tool. On the other hand, document analysis (42%) was also frequently used as a data collection tool. This indicates that especially in education and social sciences research, analyzing existing sources, written documents, or teaching materials is a widely used method to gather information. There were also studies using structured interview forms (1%), but observation was less preferred compared to other methods. Additionally, it was found that multiple data collection tools were sometimes used together in some studies. For example, semi-structured interview form and audio recording (2%), semi-structured interview form and observation (2%), document analysis, observation and semi-structured interview form (1%), semi-structured interview form, audio recording, and student diaries (1%), and semi-structured interview form and document analysis (1%) were combined in some research. Using multiple data collection tools allows for stronger and more reliable results and broadens the scope of the research.

Findings related to the fifth research question.

Table 5. Presents The Findings Related to The Analysis Techniques Used in The Articles Within the Scope of The Research.

Analysis Technique	f	%
Content Analysis	54	%54
Descriptive Analysis	41	%41
Content Analysis and Descriptive Analysis	5	%5
Total	**100**	**100**

According to Table 5, 100 qualitative articles related to social studies education between 2020 and 2024 were examined. When looking at the distribution of analysis types applied in these studies, Content Analysis (54%) had the highest share, while Descriptive Analysis (41%) was used less frequently. Additionally, it was found that some studies employed multiple analysis techniques together. Content Analysis and Descriptive Analysis were used jointly in 5% of the studies. This indicates that the research mainly relies on content and descriptive analysis methods, although the combined use of both techniques is limited.

Discussion

The social studies course encompasses various disciplines such as history, geography, sociology, and social sciences with the aim of helping students understand their social lives and environments. In this course, topics such as significant events of the past, the impact of geographical features on social life, the functioning of economic systems, and the development of societies are addressed. Additionally, universal values such as human rights, justice, and equality are emphasized. Social studies aim to develop students' awareness of their social responsibilities, rights, and roles while fostering a sense of global citizenship. This course guides students to become conscious and responsible individuals both on an individual and social level.

This study aims to examine the distinct characteristics of qualitative research articles published in the field of social studies education in Turkey between 2020 and 2024 and to reveal the general trends of these articles. Within the scope of the research, questions regarding the distribution of qualitative studies during the period, research designs used, preferred sample groups, data collection tools, and data analysis methods are addressed. In this way, it is aimed to analyze the current state of qualitative research in social studies education and contribute to the field.

During the data collection process, studies conducted with qualitative research methods in the field of social studies education between 2020 and 2024 were examined, and research data related to graduate education in the field were identified based on these studies. Document review was used as the research design. Accordingly, a total of 100 qualitative articles related to social studies education were subjected to content analysis.

When the 100 qualitative articles in the field of social studies education were examined, significant year-to-year changes in the number of published articles were observed. The year 2020 was the busiest publication year in the

research field, with 39% of all articles published in that year. The year 2021 experienced a significant decline, with the proportion of published articles falling to 19%. In 2022, the number reached its lowest with only 8 articles, indicating a notable decrease for that year. In 2023, although the number of publications rose again to 29%, this increase remains low compared to the intensity of 2020. Lastly, 2024 stands out as the year with the lowest number of published articles at just 5%.

When examining 100 qualitative research articles in social studies education, the most common research design was found to be document analysis (34%). Document analysis can be regarded as a frequently preferred method for examining written materials in the social studies field. The second most common was case study (24%), followed by phenomenology (23%). Basic qualitative research design was used in 9% of the articles. Survey design (5%) and action research (4%) were the least preferred research designs in qualitative studies in social studies education. Moreover, one article did not specify a research design. Overall, qualitative research in social studies education generally relies on methods that examine written sources and participants' experiences.

Among the 100 qualitative articles in social studies education, 58% included sample groups, while the remaining 42% did not. This indicates that most studies were conducted with sample groups, but some studies may have been carried out using different methods. When sample groups were examined, the most studied group was teachers (56.90%). Undergraduate students (18.97%) ranked second, followed by middle school students (13.79%). Elementary school students and student parents were among the least studied groups (1.72%). This suggests that social studies education research mostly focuses on teachers and university students, while elementary students and parent opinions have received less attention. Additionally, some studies used more than one sample group. For example, combinations such as teachers and middle school students (1.72%), teachers and elementary school students (1.72%), undergraduate students and middle school students (1.72%), and teachers, elementary school students, and parents (1.72%) allowed more comprehensive results by comparing different perspectives.

When the 100 qualitative articles in social studies education were examined, the most common data collection tool was the semi-structured interview form (50%). Document analysis (42%) was the second most frequently preferred method. This shows that analyzing written materials to collect data is a common approach in education and social sciences. Structured interview forms (1%) were rarely used. Observation was less preferred compared to other methods. Moreover, some studies used multiple data collection tools together. For example, semi-structured interview and audio recording (2%), semi-structured interview and observation (2%), and document review, observation, and interview forms (1%) were among such combinations. Regarding data analysis in the 100 qualitative articles in social studies education, content analysis (54%) was the most commonly used method, while descriptive analysis (41%) was used less frequently. Some studies used both content and descriptive analyses together (5%). This indicates that research mostly relies on content and descriptive analysis methods, although their combined use is limited.

Conclusion

In light of the above findings, it was concluded that qualitative research in the field of social studies education mostly relies on content analysis and descriptive analysis methods, with limited use of these methods in combination.

Furthermore, the most commonly used research design was document analysis, and teachers and undergraduate students were the primary sample groups. Among data collection tools, the semi-structured interview form stood out as the most preferred method. Significant changes in the number of articles published by year were observed, with 2020 being the year with the highest publication volume.

Recommendations

In future studies, it would be beneficial to examine qualitative research in the field of social studies education more comprehensively by using a wider variety of data collection tools. Although semi-structured interview forms are widely used, increasing the preference for observation and structured interview forms could allow for the comparison of different data collection methods. Additionally, expanding studies to include different sample groups, especially giving more attention to primary school students and parent perspectives, could broaden the scope of social studies education research. Regarding research designs, it is recommended to use a variety of research designs beyond document analysis and phenomenological approaches. Employing multiple data collection tools together in studies can enhance the reliability of research and enable more detailed results. Although the combined use of content analysis and descriptive analysis methods is common, increasing the number of studies utilizing this combination could contribute to a deeper analysis of data. New studies are also advised to explore different subfields within social studies education and focus on developing innovative methods aimed at both teachers and students. This approach could create a broader perspective on social studies education practice and pedagogical methods.

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Prospective Social Sciences Teachers' Views on The Concept of Cultural Literacy

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Abstract: Cultural literacy is the individual's perception and awareness of both one's own culture and other cultures as a continuous learning process. It is the teacher's ability to understanding, comprehend and accept the values of different cultures and to include students in their own and foreign cultures. The aim of this study is to reveal the views of pre-service social studies teachers on the concept of cultural literacy. Case study research design, one of the qualitative research designs, was used in the study. The literature on the subject was reviewed and previous studies on the concept of cultural literacy were examined. A semi-structured interview form was used to collect data. Descriptive analysis technique was used to analyze the data. According to the data obtained, most of the participants preferred direct experience and observation to improve their cultural literacy and defined the concept of cultural literacy as knowing and recognizing their own culture. A study was conducted to observe and explore the views of pre-service social studies teachers on the concept of cultural literacy, their knowledge of the concept of cultural literacy, and how they define the concept of cultural literacy.

Keywords: Social studies teaching, cultural literacy, qualitative research.

Introduction

Art, technology, and education are part of the culture and society (Ciddi, 2025; Coskun, 2025; Çakır, Öztürk, & Ünal, 2019; Gulnar, 2025; Kara, 2020; Kibici, 2025; Kilincer, 2021; Ozdemir, 2022; Ozkan, 2022; Ozturk, 2023; Öztürk, Türe, & Yaglici, 2021; Ünal & Çakır, 2023; Tekin, 2025). When we look at the concept of culture as a definition, it has a wide variety. The reason why the concept of culture has such a variety of definitions is its rich cultural structure. One of the most distinctive elements that distinguish societies from each other is their unique cultural structure (Sığrı & Tığlı, 2006). When we look at the definition of culture in general terms, it is all of the values and lifestyle of a society that has been passed down from generation to generation for centuries, undergoing various changes over time (Çelik, & Güleç, 2023).

Literacy has been defined by the United Nations Educational, Scientific and Cultural Organization (UNESCO) as "a human right and the basis for lifelong learning" (cited in Becht, 2015). The first person to introduce the concept of cultural literacy was E.D. Hirsch, who, in his 1987 book Cultural Literacy: What Every American Needs to Know, defined the concept of cultural literacy with the idea that individuals should be familiar with the common knowledge and values of their own societies (Hirsch, 1987). Cultural literacy exists as a form of anticipation of the negative things that occur as a result of globalization (Sujastika, & Abdulkarim, 2022). Cultural literacy is the individual's perception and awareness of both his/her own culture and other cultures as a continuous learning process. The teacher should have the ability to understand, comprehend, accept the values of different cultures and engage students in their own and foreign cultures (Sergeeva, Poliakova, Goltseva, Kolosova, Shafazhinskaya, Polozhentseva, & Smirnova, 2019). Shliakhovchuk (2021) defined cultural literacy competencies as having local cultural awareness, developing critical thinking skills, having a sense of curiosity for continuous learning, and having leadership qualities that can realize change (as cited in Dündar & Kızık, 2023).

The aim of Cultural Literacy is to equip students and professionals with the ability to 'read' and understand their ever-evolving cultural and disciplinary contexts so that they can adapt to these contexts in such a way that they can apply their specialized training as effortlessly and efficiently as possible (García Ochoa, McDonald & Monk, 2016). Cultural literacy is of great importance in order to understand the cultural changes that the society has experienced in the past, present and future and to take appropriate steps towards these changes (Ulukaya Öteleş, & Demir, 2023).

Parr and Campbell's (2011) study shows that pre-service teachers' perspectives on literacy are in fact influenced not only by their individual experiences but also by the educational, cultural and political environments in which they live. Spence's (2016) research reveals that teachers' cultural competence levels can play a decisive role in students' perceptions of social class. According to the study, teachers' cultural competence, especially in ethnically diverse classrooms, increases students' engagement and motivation, which in turn contributes to a more inclusive and positive social atmosphere in the classroom (Spence, 2016). The experience of educational institutions confirms that teachers are not fully aware of students' needs to understand not only their own culture but also different cultures (Sergeeva, Poliakova, Goltseva, Kolosova, Shafazhinskaya, Polozhentseva & Smirnova, 2019). The views of pre-service social studies teachers on cultural literacy is one of the fundamentally important elements among today's educational approaches (Demir & Kıngır, 2022).

When the literature on the subject is reviewed, it is seen that there is a limited number of studies on the concept of cultural literacy of pre-service social studies teachers. While topics such as media, digital and financial literacy are widely covered in the literature, studies on cultural literacy are quite limited (Salur, 2022). This shows that cultural literacy, which is an important tool in understanding multicultural social structure, has not been sufficiently examined. In a study conducted by Sağlamgöncü (2022), it was determined that the majority of graduate theses in the field of social studies education focused on areas such as media literacy; on the other hand, topics that require individual and in-depth analysis such as cultural literacy were addressed in a limited number.

This research was conducted based on qualitative research method and descriptive analysis technique was used to analyze the data. Descriptive analysis is a more superficial method compared to content analysis; in this method, the

data are conveyed as they are by direct quotation without interfering with the statements in the interviews (Yıldırım & Şimşek, 2021). The aim of descriptive analysis is to organize the data obtained from the semi-structured interview form and then present them to the reader in an interpreted form. The data are classified and summarized in line with the previously determined themes and enter the analysis process. Findings can be compared with different cases when necessary (Köç & Ünal, 2018).

Purpose of the Research

The general aim of this research is to reveal the thoughts of pre-service social studies teachers about the concept of cultural literacy. Depending on the purpose of the research, it is aimed to seek answers to the following questions within the scope of semi-structured interviews:

- How do pre-service social studies teachers define the concept of cultural literacy?
- According to pre-service social studies teachers, what does cultural literacy mean in the social studies course?
- How do pre-service social studies teachers define their own personal development in cultural literacy?
- According to pre-service social studies teachers, what are the characteristics of a culturally literate teacher?

A semi-structured interview guide usually includes follow-up research questions and main open-ended questions that the interviewer can refer to throughout the interview (Adeoye-Olatunde, & Olenik, 2021). The semi-structured interview technique is far from the rigidity of fully structured interviews and more limited than the flexibility of unstructured interviews; it strikes a balance between both methods (Demir & Açar, 2011). Therefore, a semi-structured interview form was applied.

The interviews with the participants will be recorded through a voice recorder on the basis of confidentiality. The reason for this is that it is one of the factors that increase the quality and reliability of qualitative research in terms of ensuring the accuracy of the data, saving time, not missing details in the interviews, objectivity in collecting data and listening to the recordings over and over again.

Table 1. Demographic characteristics of the participants

Class Level	Gender	
	Girl (G)	Boy (B)
2nd grade	3	2
3rd grade		
4th grade	3	2
Total	2	3
	8	**7**

According to Table 1, a total of 15 pre-service teachers were included in the study. When the demographic characteristics of the participants are analyzed, it is seen that 8 of them are female and 7 of them are male in terms of

gender. When the distribution according to the grade level is examined; there are 3 female and 2 male students in the 2nd grade, 3 female and 2 male students in the 3rd grade, and 2 female and 3 male students in the 4th grade.

Obtaining Data

Data were collected by conducting interviews with the participants within the scope of a semi-structured interview form. As a result of the interviews, it is aimed to reveal the perceptions of pre-service social studies teachers towards the concept of cultural literacy. Within the scope of the semi-structured interview form prepared, progress was made towards the purpose of the research. It is aimed to elaborate the subject within the scope of the interview by asking the following questions to the pre-service social studies teachers for the purpose of the research. During the interview, it is expected to provide more detailed exploration for the purpose of the research by asking the participants drilling questions other than the following question framework. For this reason, it is aimed to achieve the purpose of the research by preparing semi-structured interview questions.

- How do pre-service social studies teachers define the concept of cultural literacy?
- What does cultural literacy mean to pre-service social studies teachers?
- How do pre-service social studies teachers define their own personal development in cultural literacy?
- According to pre-service social studies teachers, what are the characteristics of a culturally literate teacher?

In order to record the interviews accurately and use them in the analysis process, a voice recorder was used during the interviews and the audio recordings obtained were used as reference throughout the research process. Before the interviews, it was stated that all recordings would be kept confidential and would be used only for the purpose of the research in order for the participants to express their feelings and thoughts comfortably.

Data Analysis

This research was designed based on qualitative research method and descriptive analysis technique will be used to analyze the data obtained. Descriptive analysis offers a more superficial analysis approach compared to content analysis; it allows the data to be transferred faithfully to the statements of the participants without direct intervention (Yıldırım & Şimşek, 2021). In this type of analysis, the data obtained through the semi-structured interview form are organized and interpreted within the framework of predetermined themes and presented to the reader. In the descriptive analysis process, the data are systematically classified, summarized and analyzed by making sense in line with the themes. When deemed necessary, the findings obtained can be evaluated comparatively with data from similar or different studies (Köç & Ünal, 2018).

Credibility

In order to ensure credibility in the research, both in the data collection process and in the data analysis process, the process was monitored by experts in this field. During the data collection process, the interviews with the participants

were recorded with a voice recorder to ensure reliability. In addition, the questions in the semi-structured interview form were also examined by experts in the field.

Results

Definition of the Concept of Cultural Literacy

According to the findings of the study, according to the pre-service social studies teachers, the concept of cultural literacy was defined as in the table below.

Table2. Definitions of Cultural Literacy

Code	Frequency (n)	Participants (G/B)	Percentage (%)
Knowing, recognizing and preserving one's own culture	9	G1, G3, B1, B2, G4, B3, G5, G7, B4	%60
Recognizing different cultures	7	G2, G3, G5, G7, G8, B5, B7	%46,67
To be able to establish intercultural relations	2	G8, G7	%13,33
Developing cultural awareness and tolerance	6	G2, B1, B2, G4, B5, B7	%40
Integration of cultural values into the life of the individual	5	G4, B1, G6, G7, B6	%33,33

According to the findings of the study, the majority of the participants defined the concept of cultural literacy as *"knowing and recognizing one's own culture (f9)".* This result shows that pre-service teachers generally consider cultural literacy in terms of protecting and transmitting their own culture. Then, the majority of the participants defined *cultural literacy as recognizing different cultures (f8), developing cultural awareness and tolerance (f6), integrating cultural values into one's life (f5)* and finally, establishing intercultural relations (f2). As can be seen in Table 1, some participants defined cultural literacy from more than one perspective. For example;

G3 *"I don't know exactly what cultural literacy is, but I know what the words culture and literacy mean. From this point of view, I can say that knowing different cultures, but also knowing one's own culture and adopting it."* By using these statements, she defined the concept of cultural literacy both in terms of one's own culture and in terms of different cultures.

The Place of Cultural Literacy Concept in Social Studies Lesson

It was aimed to understand how the participants interpreted and defined the relationship between the concept of cultural literacy and social studies teaching. Interview questions were asked for this purpose. The answers given by the participants are coded in Table 3 below.

Table3. Place of Cultural Literacy in Social Studies

Code	Frequency (n)	Participants (G/B)	Percentage (%)
The central role of culture in social studies	9	G1, G2, G3, G4, G5, G6, B1, B2, B3	%60
The importance of culture and heritage learning area	5	G2, G5, G8, B1, B4	%33,33
Social studies course being connected to life	6	G2, G5, G6, B1, B3, B7	%40
Cultural diversity and tolerance	4	G4, G5, G7, B5	%26,67
Lack of cultural literacy training	3	B3, B6, B7	%20

According to the findings obtained within the scope of the research, pre-service social studies teachers think that the concept of cultural literacy has a great importance in the social studies course. As the reason for this, the participants most frequently emphasized that *culture is the central aspect of the social studies course (f9).*

In addition, by giving the example of the culture and heritage learning area within the scope of the social studies course, one of the participants, G3, stated that culture is so important for the social studies course that it can actually be a learning area*: "I think culture is very important for the social studies course. Even within the learning areas, there is a unit on culture and heritage. Turkish culture contains many things, and since the social studies course is a course from life, I think the relationship between the two is very strong."* He emphasized by using the following statements. On the other hand, the participants stated that *cultural literacy education is not sufficiently addressed in social studies teaching (f3)* and that pre-service teachers have insufficient knowledge on this subject, B3 one of the participants said, *"I think it has a great place and importance, but I don't think this subject is emphasized too much while studying in the social studies teaching department. I think there should be a cultural literacy course in the fourth grade, just as there is a media literacy course. This course can provide pre-service teachers with more information about culture. For example, I had never heard of this concept before, and I learned about it thanks to this research. Social studies is a course from within life. Since culture is the society itself, we cannot think of the two concepts separately from each other."* He stated that cultural literacy course should be given to pre-service teachers as a course.

Reasons for Cultural Literacy Inadequacy

According to the findings obtained in the research, the reasons why the participants consider themselves inadequate are given in Table.4. According to the findings, the participants who considered themselves inadequate stated that they considered themselves inadequate mostly due to *lack of knowledge (f11).* It was observed that a significant number of the participants who mentioned lack of knowledge also mentioned *lack of interest in different cultures (f9).*

Some of the participants mentioned that although they were interested in their own cultures, they lacked interest in other cultures. For example, participant G6: *"I do not consider myself sufficient in this sense because I do not think I*

have done enough research. I like to learn about our own culture, but I am not interested in other cultures, I think this inadequacy is due to lack of interest. Just reading is enough for me to learn information, but I do not think I have done much research on this subject." By using these statements, he states both that there is a lack of knowledge and that this lack of knowledge stems from a lack of interest in different cultures.

Table4. Reasons for the Participants' Perception of Themselves as Inadequate

Code	Frequency (n)	Participants (G/B)	Percentage (%)
Lack of information	11	G1, G2, G4, G6, G7, G8, B1, B3, B5, B6, B7	%73,33
Lack of interest and curiosity in different cultures	9	G1, G2, G4, G6, G7, B1, B4, B5, B6	%60
Lack of cultural experience and practice	3	G3, G7, B2,	%20
Lack of resources	1	G2	%6,67

Again, another participant said, *"I do not consider myself sufficient in this field. The reason for this is that I have not done enough research because it is not a subject that interests me. I have curiosity and interest in our own culture, but I do not have any interest in other cultures. (B4)"* expressing that the reason for not having knowledge about different cultures is the lack of interest.

Some of the participants also mentioned *lack of experience (f3)* as a reason for feeling inadequate. Participant G7, who is open to gaining knowledge about different cultures but considers himself insufficient in terms of experience, said: *"Another reason why I do not consider myself sufficient is that I am open to different cultures and I am curious, but theoretical information remains in the air. Maybe if there is an activity where we can learn this in a fun way, maybe then it would be a little bit easier and more fun to learn by doing and experiencing."* By emphasizing the inadequacy of theoretical knowledge in terms of permanence, he mentions the importance of learning by doing-living. Another opinion was the lack of resources G2: *"Not being able to go and see the environment due to lack of financial resources directly affects my level of cultural development."* He associated the lack of experience and experience with the lack of financial resources.

Activities to Improve Cultural Literacy

According to the findings obtained in the research, the activities that the participants have done to improve their cultural literacy levels are given in Table 5.

Within the scope of the research is analyzed. Most of the participants prefer direct experience and observation to develop their cultural literacy. For example;

G1 said, "*I participate in trips to get to know cultures, but I have never done anything for abroad, I can think of traveling and seeing those places too. It ends with traveling and seeing them to get to know their culture.*" By using these expressions, she focuses on exploring cultures through trips and prefers to learn by traveling.

B2 argues that cultural literacy development is more permanent and effective not only through books and theoretical knowledge, but also by traveling, observing and interacting directly.

Table 5. Activities Carried Out by Participants to Improve Their Cultural Literacy Levels When the Table Obtained

Code	Frequency (n)	Participants (G/B)	Percentage (%)
Trips and travels	7	G1, G2, G4, G6, B2, B4, G8,	%46,67
Utilizing visual and digital resources	6	G2, G3, B1, B4, B5, B7,	%40
Oral history	3	G5, G6, B5	%20
Cultural experiences and events	4	G2, G5, G7, B4,	%26,67
Books and articles	4	G3, B5, B6, G5	%26,67

When the table is analyzed, another factor that the participants think contributes the most to their cultural literacy development is *utilizing visual and digital resources (f6)*. As an example, for this

G2 said, *"I understand visuals, so there was a program called Diyar Diyar Anatolia, I was watching that program. Watching those videos and programs added a lot to me culturally. At the same time, I enjoyed learning."* She thinks that the information she obtained from a television program she watched developed her culturally. Another participant who supported this development method said, *"When I was little, there were cultural programs on Minika Go and TRT Çocuk, and I liked to listen to and watch them. I think that such programs support multiple learning environment because they appeal to both visual intelligence and auditory intelligence, and I think they are more memorable things, they provide permanent learning, thus enriching the learning environment (G7)."*

Some participants mentioned that they try to improve themselves through reading and research. One participant, who achieved this development through *books and articles (f4),* stated that he was especially interested in historical information and for this reason, he tried to integrate the information he gained by reading articles containing historical information into the field of social studies, *"I am very interested in history, so I read a lot of articles. I try to integrate the articles I read in history into the field of social studies. (B6)".*

Another participant mentioned the importance of cultural books in learning about different cultures by saying that she used book reading as one of the tools to improve her cultural literacy, especially by reading books that talk about different cultures, *"I also like reading books, I read a book by a Greek author about the culture in his own country as a book that talks about different cultures. I can give an example of this. (G3)".*

Another method used by the participants to improve themselves in the field of cultural literacy was oral history. Participants emphasized the importance of the culture that is passed on from elders to young people through oral history and the importance of this cultural transfer, especially through family conversations: *"Simply put, culture is*

passed on from elders to young people in an oral way. I like it more that way and I try to be active in terms of participating in this, whether it is my family, family conversations or a collective activity, and when we come together with people younger than me, I try to share my own thoughts and ideas with them and try to transfer them to them in some way. (G5)" emphasizes the importance of oral history in terms of cultural transmission.

Another participant said, *"I am very interested in the things I hear orally from my elders. For example, my grandfather has many history books, and since history is a field that interests me a lot, we constantly have conversations with him on history and its field. (B5)."* She states that she develops her cultural literacy through oral history. She states that she developed herself culturally through the historical information she heard from her elders and the conversations she had with them.

Some of the participants emphasized cultural experiences and activities as a factor that supports the development of cultural literacy*: "I went to a folk dances course that included different cultures and learned different dances and games. This added a lot to me culturally and at the same time I was having fun while learning. (G2)"*, emphasizing that such activities offer the opportunity to learn cultural diversity and are also a fun experience.

Characteristics of a Culturally Literate Teacher

According to the findings obtained in the research, the characteristics that a culturally literate teacher should have are given in Table 6 below.

Table:6 Characteristics of a Culturally Literate Teacher

Code	Frekans (n)	Participants (G/B)	Percentage (%)
Cultures Respectful	9	G1, G2, G3, G6, G5, G7, G8, B2, B3	%60
High Communication Skills	8	G2, G3, G4, G6, G7, G8, B3, B5	%53,33
Empathy and Tolerance	7	G3, G4, G6, G7, G8, B3, B5	%46,67
Inquisitive, curious	6	G2, G3, G6, B1, B2, B5	%40
Adaptation Skills	6	G3, G5, G6, G8, B3, B4	%40
Knowledge Transfer	5	G1, G2, G3, G4, B2	%33,33
Consistency	4	G7, B7, B6, G8	%26,67
Social Awareness	5	G4, G6, G7, B5, B7	%33,33
Patriotism	3	G6, B5, G8	%20
Ability to analyze and associate	3	G8, G6, G7	%20

According to the findings, a culturally literate teacher does not only convey information to his/her students; he/she should also have the ability to understand and respect different cultures and embrace this diversity with tolerance. According to the views of the participants, a teacher with high cultural literacy should primarily have cultural awareness, be respectful towards different cultures, empathetic and a good communicator. A teacher needs to adopt a researcher's identity in order to establish a true connection with his/her students and guide them to understand different cultures. At the same time, the teacher's respectful approach to different cultures depends on transferring this knowledge to his/her students in an accurate and consistent manner. When the opinions of the participants supporting the findings of the research are analyzed;

"I think a teacher with high cultural literacy should first of all be a patriotic teacher. He/she should not see his/her own culture as superior to other cultures, he/she should tolerate all cultures. They should have high communication skills, good diction and eloquence. It should connect the student to the lesson and guide the question marks in the student's mind. They should be able to make comparisons between old and new cultures, make comparisons between the past and the future, and know how to pass this on to their students; in other words, the ability to understand time and chronology should be in the teacher and then passed on to the student.(G6)" G6's statement reveals that cultural literacy is a multidimensional competence area and that this competence is not only limited to sensitivity to cultural diversity, but should also include the personal, communicative and historical perspective of the teacher.The participant's emphasis on "patriotism" and "not seeing one's own culture as superior" indicates that the teacher should exhibit a tolerant and egalitarian approach towards different cultures while preserving his/her own identity. This approach shows that cultural literacy not only supports interpersonal relations but also social peace and cultural harmony processes. In addition, the emphasis on communication skills, diction and oratory reveals that cultural literacy also includes linguistic and interactional dimensions in order for the teacher to effectively manage classroom interaction and establish a strong bond with students. The participant's reference to the concepts of time and chronology shows that the teacher should have the competence to evaluate cultural elements in a historical context and that this skill can serve to develop historical thinking skills in students by establishing meaningful links between the past and the future. In this context, cultural literacy is considered not only as a level of awareness but also as a comprehensive professional competence that shapes a teacher's pedagogical stance.

"If I, as a person from Antalya, am assigned to a village in the east, I may not be able to place my culture there, but I can exchange with the culture of that place. I need to adapt there. Therefore, a teacher should be able to manage the adaptation process well and be open to innovations. They should not be timid by saying 'I don't know this', they should be hungry to learn, and their identity as researchers and observers is very important. Students are more interested and affectionate towards sincere teachers. Therefore, it is important to be a teacher who can also win the love of the students. Everyone should be treated with respect and love without discriminating between Turks and Kurds."(B3). B3's views show that cultural literacy is closely related to the basic adaptation and communication skills required in the teaching profession. The participant's emphasis on "interacting with the other culture instead of trying to implant one's own culture" reveals that cultural literacy is a two-way learning and exchange process. In this context, it is stated that the teacher should show sensitivity to the local context and see cultural interaction as a mutual learning experience rather than a one-sided transfer process. The participant's emphasis on concepts such as "adaptation", "openness to learning" and "observation" shows that cultural literacy is not a static accumulation of knowledge but a

dynamic process. The teacher's development of a researcher and observer identity in this process makes it possible not only to recognize cultural differences but also to integrate these differences into the educational process in a meaningful way. Moreover, the participant's statement that students are more interested in friendly teachers shows that cultural literacy has a direct impact on pedagogical relationships. Finally, the statement "approaching everyone with respect and love without discriminating between Turkish and Kurdish" emphasizes that cultural literacy involves not only cultural awareness, but also an ethical stance and an inclusive attitude.

Conclusion, Discussion and Recommendations

This study aimed to analyze pre-service social studies teachers' views on the concept of cultural literacy, how they define the concept, how they relate it to the social studies course, and their perceptions of individual competence in this subject.In line with the data obtained, it was revealed that pre-service teachers defined the concept of cultural literacy largely through "recognizing, knowing and maintaining one's own culture"; however, they also gave limited importance to components such as recognizing different cultures, developing cultural awareness and tolerance.

Most of the participants stated that cultural literacy is very important for the social studies course.Especially in the context of the "Culture and Heritage" learning area, it is emphasized that cultural literacy is one of the basic building blocks of the course.However, another noteworthy finding is that the participants stated that they were generally introduced to this concept for the first time during this research process, so they did not think that this topic was systematically covered in their educational life.

This shows that pre-service social studies teachers have interest and sensitivity in cultural literacy, but this issue is not sufficiently supported both theoretically and practically.Participants mostly stated that they preferred direct experience and observation to develop their cultural literacy.This shows that cultural literacy develops in individuals not only through academic knowledge but also through a process based on experience and observation.

Similarly, in the study conducted by Kafadar and Şan (2021), it was stated that pre-service teachers defined cultural literacy more in the individual cultural context, and that there were deficiencies in their knowledge and empathy skills towards different cultures.he common point in both studies is the pre-service teachers' perception of themselves as insufficient in cultural literacy and their criticism that this area is not sufficiently covered in their education processes. İbrahimoğlu's (2017) study examines how pre-service social studies teachers perceive the concept of culture and their approaches to different cultures. The self-culture-oriented approaches of pre-service teachers towards the concept of cultural literacy were also emphasized by İbrahimoğlu (2017) in the literature. In both studies, it was stated that pre-service teachers' competencies towards different cultures were limited and that they experienced deficiencies in their education processes in this regard. However, in this study, it is seen that candidates emphasize practical activities for their cultural development (Akman & Orhon, 2025; İbrahimoğlu, 2017).Based on the findings of this study, it can be said that cultural literacy should be addressed more structurally in teacher training programs.In this context, it is suggested that cultural literacy training should be structured as a separate module in teacher training programs and that this content should be directly integrated into the social studies curriculum.As Hirsch (1983) argues, the

systematic transmission of shared cultural knowledge facilitates not only academic achievement but also the social integration of individuals.

It is seen that pre-service social studies teachers' perceptions of cultural literacy largely focus on recognizing their own cultures. However, this may be insufficient in terms of understanding different cultures and developing intercultural interaction skills' this context, the three-dimensional cultural literacy scale (cultural awareness, competence and construction of knowledge) developed by Kıvrak, Özden and Erbaş (2023) should be integrated into education programs to support the development of pre-service teachers' multidimensional cultural literacy skills. Thus, cultural literacy will turn into a comprehensive learning process that includes not only knowledge-based but also behavioral and attitudinal dimensions.

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Project Teaching and Chemical Experiment in Pedagogical Practice Within Supplementary Pedagogical Study

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Abstract: The main goal of the supplementary pedagogical education at the Slovak University of Technology in Bratislava is the preparation of teachers of vocational technical subjects in secondary schools - ISCED 3. Teachers of vocational subjects must be prepared in such a way that their professional profile respects, on the one hand, the requirements of educational and industrial policy and the concept of employment in the Slovak Republic. On the other hand, professional profile has to be compatible with the requirements for teacher education within CEDEFOP, the umbrella organization for the education of teachers of vocational subjects within Europe. All elements of the didactic system within the supplementary pedagogical education, their selection or modification, are meaningfully subordinated to this goal. The result of this effort is a teacher with a qualitatively desirable range of competences, where pedagogical practice stands at the top of the competence spectrum. This article deals with the implementation of such pedagogical practice within the supplementary pedagogical education, which created a meaningful bridging of high school and university teaching through project teaching. The teaching practice took place at the Faculty of Chemical and Food Technology of the Slovak University of Technology in Bratislava. However, high school students participated in the solution of a specific project assignment. Worksheets and methodological procedures for teachers were developed for this project. Thus, the project task became not only a strong motivational tool for the implementation of a specific chemical analysis, but the project also had a significant secondary motivational effect. The project motivated high school students to study at university and at the same time to study chemistry, which is one of the least popular subjects due to its difficulty

Keywords: Learning 1, Motivation 2, Project Teaching 3, Chemical Experiment 4

Introduction

Man and his admirable wisdom, enhanced by the drive to push the boundaries of the unknown, was the primary determinant of the scientific and technological revolution that, from the end of the 19th century to the present, has given the reality of existence entirely new coordinates. It began with electrification, the first automobiles, the

development of the chemical and aviation industries, large-scale mechanical production, electrical engineering, and has continuously led to the world of computers, information technologies, and artificial intelligence as we know them today.

Alongside progress in technical and natural sciences, the direction of the human sciences also evolved. Pedagogical and psychological sciences created the necessary foundation for the quality of educational systems. Education and teaching could not ignore the challenges of the technical and natural worlds; significant qualitative changes in education were a clear response to a changing world. Ideas of progressivism, constructivism, and a whole spectrum of alternative approaches (Montessori movement, Waldorf school, Dalton plan, Winets system, Keller plan, Mastery Learning, etc.), as well as project-based and problem-based learning, were tangible responses to progress in the natural and technical sciences. The humanities, through their transformation, responded by creating an educational system that would prepare students for the challenges of the modern technical and scientific world. Modern teaching concepts became an effective tool for the development of critical thinking and practical skills, which are essential for success in technical and natural science fields.

The main goal of the supplementary pedagogical study program for graduates of the Faculty of Chemical and Food Technology at the Slovak University of Technology in Bratislava is to acquire the qualification prerequisites for teaching specialized subjects in the fields of chemical and food technology. Graduates of this faculty, who return to schools as teachers of specialized chemical and food-related subjects after years of professional practice, will gain theoretical knowledge and practical skills in pedagogical-psychological, socio-scientific, and subject-specific didactic disciplines. The latest findings about the possibilities of innovating curricula in chemistry and food technology and their effective and creative didactic transformation into student competencies drive their professional qualification. Partial cognitive objectives of the study are defined at two levels – goals in the area of knowledge and goals in the area of skills.

The lower-level objectives are represented by the following goals:
- Explain the principles of psychological development and the individual peculiarities of a high school student.
- Describe methods and tools for identifying developmental and individual characteristics of a student.
- Describe learning styles and other characteristics of students that influence learning.
- Describe methods and tools for identifying learning factors.
- Describe methods and tools for identifying student characteristics influenced by the socio-cultural environment.
- Understand the theoretical and practical relationships of subject-specific didactics in their specialization in relation to lesson planning; know the curriculum of taught subjects and their didactics.
- Explain basic curricular documents and the methodology of their creation.
- Describe the procedure for lesson planning.
- Define and classify material and non-material teaching tools.
- State the criteria for the didactic effectiveness of teaching aids.
- Explain learning theories as a basis for selecting an appropriate teaching model.
- Describe strategies for personal and social development of students, including students with special needs.

- Describe methods for obtaining diagnostic data on a student, principles of diagnosing, and stages of the diagnostic process.
- Describe the diagnosis of internal teaching conditions.
- Describe types and methods of assessing the process and outcomes of teaching.
- Describe the roles, types, and phases of self-reflection, the goals of self-reflection, and self-assessment.
- Describe methods of self-reflection and self-evaluation.
- Describe current trends in their field, in information technology, and in the area of education and teaching.

The goals in the area of competencies can be characterized as follows:
- Identify developmental characteristics of students using appropriate methods and tools, interpret them, and select the appropriate approach for pedagogical interaction.
- Identify individual student characteristics in the area of learning.
- Choose differentiated optimal strategies for working with students with special needs and students from different socio-cultural backgrounds.
- Adapt national educational programs to the specific conditions of the school, class, and students.
- Participate in the creation and updating of the school curriculum.
- Evaluate and select curriculum content relevant to the goals and performance standards, considering the specific needs of professional practice, region, and innovations in the field.
- Identify interdisciplinary relationships.
- Identify structural elements of the curriculum for the taught subject and their interrelationship.
- Independently design the curriculum for the taught subjects and teaching units.
- Didactically transform, interpret, and effectively communicate the core content, methodology, and epistemology of disciplines in their technical specialization.
- Evaluate the universality, durability, and significance of innovations in the field for education in vocational schooling.
- Implement new knowledge practically into the curriculum of the taught professional subject.
- Select and use relevant methods, forms, and material tools with respect to the educational context (objective, subject matter, student).
- Respond flexibly to unforeseen situations in teaching.
- Motivate and communicate effectively with students.
- Ensure a smooth course and pace of teaching, support and develop student activity in the classroom.
- Create a positive climate and prevent problematic student behavior.
- Manage and monitor student learning.
- Use diagnostic methods to understand students, their attitudes, interests, value orientations, relationships with the subject, schoolwork, as well as relationships among students.
- Assess the level of student knowledge and skills using various diagnostic methods.
- Interpret and evaluate the obtained diagnostic data, and propose pedagogical interventions.
- Define areas of reflection and evaluation in one's own pedagogical activity.
- Identify strengths and weaknesses in their own pedagogical work.

- Set goals and methods for their professional growth in accordance with prospective trends in education, school intentions, and professional role.
- Continuously improve their personal and professional qualities.

Teacher Professionalism

Teacher professionalism is developed through pedagogical practice on an ongoing and progressive basis each semester, alongside a wide range of theoretical disciplines, including pedagogy, psychology, chemistry didactics, communication and rhetoric, didactic technology, current trends in education, and professional communication.

After completing the first so-called orientation practice, the student is capable of orienting themselves in the secondary school environment—becoming familiar with the school's history, educational philosophy, connection to professional practice, local environmental specifics, the career opportunities for graduates in the field, the organization of work and the school year, the structure of teaching staff, the school's educational program, the role of chemical and food science subjects in the curriculum, their specifics and interrelations with other subjects, teaching documentation, school plans, and its material equipment. The output is a student record that includes a description of the school's target orientation, an evaluation of the quality of the orientation practice, and the school's approach to the implementation of practice.

Diagnostic Practice

Diagnostic practice occurs in the second semester of the study. After its completion, the student is able to diagnose and assess the teaching process in terms of the quality of the teaching process and the required teacher competencies:

- Teacher readiness for the lesson, strategies used in teaching chemistry and food science subjects, selection, interpretation, and didactic transformation of the curriculum, presentation competencies, management and organizational skills, student performance evaluation, creating a positive classroom climate, authority, preferred approaches, and their relationship to students.
- Understanding students' interests, knowledge levels, attitudes towards learning and subjects, especially in the student's area of specialization, learning skills, learning styles, and the students' background and cultural environment.
- Analyzing students' active involvement in teaching—pacing and fluency, overview, management of study time, providing supportive feedback with an emphasis on the substitution effect, flexibility when changing the lesson plan, adaptability, etc.

Didactic-Projective Practice

In the third semester, the output of didactic-projective practice is the written preparation of lessons and the demonstration of the following pedagogical skills:

- Orienting oneself in both didactically prepared and unprepared sources of knowledge—school educational programs, curriculum, syllabi, textbooks, professional literature, internet sources, etc.
- Performing didactic analysis of the curriculum of a thematic unit and the topic of a lesson.

- Determining and selecting essential elements of the curriculum and appropriately interpreting and organizing them.
- Formulating specific lesson objectives according to selected taxonomy of objectives.
- Choosing appropriate teaching methods and forms for different phases of the lesson and relevant student activities, considering the teaching context.
- Selecting and preparing examples from practice, model examples, tasks, problems, case studies, formulating questions, etc.
- Based on knowledge of the school's material resources, selecting and appropriately integrating didactic techniques, teaching aids, worksheets, tables, etc., into the lesson.
- Time-managing the didactic cycle of the lesson.
- Preparing a didactic test for the selected thematic unit with the appropriate mathematical characteristics.
- Creating a computer presentation of the curriculum.

Integration-Implementation Practice

Integration-implementation practice is the highest level in the taxonomic hierarchy. The student is capable of independently carrying out planned lessons within the taught chemistry and food science subjects, demonstrating the following pedagogical skills:

- Being able to motivate and maintain students' attention.
- Interpreting and presenting the curriculum with meaningful didactic transfer, applying didactic principles and principles of rhetoric and communication.
- Using optimal and diverse teaching methods, forms, and material resources.
- Fluently and purposefully managing and organizing their own activities and students' activities.
- Creating a positive atmosphere and maintaining classroom discipline using legitimate—pedagogically, psychologically, and didactically justified and proven—methods.
- Sensitively evaluating students' efforts and assessing their ongoing and final performance using optimal diagnostic, control, and evaluation procedures, consciously applying the substitution effect.
- Critically evaluating their own activity and continuously improving it based on conceptualization and feedback from students and the supervising teacher, with the output being a written self-reflective analysis of each lesson.

The gradation of pedagogical practice culminates in meaningful teacher competencies that become an integral part of the teacher's personality. In the case of chemistry teachers, it is extremely important that the desired teacher competencies counterbalance the indifference or even aversion to the subject of chemistry, which is unfortunately typical of many high school students today.

Chemistry as a Subject of Disinterest

Chemistry is one of those subjects considered essential for understanding natural processes that affect our everyday

lives, yet it is also viewed as a difficult and abstract discipline. Chemistry adds a "molecular or atomic dimension" to reality. It requires excellent abstract thinking, a high degree of imagination, and the ability to create meaningful mental models. Given the long-standing trend of diminishing students' mathematical knowledge and logical thinking skills, chemistry has become an unattractive subject, as mathematics is needed in many chemical topics as a tool that enables reaching the desired outcomes. This negative intersection of chemistry and mathematics exacerbates the disinterest in studying chemistry, which is reflected in the long-term quantitative decrease in the number of students at the Faculty of Chemical and Food Technology at the Slovak University of Technology in Bratislava, with consequences for quality (Pricea, W. S., and Hill, J., O. 2004).

Expressed in the words of high school students: "Chemistry is interesting, but an extremely challenging and difficult subject that I don't understand at all, so I don't want to study it!"

For many students, it can be difficult to understand complex chemical reactions, molecular structure, or the laws that govern chemical processes. Traditional teaching methods, which focus mainly on theoretical lectures and memorization of information, can lead to frustration and misunderstanding, which diminishes interest in the subject. Therefore, it is essential that chemistry teaching does not remain on a theoretical level but gives students the opportunity to apply their knowledge in practice (Mahedo, M. T. D. and Bujez A. V. 2014). One possibility is project-based teaching. Project-based teaching, which involves real experiments, allows students to see the concrete results of chemical reactions, significantly increasing their motivation and interest in the subject. In this way, chemistry becomes not only more understandable but also more attractive, contributing to a better understanding of its importance and practical use in everyday life.

In the 2023/24 academic year, we decided to conduct the pedagogical practice in the fourth semester of the supplementary pedagogical study as project-based teaching for high school students (ISCED 3) on our university campus, directly in the laboratories of the Faculty of Chemical and Food Technology in Bratislava. We expected that this project-based teaching would have a double positive synergistic effect—it would enhance professional teacher competencies and contribute to the positive motivation of high school students for future studies of chemistry at the university.

Project-Based Teaching

Project-based teaching has been established for over a hundred years as an effective and innovative method of education that differs from traditional teaching in that it emphasizes active student participation in practical, interdisciplinary tasks. This approach allows students to better understand the theoretical foundations and their application in real-world conditions. Project-based teaching is a pedagogical concept that focuses on solving complex problems through real projects, in which students are active participants in the learning process. This approach fosters independence, creativity, and the development of critical thinking, in line with modern trends in education. The use of project-based teaching in chemistry has specific advantages, as chemistry, being a natural science subject, not only involves theoretical knowledge but also laboratory practice, which is essential for understanding basic principles. Project-based teaching in chemistry allows students not only to apply theory in practice but also to see how chemical

reactions and processes take place in the real world.

Project-Based Teaching from the Perspective of the Student's Personality

- Respects the uniqueness of the student—abilities, interests, and individual needs

- The student is at the center of the process, naturally engaging in it

- Stimulates the student's curiosity and imagination

- Increases the attractiveness of teaching, associated with an intense experience

- Contributes to the student's self-realization

- Provides more space for self-expression and formulation of thoughts

- New knowledge is more firmly retained in memory

- The need for peer acceptance is naturally shaped by group work

Project-Based Teaching from the Perspective of the Teacher's Personality

The teacher becomes a friend, a partner who helps the student acquire new knowledge and skills.

- Facilitator – does not lecture but guides students to discover.

- Mentor – provides feedback and helps teams solve problems.

- Observer – evaluates not only the output but also the learning process (Tran, V. D. 2014).

Project-Based Teaching from the Perspective of the Content

- The curriculum is not the goal, but a means of developing interest, abilities, and creativity

- Realization of meaningful conceptualization

- An active process of defining concepts—the process of knowledge is a balanced and internally harmonious connection of practice, theoretical concepts, and methodology of thinking

- Modifiability of content

Project-Based Teaching from the Perspective of Organization

- The choice of methods and forms is subordinated to the emphasis on collaboration and student activity

- The chosen means teach tolerance, respect, communication, cooperation, and conflict resolution

- The student has the opportunity to intervene in their selection

- Responsibility for the results is much more shifted to the student

- The organization of teaching supports the interdisciplinarity of subjects

- Competitive strategy is replaced by a highly effective cooperative strategy (e.g., Nizwardi et al., 2017).

Acidimetric Determination of NaOH

The main objective of the project was to design a methodological procedure for a chemistry lesson focused on analytical chemistry procedures—specifically acidimetry—by determining NaOH in a technical product through project-based teaching with elements of an excursion. This form of project-based teaching expanded the possibilities and methods of acquiring knowledge and competencies for high school students in the subject of chemistry.

Project description

The project-based teaching took place at the Slovak University of Technology (STU) over two teaching days and focused on the practical application of chemical principles in real-world conditions. During these two days, students from vocational high schools, under the guidance of university professors, participated in the experimental measurement of sodium hydroxide (NaOH) concentration in crude oil.

Each teaching day lasted 4 teaching hours, divided into two parts, each consisting of 2 hours of work. There was a short 15-minute break between these blocks for rest and preparation for the next part of the experiment. A total of 24 students participated on each teaching day, divided into two groups of 12 students. This model allowed for the division of tasks and efficient monitoring of the experiment's progress for each group. Each group focused on different aspects of the experiment, from sample preparation to measurement and analysis of results.

No prior homework preparation was required for the project-based teaching. However, participation in the project required knowledge of the chemistry curriculum taught in high school. This meant that topics such as chemical reactions, analytical methods, and basic laboratory techniques were already covered in the standard high school chemistry curriculum. This approach ensured that students had sufficient theoretical knowledge to effectively engage in the practical experiments without needing additional explanations of basic chemical principles during the project. The project-based teaching took place individually (each student worked on their task independently) with the opportunity for cooperation between students throughout the project. The individual form of conducting the experiment was chosen to develop skills in the chemistry laboratory and support meaningful self-reflection (e.g., using a burette, pipette, and standard solutions). The theme of the project-based teaching was not revealed to the students in advance; they were surprised, and their curiosity served as the motivation. The entire work for the project-based teaching was divided into three phases: preparatory, implementation, and evaluation.

The main task prepared for the laboratory exercise (project) was an acid-base titration exercise, specifically the acidimetric determination of NaOH content in a technical product. An interesting aspect of the entire project is the interdisciplinary connection between the subjects of chemistry (neutralization reactions), physics (color spectrum changes), mathematics (calculations for determining the analyte in the sample), and engineering (practical exercises, working with glassware).
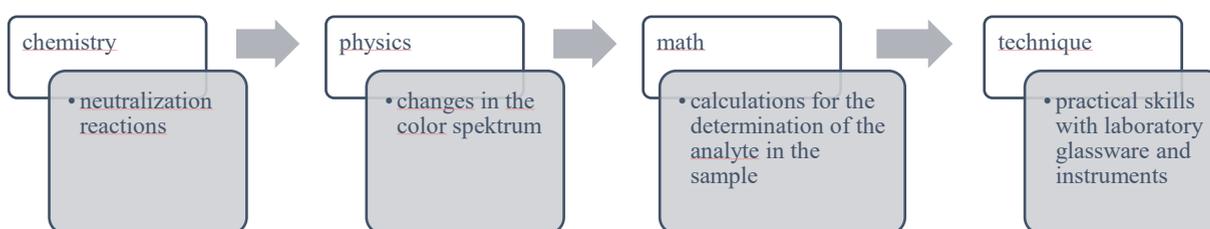
Figure 1: Interdisciplinarity of Project

Preparatory and Implementation Phases of the Project

In the preparatory phase, it was essential to formulate the objectives, select the topic, and create the problem-based task. To engage the students from the outset, the topic was based on a real-life example. The students were introduced to the role of chemists in the analytical laboratory of a private company, where samples of NaOH were sent from Slovnaft (the largest refinery in the country) to verify whether they were in proper condition due to concerns about improper preparation. The students had to approach the task responsibly, as the correct outcome depended on the further production of a large quantity of products and the potential for significant economic losses, as well as the good reputation of the company they were working for.

It was important to assess the students' capabilities, assuming that they had knowledge of neutralization reactions and could perform basic chemical calculations. Therefore, students from the third year of a bilingual high school were chosen. Equally important was assessing the material and technical equipment, designing tools, preparing the laboratory, necessary chemicals, glassware, and protective gear, and evaluating the Health and Safety requirements for the chemicals with which the students would be working.

Figure 2: Worksheet for the Students

The next step was to prepare worksheets for the students, a methodological procedure for the teachers, break down the main topic into smaller subtopics, and create a time schedule for the project-based lesson. The preparatory phase also included studying the topics in detail, estimating possible questions from students, and preparing to answer them. The worksheet was prepared in a simplified form for the students and in a more detailed form, including the refined me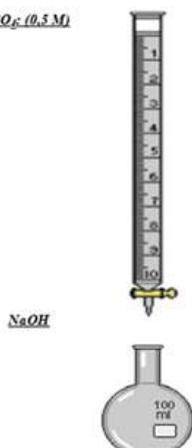thodological procedure for the assistant teachers. The assumption was that the worksheet would be filled out by the students during the project-based teaching. The worksheet was structured as follows.

A key assumption for correct calculations was the accurate stoichiometrically balanced chemical equation and the basic formulas for calculating the amount of substance. The teacher needed to clarify concepts such as the amount of substance, molar mass, Avogadro's constant, and the relationships between them. They also needed to be sure about units such as mol, kg/mol, g/mol, etc. Additionally, the teacher should pre-calculate the entire process to be able to quickly respond to student questions and identify errors in their calculations.

In preparing for potential student questions, the teacher, besides studying neutralization reactions, calculations, descriptions of laboratory glassware, correct pipetting procedures, and solution preparation, needed to gather information about Slovnaft, knowing basic characteristics of the industrial giant. The teacher also had to be prepared for the topic of acid-base indicators and explain why they change color.

The main theme of the project-based lesson is acid-base titration. Within this theme, it was necessary to consider several subtopics that needed to be explained clearly to the students, guiding them step by step through the practical execution. The first subtopic is the industrial chemical production in Bratislava, Slovnaft, what is produced there, the transition to NaOH production, and the role of testing analytical laboratories. In the second step, the issue of titrations, acid-base titrations, the neutralization reaction between NaOH and H_2SO_4, and the Tashiro indicator, its function and why it changes color, were discussed. Safety and health protection procedures were also explained. The third subtopic describes laboratory glassware, its technical names, and proper usage. The fourth part discusses solution preparation, explaining what quantitative transfer of a sample means, and the students practice working with a burette, learning how to correctly perform a titration. In the fifth part, the lead teacher focuses on calculations. In the sixth part, the results of the calculations are logically justified, determining whether they pertain to the original sample or if they are partial. The final part involves evaluating the results, comparing them to real values, and discussing where potential errors might have occurred, encouraging group-wide discussion. In the final phase of the project, the laboratory is cleaned, students provide feedback, and they take home the completed protocol along with the knowledge gained.

Evaluation Phase of the Project

During the evaluation phase, students received individual feedback in the form of result verification. Small deviations were considered insignificant, provided that one of the three values for the volume consumption of the titrant was significantly different from the others; it was excluded from the calculation. The students achieved very satisfactory results and gained proper laboratory experience. However, to reinforce their skills, the task would need to be repeated multiple times at longer intervals, as confirmed by a study on seven-step project-based learning, which showed that

three consecutive repetitions significantly contributed to the improvement of the students' knowledge and skills (Nizwardi, 2017).

Students also evaluated their work by writing conclusions in the protocol, assessing whether the experiment was successful, to what extent, what difficulties they encountered, and where mistakes may have occurred. At the end, the teacher assessed the students' practical work, and praise was not withheld as they showed real skill. The work of the individuals was also evaluated, and they were praised for their cooperation within the group. The evaluation phase partially overlapped with the implementation phase, as it was necessary to assess the partial goals that the students achieved through acquiring practical skills. Students continuously provided feedback through their interest, questions, discussions, and comments. The atmosphere in the laboratory was creative and relaxed, while also maintaining discipline, with humor present throughout.

Discussion

The chosen theme of the project-based teaching captured the students' attention, and they worked with interest. The topic was appropriately chosen, interdisciplinary, and cross-cutting. The project-based teaching ensured the simultaneous fulfillment of several key objectives in the chemistry subject. Students were introduced to the importance of chemical knowledge for humans by linking theory with practice. The project-based teaching contributed to achieving general educational goals, developing key competencies, and helped students gain practical laboratory skills, as well as social competencies through group discussions and a willingness to assist one another. Project-based teaching also developed scientific literacy and the ability to understand technical texts. Students learned to read and comprehend protocols and perform experiments based on them. They learned, for example, what it means to quantitatively transfer a sample and adjust it to the required volume. They gained the ability to independently apply their knowledge to real-world tasks while developing logical, critical, and creative thinking. They acquired essential manual skills that they will be able to use in everyday life. To successfully complete the project task, each student had to be active throughout the entire process. Project-based teaching deepened their pre-existing knowledge and guided them toward independence and responsibility for their own results, as well as for the success of the entire group.

Benefits for Students

- Development of Critical Thinking: Students learn to analyze, evaluate, and solve problems, which is a key skill in modern education.
- Practical Application of Theory: Through practical experiences, students gain a better understanding of chemical reactions and processes, enhancing their ability to apply theoretical knowledge in practice.
- Improvement of Team Collaboration: Project-based learning requires teamwork, enabling students to develop communication and organizational skills.

Benefits for Teachers

- Innovative Teaching Methods: Project-based learning allows teachers to apply modern pedagogical approaches, contributing to their professional development.

- Increased Student Motivation: Teachers observe higher engagement and motivation in students when involved in real-world tasks.
- Comprehensive Assessment: Project-based learning allows teachers to assess students not only on theoretical knowledge but also on practical skills and problem-solving abilities.

Benefits for the Broader Community

Project-based teaching in chemistry has broader societal significance. Students who participate in such projects are better prepared for future employment in technical and scientific fields. These practical experiences help them better understand the world around them and contribute to the development of critical thinking, which is essential in today's society, facing numerous environmental, technological, and social challenges.

Opportunities for Project Improvement

Although project-based learning offers many advantages, there are areas that could be further improved:

- Ensuring Adequate Equipment: Especially in fields like chemistry, project-based learning requires specific laboratory equipment. Universities and schools should invest in high-quality laboratory devices that allow students to work with modern technologies.
- Enhancing Collaboration Between Schools and Universities: For project-based teaching to be even more effective, cooperation between secondary schools and universities should be improved to facilitate better knowledge and experience transfer.
- Focus on Software Tools Skills: For more complex analyses and data processing, students should be better prepared to work with various analytical tools such as statistical programs or software for processing experimental data.

Conclusion

Project-based learning in chemistry at the level of secondary vocational schools represents a very effective way to connect theory with practice, thereby developing students' abilities that are essential for their future professional lives. Experiences from our activities at the Slovak University of Technology have shown that this approach not only increases students' motivation and improves their practical skills but also presents new challenges and opportunities for teachers. With further support in the areas of equipment, cooperation between schools and universities, and a focus on modern technologies, we can further enhance this educational approach, which has the primary potential to positively impact educational systems at all levels with secondary influence into the future.

The future of society is determined by many factors, whose hierarchy has, depending on the evaluator, always different arrangements. Despite the apparent diversity, there are universally valid or universal characteristics identifiable in all hierarchies. These are characteristics whose common denominator is identity. The identity of a person is a multiple construction consisting of four complementary elements: personal, social, aspirational, and dissociative identity.

The identity of young people at each stage of social or historical development is a synergistic outcome of the influence of family, education (formal, informal, and non-formal), and external social conditions. In the confrontation of the

future with the past, the painful contours of the values of current existence are revealed. The contemporary civilized world has lost sight of what Plato in antiquity called the Good, represented by the symbiosis of truth, temperance, and beauty, Aristotle as eudaimonia, Comenius in the 17th century as wisdom as a virtue or wisdom as an ethical category, and Kant at the end of the 18th century as the moral imperative. Wisdom or professionalism in the 21st century needs to have not only a dimension of rationality but also a dimension of ethics. The knowledge society as a technical term will find real application in everyday life only under the condition that ethical or moral principles become goals of life in themselves. In the process of transforming ethical principles into life goals, teachers, in addition to parents, play an irreplaceable role. Teachers of all subjects — both technical and natural sciences, and at all levels of education — must guide their students along the line of applying goodness, which asks for nothing and sets no conditions. Unconditional goodness. The result of such influence is an infinitely expanded sense of responsibility, which may have a chance to slow down or even completely stop the commercial race of man with himself. Responsibility that restores meaning to human existence in the sense of Aristotle's concept of "the good life." Aristotle's good life is transformed in the process of education and learning into a thorough effort by teachers to prepare the next generation for life in such a way that they are able to move life roles from the dimension of utilitarianism to the creation of a meaningful dimension of what is desirable or necessary.

The dynamics of phenomena in the teaching profession, its integrity, and complexity cannot be mastered without adequate knowledge, skills, and desirable attitudes. Professional preparedness alone is not enough, just as enthusiasm and selflessness alone are not enough. The common denominator ensuring success is the connection between professional preparation and personal involvement with a sense of responsibility. Responsibility toward oneself and one's environment, responsibility toward the profession.

Notes

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The State of Mental Health Program Implementation in Secondary Schools

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Abstract: This study aimed to determine the level of implementation of school mental health programs in the secondary schools of the Cabadbaran City Division. A sample of 46 participants was purposively selected from the different public high schools in Cabadbaran City. Survey questionnaires were used to gather the data for the study to determine the level of implementation of mental health among the high schools of Cabadbaran City. The study used six indicators to evaluate how well mental health programs are being implemented. The data from the respondents revealed that a lack of implementing guidelines, a lack of resources, proper training, and a lack of curriculum integration are the main challenges they face in implementing mental health. The study revealed a moderate implementation of the mental health program at the school level. In light of the findings, improving the implementation of the mental health program is a top goal.

Keywords: mental health, level of implementation, mental health program, secondary schools

Introduction

Mental health is a state of mental well-being that helps people cope with stresses, understand their abilities, learn, work, and contribute to the community (WHO). It was observed that many of the students who are facing a mental health crisis are hesitant to call for help. This problem can become more critical if not addressed, prevented, or detected early. This is supported by Malolos et al. (2021), who state that children are among the most vulnerable population in society and that childhood is the crucial period during which most mental health problems begin.

Educational institutions play a crucial role in promoting mental health and emotional well-being among students. They not only contribute to the prevention of mental health issues but also provide a supportive environment for identifying and assisting children who experience emotional challenges (WHO). Schools promote students' mental health and well-being through education, prevention, and early intervention. These strategies can reach many youth and reduce the impact of negative experiences, thereby improving students' health and overall well-being (Centers for Disease Control and Prevention, 2025). Prioritizing mental health support in schools is essential, as it is vital to students' overall well-being. When these needs are overlooked, it can lead to serious challenges in their ability to

thrive at home, in the classroom, and their communities. Investing in mental health strategies within educational settings is beneficial and necessary for fostering a healthier, more successful generation (ACMH, 2024).

Adolescents may have difficulties resulting from insufficient adjustments due to the incompatibility between their mental and physical development, as they undergo rapid physical and cognitive changes at this stage. Further psychological issues and even deviant actions may result from these issues. In today's culture, stress has ingrained itself into daily existence as a physiological reaction to a perceived threat. Stress can be seen as a collection of neurological and physiological processes that fulfill an adaptive purpose, and it has detrimental consequences on life's events and circumstances, according to Chu et al. (2024).

In schools, the Department of Education addresses mental health issues and concerns by conducting mental health awareness through the Oplan Kalusugan sa DepEd flagship programs. It aims to promote mental health awareness about the different mental health issues, assessing and identifying learners at risk of mental health issues, and a proper referral system to those who were identified as having mental health issues. According to Wainberg et al. (2017), mental health care suffers from stigma, lacks access to high-quality mental health services, human resources, referral delivery issues, and implementation issues. These observations motivated us to question the school mental health program implementation level. This is because the school mental health program is crucial to improve and or minimize the mental health issues arising among the learners.

The school mental health program is inconsistent in its implementation across all schools nationwide. Most mental health issues carry the risk of taking their own lives. According to the data gathered by Philstar, the Department of Education's 2021 data shows that hundreds of learners have died by suicide, while thousands have attempted suicide. It also shows that only a few among the thousands of schools conducted and celebrated mental health awareness programs. The lack of implementation of mental health awareness is crucial to the learners who are at risk. Thus, questions can be raised about implementing the mental health awareness program in schools. Mental health issues can only be addressed if the program is implemented correctly. Hence, this study seeks to assess the implementation of mental health awareness programs in schools by addressing the research question: What is the level of implementation of mental health programs in high schools?

The level of implementation of the mental health awareness program plays a significant role in the learners' mental health. So, the focus of the discussion is the level of implementation of the mental health awareness program. The school head, mental health coordinator, and guidance advocate were responsible for promoting mental health awareness to the learners. This study was influenced by the School Mental Health Theoretical Framework of Cavioni et al. (2020).

School Mental Health Theoretical Framework consists of three domains: school mental health, the related environmental context, which includes the family and community, and policy. The primary topics are thoroughly covered in connection with the various developmental systems and mental health consequences. They describe the promotion of social and emotional learning (SEL), which shows that the SEL programs received positive feedback about improved social-emotional skills, increased self-worth and school connection, improved classroom behavior,

increased academic motivation and performance, and decreased conduct issues, bullying, and aggression as well as emotional distress like stress, anxiety, and depression. In addition, the studies related to the promotion of resilience have reported positive results with improved resilience outcomes, stress management, coping skills, social and emotional competence, and learning interest and decreased anxiety, depression, and risk-taking behavior (Cefai et al., 2018; Fenwick-Smith et al., 2018; Pearsall et al., 2015; Meschke & Patterson, 2003; Twum-Antwi et al., 2020; Ungar, 2028).

Furthermore, the prevention of behavioral, emotional, and social problems in schools usually deals with depression, anxiety, social withdrawal, substance use, self-harm, rule-breaking delinquency, and aggressive behavior. In the intervention program, a significant decrease in mental health problems was found. It showed that the intervention program had been effective and lasted almost one year of follow-up (Wilson et al., 2003). Lastly, this framework emphasizes collaboration and cooperation between the developmental systems, the family, and the community, significantly promoting school mental health. It also intensifies the cooperation of the policymakers to guarantee its effectiveness by making it more sustainable, especially in schools. The sustainability of any program is best if everyone cooperates and collaborates to maintain and uphold the effectiveness of school mental health programs. Every program must be connected to the existing mental health education policy and buoyed by the local and national policymakers to have the best and lasting positive results.

Method

Research Design

A quantitative evaluation research design is used in this study, specifically the outcome evaluation research, since it concerns the implementation level of the mental health awareness program. The design is often referred to as program evaluation. Outcome evaluation measures the effectiveness of programs, projects, and resources allocated to a specific project or objective. This research design effectively utilizes social research methods to gather and analyze valuable insights, which can enhance our understanding of organizational processes (Formplus, 2020). A questionnaire is a standard quantitative research instrument deployed in evaluation research. It is used to gather relevant information from respondents. Typically, it aggregates different questions or prompts that help the researcher obtain valuable information from respondents.

Population and sampling

From the population of 46 respondents in 13 public high schools, a sample of 39 respondents, composed of school heads, mental health coordinators, and guidance advocates, was purposively selected. Purposive sampling purposely chooses participants based on their characteristics, expertise, knowledge, experiences, or other relevant criteria. It is a method to ensure all information gathered is meaningful, appropriate, and relevant. Purposive sampling focuses on participants who can provide valuable insights and quality data for research. Hence, we believe that the participants involved in the study had different experiences due to their different backgrounds, geographical area of assignment, and experiences related to the mental health implementation program. Hence, the different roles of the participants impacted the implementation of mental health awareness in their respective schools.

Research Instrument

This study used a survey questionnaire to gather the data and relevant information for this research. There are two parts of the questionnaire: Part I and Part II. Part I of the questionnaire is the profile of the respondents, including names, age, sex, school category, and position or designation. Part II of the survey questionnaire is the set of questions that the respondents are asked to answer. Five options were included in the questionnaire, which used a Likert scale to collect data: strongly agree (score=1), disagree (score=2), neither agree nor disagree (score=3), agree (score=4), and strongly agree (score=5). Survey questionnaires were used to conduct the survey. Researchers created the questionnaire using the expertise of the professionals as a guide. The indicators were: mental health program dissemination, mental health resources, curriculum integration, support systems, monitoring and evaluation, and training and seminars. Each indicator had seven questions to be answered by the respondents.

Results and Discussion

This study assessed the level of implementation of mental health programs in schools. Respondents were grouped by age, sex, school category, and designation. This detailed profiling of the participants promotes understanding of their background and the mental health program.

Respondent Profiles

This section asked the participants their sex, age, school category, and designation. Table 1 presents a comprehensive overview of the survey of the participants' demographic characteristics, specifically their sex, age, school category, and designation. The sex distribution exhibited a notable inclination of women, with 76.9% (30 people) identifying as female. On the other hand, the male population is 23.1% (9 persons). Regarding age, persons between 32 and 37 accounted for a significant portion, 38.5% or 15 individuals. The least among the age range was 5.1% or two individuals. Most respondents come from a small school, 41% (16 persons). Secondly, the medium school had 38.5% (15 people), and the least from the big school at 20.5% (5 people).

Mental health coordinator emerged as the top designation, accounting for 43.6% or 17 participants. Closely followed by guidance advocates, with a percentage of 35.9% or 14, indicating significant alignment. School heads/ principals exhibited the smallest fold, about 20.5% or eight narratives.

Table 1. Profile of Respondents

	Description	N	%
Sex	Female	30	76.9
	Male	9	23.1
Age	26-31 years old	19	25.6
	32-37 years old	15	38.5
	28-43 years old	9	23.1
	44-49 years old	3	7.7
	50-55 years old	2	5.1
School Category	Small	16	41

Designation	Medium	15	38.5
	Large	8	20.5
	Mental Health Coordinator	17	43.6
	Guidance Advocate	14	35.9
	School Head/ Principal	8	20.5

Mental Health Program Dissemination

The table shows the weighted mean of the mental health program implementation level according to the dissemination indicator. In terms of content, the statement "I am aware of the Mental Health Program of the Department of Education" has a weighted mean of 4.60, interpreted as a very high level. This indicates that the respondents are aware of the Mental Health Program of the Department of Education. The statement "I am aware of the Philippine Mental Health Act of R.A 11036 and its mandate to schools, has 4.45, interpreted as very high. This indicates that the respondents know the Philippine Mental Health Act or R.A. 11036 and its mandate to schools. The statement "Mental Health awareness initiatives in my school are inclusive and considerate of diverse perspectives" has a 4.33; even though it is the lowest mean, it is still interpreted as very high. This indicates that Mental Health Awareness initiatives in schools are inclusive and considerate of diverse perspectives.

Based on this result, in Table 2, Mental Health Program Dissemination with overall numerical data of 4.407 is interpreted as a very high level of implementation, which means that the program dissemination was implemented extremely well. According to Harmsworth et al. (2000), there were three ways to think about dissemination: dissemination for awareness, understanding, and action. Results showed that mental health program dissemination was delivered to the schools. The result is supported by Bumbarger & Perkins (2008), who state that better public health outcomes could result from a process that starts with strong randomized trials demonstrating the efficacy and usefulness of preventative programs through dissemination.

Table 2. Mental Health Dissemination

	Question	Mean	Standard Deviation	Interpretation
Q1	I am aware of the Mental Health Program of the Department of Education.	4.60	0.744	Very High
Q2	I know the Philippine Mental Health Act or R.A. 11036 and its school mandate.	4.45	0.749	Very High
Q3	Mental health awareness initiatives in my school are inclusive and considerate of diverse perspectives.	4.33	0.797	Very High
Q4	Mental health awareness initiatives: Help reduce stigma surrounding mental health.	4.35	0.770	Very High
Q5	Mental health awareness initiatives: They are inclusive and considerate of diverse perspectives.	4.40	0.778	Very High
Q6	I am aware of the mental health services in my school.	4.35	0.893	Very High
Q7	Overall, I am aware of my school's mental health awareness efforts.	4.38	0.868	Very High
	Overall	4.407	0.798	Very High

Mental Health Resources

The table shows the weighted mean of the mental health program implementation level according to the Mental Health Resources indicator. In terms of content, the statement "There are adequate available mental health awareness resources in my school" has a weighted mean of 3.20, interpreted as a moderate level. This indicates that there were moderate mental health resources available in school. The statement "The quality of mental health resources provided by my school is excellent" has 3.00, which is interpreted as moderate. This indicates that the mental health resources offered in schools are of a moderate quality.

Based on this result, in Table 3 Mental Health Resources, with an overall numerical data of 3.118, this is interpreted as a moderate level of implementation, which means that there were moderate mental health resources available in schools. The result is supported by Saraceno & Saxena (2002), resources for mental health are woefully inadequate, although mental problems account for a significant share of disease-related impairment and burden. The majority of emerging and impoverished nations have relatively little information available about mental health resources. According to the World Health Organization (WHO), insufficient knowledge about available resources impedes the endeavors of non-governmental organizations, professional associations, and consumer groups to advocate for enhancing mental health care services and drawing attention to particular needs. In addition, Bains & Diallo (2016) state that 2—25% of children and adolescents suffer from mental health disorders, and few of them obtain services. Struggles to find the funds are one of the reasons, according to Bendheim (2022).

Table 3. Mental Health Resources

	Question	Mean	Standard Deviation	Interpretation
Q1	There are adequate mental health awareness resources in my school.	3.20	0.608	Moderate
Q2	The variety of mental health resources offered by my school meets the diverse needs of students.	3.13	0.607	Moderate
Q3	The quality of mental health resources provided by my school is excellent.	3.00	0.716	Moderate
Q4	The hours of operation for mental health resources in my school are sufficient.	3.03	0.698	Moderate
Q5	I believe that mental health resources in my school effectively address students' mental health needs.	3.13	0.563	Moderate
Q6	I feel comfortable seeking help or support from the mental health resources available at my school.	3.18	0.594	Moderate
Q7	Overall, I am satisfied with the availability and accessibility of mental health awareness resources in my school.	3.18	0.675	Moderate
	Overall	3.118	0.637	Moderate

Curriculum Integration

The table shows the weighted mean of the mental health program implementation level according to the Curriculum Integration indicator. The statement "The integration of mental health into the curriculum helps reduce stigma surrounding mental health" has a mean of 3.40, interpreted as high. This shows that mental health topics are effectively incorporated in several subjects across the curriculum. On the other hand, in terms of content, the statement "The integration of mental health awareness into the school curriculum is adequate" has a weighted mean of 3.13, interpreted as a moderate level. This indicates that the level of curriculum integration for mental health awareness in schools is moderate.

Based on this result, in Table 4, Curriculum Integration with overall numerical data of 3.327 is interpreted as a moderate level of implementation, meaning that there was a moderate level of curriculum integration in schools. The result is supported by Ravindran et al. [25], who found that there were high rates of mental illness and poor mental health knowledge documented among youths. It was shown through a Mental Health Curriculum, a Canadian-based program that revealed a positive contributing factor to mental wellness and functioning among youth. According to research of Bendheim (2022), a gap exists between the legislators' implementation of new mandates and funding for mental health education and the instructors' struggle to find the funds, implement the curriculum, and teach mental health in a common language because of staff overload, a lack of staff education, and lack of support.

Table 4. Curriculum Integration

	Question	Mean	Standard Deviation	Interpretation
Q1	The integration of mental health awareness into the school curriculum is adequate.	3.13	0.607	Moderate
Q2	Integrating mental health awareness into the curriculum enhances my overall learning experience.	3.30	0.608	Moderate
Q3	Integrating mental health awareness into the curriculum helps reduce stigma surrounding mental health.	3.40	0.496	High
Q4	Mental health awareness should be a mandatory part of the school curriculum.	3.30	0.533	Moderate
Q5	Mental health awareness in the curriculum equips me with valuable skills to support my mental well-being.	3.38	0.490	Moderate
Q6	Mental health topics are effectively incorporated into various subjects across the curriculum.	3.33	0.549	Moderate
Q7	I am satisfied with integrating mental health awareness into the school curriculum.	3.35	0.533	Moderate
	Overall	3.327	0.545	Moderate

Support System

The table above shows the weighted mean of the mental health program implementation level according to the Support Systems indicator. The statement "the mental health coordinators/advocates responsible for providing mental health

support are approachable and supportive" has a mean of 3.43 and is interpreted as high. This indicates that the mental health coordinators/advocates are responsible for providing mental health support, and are approachable and supportive. Furthermore, "the mental health support services in my school provide timely assistance to students in need" has a weighted mean of 3.30 and is interpreted as moderate. This indicates a moderate level of timely assistance provided to students in need by the mental health support services in school.

Based on this result, in Table 5, Support Systems with an overall numerical data of 3.357 is interpreted as a moderate level of implementation, meaning that there was a moderate level of support systems in schools. The result is supported by Mann et al. (2019), who found a lack of support staff related to school-based mental health personnel, such as school guidance counselors, which resulted in arrests and law enforcement data. According to Patalay et al. (2016), in about 3% of the schools surveyed, it was said that mental health services were not given priority. In addition, limited staff capability, finance, and access to specialists were recognized as the main hurdles to implementing the mental health program.

Table 5. Support System

	Question	Mean	Standard Deviation	Interpretation
Q1	There are mental health support services available in my school.	3.33	0.694	Moderate
Q2	The accessibility of mental health support services in my school is sufficient.	3.38	0.740	Moderate
Q3	The confidentiality of mental health support services in my school is respected and maintained.	3.41	0.675	Moderate
Q4	My school's mental health support services provide timely assistance to needy students.	3.30	0.672	Moderate
Q5	I believe that mental health support services in my school positively contribute to the well-being of students.	3.35	0.673	Moderate
Q6	The mental health coordinators/advocates responsible for providing mental health support are approachable and supportive.	3.43	0.495	High
Q7	Overall, I am satisfied with my school's mental health awareness support system.	3.30	0.663	Moderate
	Overall	3.357	0.658	Moderate

Monitoring and Evaluation

The table above shows the weighted mean of the mental health program implementation level according to the Monitoring and Evaluation indicator. The statement "I believe that the monitoring and evaluation of mental health awareness initiatives help improve the overall well-being of students" means 3.38 and is interpreted as moderate. This shows that the monitoring and evaluation of mental health awareness initiatives moderately help improve students' overall well-being. On the other hand, the statement "I feel that the evaluation process effectively identifies areas for improvement in mental health awareness initiatives" has a mean of 2.88, interpreted as moderate. This shows that the evaluation process is moderately effective in identifying areas for improvement in mental health awareness initiatives.

Based on this result, in Table 6, Monitoring and Evaluation, with an overall numerical data of 3.112, which is

interpreted as a moderate level of implementation, there was a moderate level of monitoring and evaluation of the mental health program in schools. The result is supported by Dowdy et al. (2010), who state that monitoring and evaluation of mental health is costly, and the resources are limited. In addition, the data gathered was insufficient for intervention planning. The research of Stewart et. al (2024) emphasizes the importance of assessing the impact of school mental health among young individuals. Nonetheless, schools have very few resources to obtain systematic and evidence-based data to identify and monitor the mental health needs of all learners.

Table 6. Monitoring and Evaluation

	Question	Mean	Standard Deviation	Interpretation
Q1	There is monitoring and evaluation of mental health awareness initiatives in my school.	3.25	0.670	Moderate
Q2	The methods used to monitor and evaluate mental health awareness initiatives are sufficient.	3.05	0.815	Moderate
Q3	I believe that the monitoring and evaluation of mental health awareness initiatives help improve students' overall well-being.	3.38	0.673	Moderate
Q4	I feel that the evaluation process effectively identifies areas for improvement in mental health awareness initiatives.	3.10	0.882	Moderate
Q5	The school administration is committed to acting upon the findings of mental health awareness evaluations.	2.88	0.883	Moderate
Q6	Overall, I am satisfied with the monitoring and evaluation processes for mental health awareness initiatives in my school.	2.90	0.928	Moderate
Q7	I feel that the evaluation process effectively identifies areas for improvement in mental health awareness initiatives.	3.23	0.660	Moderate
	Overall	3.112	0.805	Moderate

Trainings and Seminars

The table shows the percentage of respondents who attended training and seminars related to the mental health program. In terms of content, most of the respondents attended or participated in bullying and physical violence, with a numerical data of 62.50% and mental health, 60%, which is interpreted as high. Stress, anxiety, depression, and other mood disorders have numerical data of 55% and 47.50%, respectively, and it is interpreted as moderately attended or participated. The intervention programs for mental health, suicide, and suicidal violence have 37.50% and 35%, which is interpreted as low and indicates that some respondents participated in or attended this kind of seminar. Lastly, crafting a school mental health program had, and crafting school policy related to mental health program had 12.50% and 10% in numerical data and interpreted as very low, which indicates that few schools crafted mental m and school policy related to mental health program and crafting of school mental health programs.

Based on this result, in Table 7, Training and Seminars have overall numerical data from the respondents of 40%, which is interpreted as moderate. This means insufficient training and seminars on the mental health program are given to the school mental health personnel. The result is supported by Durlak & DuPre (2008), who state that program

implementation is affected by variables such as organization functioning, technical assistance, training attained, etc. According to the research conducted by Patalay et al. (2016), mental health provision, less financing, limited school staff capacity, lack of national strategy, and lack of access to specialists were the main obstacles cited by half of the schools interviewed.

Table 7. Trainings and Seminars

Question	No. of Respondents	Percentage	Interpretation
Mental Health Act	24	60.00%	High
Stress and anxiety	22	55.00%	Moderate
Depression and other mood disorders	19	47.50%	Moderate
Suicide and suicidal ideation	14	35.00%	Low
Bullying and physical violence	25	62.50%	High
Intervention programs for mental health issues	15	37.50%	Low
Crafting of school policy related to the mental health program	4	10.00%	Very Low
Crafting a school mental health program	5	12.50%	Very Low
Average Number of Trainings and Seminars Related to Mental Health	16	40.00%	Moderate

Conclusion and Recommendation

This study has several limitations. First, the study only involved the school heads, the mental health coordinator, and guidance advocates in the Division of Cabadbaran City. Therefore, the findings should be cautiously interpreted as these are the reflections of the specific participants only. Future studies might also include the other Division of the Department of Education, covering both public and private secondary schools. In addition, the research respondents are the school heads, mental health coordinators, and guidance advocates. The learners' perceptions of implementing the mental health program should also be considered since they are the program's recipients, and they can fully conclude whether or not the program is effective. Next, this study utilizes a quantitative evaluation research design. More comprehensive findings can be achieved through data from both quantitative and qualitative approaches.

Despite the limitations, these findings signal the improvement in the implementation of the mental health programs, urging the higher authorities and researchers alike to continue to improve and advance the mental health awareness program in the schools. The study reveals that the mental health program in the schools is moderately implemented, as indicated in the six indicators' results. Those six indicators serve as criteria for implementing the school's mental health program.

One key finding is that moderate mental health resources are indicated in the results. The quality of the mental health resources is the top concern. This indicates that the mental health resources are inadequate to cater to the needs of the learners suffering from mental health issues and problems. According to the National Center for Education Statistics (2024), inadequate funding is one of the most commonly cited factors limiting the schools' efforts to effectively provide mental health services to all students who need them. Therefore, the schools should provide adequate mental health resources that are essential to address the mental health problems of the learners. This enhances the learners' access to mental health resources in the school.

Another key finding is the integration of mental health in the curriculum. Mental health is moderately integrated in the curriculum or moderately incorporated in the various subjects across the curriculum. The school head should mandate mental health in the curriculum or the various subjects taught to give the learners ideas and open their minds about mental health and its importance. Incorporating mental health education into the Philippine school curriculum is not just beneficial; it is necessary. Educating students about mental health can create a more supportive, understanding, and mentally healthy generation (Empath PH, 2025). In addition, a clear mental health policy and implementing guidelines should be established in the schools to promote mental health. Perhaps, there should be opportunities to collaborate with the Department of Health. This would be beneficial in providing accurate information regarding mental health issues.

Another key finding in the support system is that it moderately provides mental health assistance to learners. The mental health coordinator and the guidance advocates should provide sufficient and timely assistance and services to the needy learners. A support system is crucial during times of mental health problems. Most schools could not provide mental health services to all the students in need because the most reported limitations involved the shortage of mental health providers, insufficient staff, and lack of access to providers (KFF, 2022). Therefore, a strong and dependable support system and services should be established in the school to strengthen the mental health program. Perchance, specialized training and seminars should also be conducted for the mental health coordinator and guidance advocate. This would be beneficial in providing an adequate mental health support system to the learners in need.

Furthermore, moderate results of mental health in the monitoring and evaluation suggest a need for a stronger and consistent monitoring and evaluation of mental health programs in the schools. Firm, endless, and reliable monitoring and evaluation of the program to enhance the services and program, and address its issues and concerns regarding school mental health. Evaluation of the mental health and social health programs is of great importance. Therefore, evaluation of the program should be planned, and it should be comprehensive and systematic (Baghian et al., 2019). Furthermore, clear criteria and guidelines for monitoring and evaluation should be established to implement the mental health program properly. This would benefit the schools in providing the appropriate mental health programs and services to the learners.

Lastly, insufficient training and seminars for the school personnel in mental health. This indicates missed relevant knowledge, skills, and attitudes regarding mental health that are needed to deal with the mental health issues of learners in the school. Semchuk et al. (2022) said that educators are not expected to take on formal mental health support roles, such as the role of school mental health professionals, and as such, do not provide mental health diagnostic or treatment services to students. However, improving the mental health literacy of educators equips teachers and school staff with the knowledge and skills to take an active role in promoting positive student mental health, identifying students at risk for mental illness, responding effectively, and collaborating with others when student mental health challenges arise. Therefore, there should be mandatory training and seminars related to mental health that will be conducted for all mental health coordinators and guidance advocates. This can enhance the capacity of the advocates to deal with and handle mental health issues and problems at the school level.

Overall, the results ultimately highlight the level of implementation of the mental health program in the schools. There

should be an improvement in the mental health resources, curriculum integration, support system, monitoring and evaluation, and training and seminars for the school mental health coordinators and guidance advocates. By implementing the recommendations and addressing areas for improvement, the school mental health program can create a more sustainable and efficient mental health program, ultimately benefiting the learners and maintaining their mental health at school.

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Education as a Determinant of the Quality of the Future

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Abstract: This paper analyses the dynamics of addressing differences among teachers within the educational process through the lens of Claude Lévi-Strauss's perspective: *"The 21st century will be the century of human science – or it won't be. The aim of science must be the minimization of human suffering and the optimization of both material and spiritual well-being."* The analysis highlights the essential role of teachers' primary self-reflection, especially in relation to students' secondary self-reflection. As human beings became increasingly self-aware and conscious of their individual responsibilities, they naturally began, in solidarity with their surroundings, to protect the most vulnerable—particularly their children. This protective instinct evolved into a profound level of care, expressed through the desire to pass on accumulated experience to the next generation, helping them avoid the hardships, failures, and painful losses endured by their predecessors. Over time, parental love and the need to safeguard future generations took on institutionalized forms. Across cultures and throughout history, educational institutions emerged as structured efforts to prepare young people for the future. These institutions sought to transmit the most valuable and meaningful aspects of contemporary knowledge, aiming to minimize—or eliminate—harmful influences on human development. But does this premise still hold true today? Is the school, as an institutionalized tool, still a meaningful force in shaping the future of the younger generation?

Keywords: Education 1, Students 2, Teachers 3, Quality 4

Introduction

As man became aware of himself and of his growing sense of individual responsibility, he naturally began to protect the most vulnerable and weakest – primarily his children – in the context of solidarity with his surroundings. This need for protection resulted in a deep level of care for future generations, manifested in the effort to pass on to the younger generation the full scope of his own experience, enabling them to avoid the hardships, failures, and painful losses experienced by older generations. Parental love and the need to protect the younger generation gradually took on an institutionalized form – educational institutions began to emerge across the world and within different civilizations. Their main purpose was to adequately and meaningfully prepare the younger generation for the future. These institutions passed on to young people the best and most meaningful aspects of contemporary knowledge so

that all that is harmful or potentially damaging could be minimized or avoided.

Is this premise still valid today? Is the school, as an institutionalized tool, a factor in creating a meaningful future for the younger generation? Have schools and universities become merely a pragmatically necessary path to individual functionality through economic benefit? Is – and can – the modern university be a suitable and meaningful compass, a fixed point for shaping the future of young people?

The 2020s, in their admirable global interconnectedness, have also revealed problems that transcend geographical zones and national borders. The world has reached a point where, not only due to pandemics, but also because of new military conflicts and catastrophic environmental conditions, the primary responsibility for addressing the quality of our future now lies with the sciences – sciences that had been marginalized throughout much of the 20th century. From the 17th century onward, scientific development has focused intensely on mastering external nature. The industrial and technological revolutions have advanced human knowledge to an extraordinary level, especially in electronics, nanotechnology, and information and communication technologies, whose influence extends across nearly all aspects of human activity.

In this dominant orientation toward controlling the external world, we have largely forgotten to meaningfully manage social relationships – and even more strikingly, we have neglected, or entirely resigned from, understanding ourselves. Self-control, self-evaluation, self-reflection – or simply, personal mental hygiene – have remained in the shadow of the progress made by technical and natural sciences.

Our often-absurd effort to adapt the external world to a life of comfort and convenience has received a clear response in recent years. Pandemics, wars, and the deteriorating state of the global environment in remote areas seldom or never visited by humans, such as Antarctica or the Himalayas show alarming signs of damage.

Thus, every wise, rationally thinking person realizes that the solution for humanity's future lies in the sciences that can humanize material and technological progress. Sciences that provide an objective and meaningful foundation for our rapid scientific and technological advancement. Anthropological, psychological, and pedagogical sciences are the sciences of the future. Above all, these fields have the potential to address the most pressing problem of our time: the problem of man. In close cooperation with the accelerating natural and technical sciences, these disciplines can help restore a value hierarchy in which all human values are harmoniously interconnected, touching not only the human mind, but also the heart.

Objective and Methodology

In the search for an answer to how to understand and shape a meaningful world of values, upbringing and education occupy a central place. Although the idea that teachers, through their everyday work, help outline the contours of the world 20–30 years into the future may seem bold, it is undoubtedly true. Parents instil (or should instil) love in their children in the broadest sense of the word, and love forms the foundation of goodness. Teachers, through their work, continuously build upon the foundations laid within the family and influence not only the cognitive but also the non-

cognitive aspects of students' personalities. A meaningful balance between both aspects is a prerequisite for establishing a value hierarchy that can serve as a pillar of a high-quality future.

So how can this be achieved? How can we prepare future teachers to succeed in this demanding task?

This introduction builds on a historical context. The Slovak University of Technology in Bratislava, where our department is located, can proudly point to two global milestones in the field of technical education. The first is that the world's very first technical university was founded in 1762 in what is now Slovakia, then part of the Austrian monarchy, where some of the most renowned scientific minds of the 18th century worked. The second, equally significant, is that our nation produced an outstanding philosopher, educator, theologian, and polymath, Johannes Amos Comenius, whom the global educational science community reveres as the "Teacher of Nations." Born in 1592, Comenius lived and worked in one of Europe's most turbulent centuries, the 17th. He dedicated his life to scientific work and is considered a logical successor to Francis Bacon. He promoted lifelong education and cultivation of the human being—not only through his concept of *panpaedia*, but also through *pansophia*. His intellectual legacy is evidenced by invitations from monarchs across Europe: he accepted an invitation from King Charles I of England to London, was summoned by Cardinal Richelieu to Paris to help reform France's education system, and in Leiden met René Descartes.

Today's philosophical discourse still references the visions of Comenius and Descartes, illustrating the lasting significance of these two pillars of 17th-century thought. Later, Comenius also visited Sweden at the invitation of its king, who shared similar educational ambitions as the French cardinal.

The genius and timeless impact of Comenius can be summarized as follows:
- He is the founder of modern didactics—the science of teaching.
- He continuously revised instructional methods and didactic principles.
- He advocated for defining educational content in line with scientific progress.
- He emphasized a comprehensive curriculum and promoted interdisciplinary connections.
- He gave special attention to the needs of language instruction.
- He was the first to exclude discipline from the set of teaching tools, limiting it instead to the realm of morality and ethics.
- He introduced the class-hour system still used globally today.

In his work *Mundus Moralis*, he passionately calls for self-reflection as a fundamental prerequisite for teachers – to evaluate their performance, identify strengths and weaknesses, critically recognize errors, and strive to overcome them.

Founding the First Technical University in the World

The need to establish a university arose from the development of the Slovak economy in the middle Ages, driven by rich mineral resources, especially gold, silver, copper, and iron. Slovakia became prominent as early as the 14th

century, when the Kremnica Mint, founded in 1328, began producing gold and later silver coins. Kremnica ducats and silver tolar (historical coin) were highly valued currencies across Europe for centuries.

Thanks to its mineral wealth, Slovak mining and metallurgy flourished in the 15th and 16th centuries, significantly advancing disciplines such as mineralogy, geology, botany, geography, physics, and mathematics. Unfortunately, there was no university in Slovakia at the time that could serve as a centre of scientific inquiry. As a result, many Slovak scholars found academic opportunities abroad. Notably, Ján Sambucus (1531–1584) from Trnava became a prominent humanist scholar in Europe. Juraj Henisch from Bardejov served as rector at the University of Augsburg, publishing a significant geographical work.

The first public autopsy at Charles University in Prague, Central Europe's oldest university, founded in 1348, was conducted by the Slovak Ján Jesenius (1566–1621), who also published an analytical Latin treatise on the subject. Other Slovaks also made their mark at Charles University, including mathematician and physicist Daniel Basilius and botanist Peter Fradelius.

While Slovak scientists sought opportunities abroad, Slovakia simultaneously attracted many European scholars. Renowned mining practices and the abundance of thermal springs drew the attention of researchers. In the 16th century, German naturalist Georgius Agricola, the father of mineralogy, worked in Slovakia and documented its mining practices in his seminal works *De natura fossilium* (1546) and *De re metallica* (1556).

The famed Swiss physician Paracelsus, often called the "Luther of Medicine," also visited Slovakia several times to study ore extraction processes. His research culminated in *De tinctura physicorum*, where he analyzed cementation—a method of extracting copper from mineral waters. As technical progress advanced, it became clear that empirical, generationally passed-down knowledge was no longer sufficient. The need for structured technical education emerged. Slovakia, with its mining heritage, contributed several global firsts: in 1627, the world's first use of gunpowder for mining was recorded in Banská Štiavnica. Between 1720–1722, atmospheric engines were used in mining, nearly in parallel with similar developments in England. To meet the growing need for technically trained experts, a mining vocational school was founded in Banská Štiavnica in 1735, under the leadership of Samuel Mikovíni. Educated in Germany, Mikovíni was a pioneering cartographer, mathematician, and mining expert. He collaborated with the renowned Slovak scholar Matej Bel on the *Notitia Hungariae Novae Historico-Geographica*. Mikovíni also produced plans for the royal palace in Buda and introduced innovative cartographic methods. He managed mining school operations and helped solve practical problems in mining, including the construction of the famous system of artificial lakes—*tajchs*—which provided essential water power for surface machinery. These reservoirs remain engineering marvels today.

Queen Maria Theresa institutionalized technical education in Slovakia by founding the Mining Academy in Banská Štiavnica in 1762. For the first time in history, technical disciplines were taught in a university format. The Academy became a global center for technological and mining education. Its pioneering status extended not only to its founding date but also to its inclusive admissions policy—students were accepted based on merit, not origin or wealth. The first Department of Chemistry and Mineralogy was established on June 13, 1763, led by Mikuláš Jacquin from the

Netherlands. A second department, focusing on mechanics and hydraulics, followed in 1765 under Mikuláš Poda. In 1770, the Department of Mining and Mining Law was formed, with Christoph Traugott Delius as its first professor. Although the Slovak University of Technology (STU) is not a direct institutional successor of the Mining Academy—due to interruptions in continuity in the 19th and early 20th centuries—it respectfully claims this heritage. For over 80 years, STU has maintained a strong tradition of technical education. Since 1963, it has offered a department for supplementary pedagogical studies for engineers.

This program ensures technological propaedeutics at ISCED 3 and ISCED 4 levels by preparing qualified teacher-technicians. Students include both full-time STU engineering students and working engineers returning for pedagogical training. The program lasts four semesters, concludes with final exams and a thesis defense, and grants graduates teaching qualifications for technical subjects at relevant secondary schools.

Methodology

In recent decades, the conceptual framework of scientific disciplines has expanded to include both quantitative and qualitative research methods. Quantitative research relies on large samples, and hypotheses are verified statistically with strong emphasis on validity and reliability.

However, the social sciences community has increasingly voiced criticism of an overreliance on numbers. Common concerns include the problematic selection of variables, the influence of uncontrolled factors (such as intelligence or delinquency), weak engagement with research participants or field environments, and the rigid nature of hypothesis testing through statistical logic.

The limitations of quantitative research in the social sciences are illustrated in Figure 1.

Quantitative Methods
- more suitable for natural and technical sciences
- distortion of "measurable" phenomena by unreliable or poorly defined concepts
- misinterpretation of correlations as causation

Qualitative Methods
- results in rapid conclusions with little or no direct contact with people or the research setting
- dependent and independent variables are often poorly defined or oversimplified
- hypothesis testing is influenced by external or uncontrolled factors
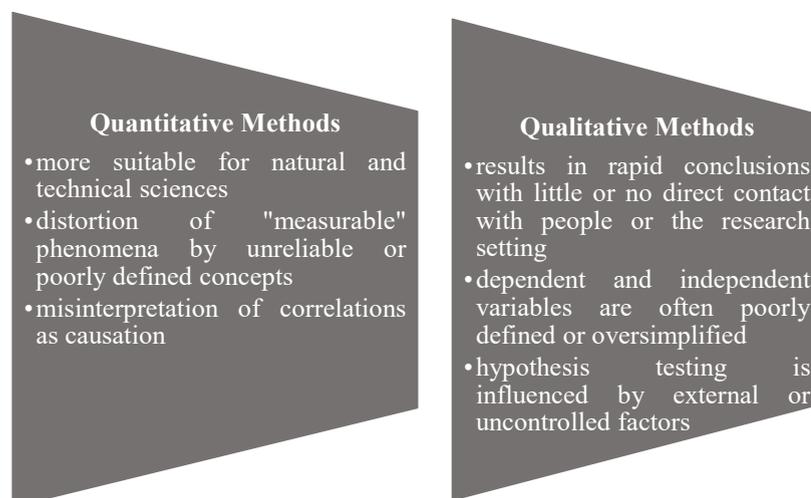
Figure 1: Characteristics of Quantitative and Qualitative Research

Source: Silverman, D. 2000. How to conduct qualitative research, own elaboration

Compared to quantitative research, the strength of qualitative research lies more in extensive, descriptive narratives than in the creation of statistical tables. Qualitative research is primarily characterized by *immersion in the problem* and does not rely on a large number of respondents. In fact, qualitative research can often address the case of just one respondent within the framework of a research problem, while still maintaining both the validity and reliability of the study, provided the research is properly structured. The criteria for evaluating qualitative research are listed in the following table.

Table 1. Criteria for Evaluating Qualitative Research

Criteria for evaluating qualitative research:
Are the research methods appropriate to the nature of the question being asked?
Can we clearly identify the connection to existing knowledge or theories?
Was the data collection and description of the records carried out systematically?
Is the sensitivity of the method appropriate to the needs of the research question?
Are the criteria used in selecting cases, collecting data, and analyzing them clearly described?
Does the research refer to accepted analytical procedures?
Is the analysis systematic?
Is there an adequate discussion of how themes, concepts, and categories were derived from the data?
Is there an adequate discussion of the evidence for and against the researcher's claims?
Are the data clearly distinguishable from their interpretation?

Results and Discussion

Self-Reflection of a University Teacher

In the context of student-teacher interaction, a teacher cannot solely rely on principles of general management that are conditioned by rational strategy and logic. While these principles are effective in many contexts and can be teachable, they are based on logical, scientific thinking that may not be sufficient for everyday situations. Everyday life is often chaotic, and such life situations do not necessarily align with predefined qualitative and quantitative characteristics. Thus, the teacher's approach cannot simply be based on these formal strategies alone.

In the hectic pace of everyday life, a person rarely has the luxury to first assess a problem, define potential causes, and then select an appropriate solution. Instead, the dominant task is to make quick decisions, often guided by general or personal interests, while solving multiple problems simultaneously. Such situations demand that the individual conceptualize solutions in ways that go beyond their prior knowledge or experience. For teachers, this means often having to plan on the spot with minimal information and make sound decisions that allow them to act promptly, without delay.

A linear process, such as the gradual progression from problem identification, analysis, and solution, should be the exception in both a teacher's work and in students' everyday lives. In real life, problems are often cumulative and

interconnected, and the environment is fast-paced. Following a strict phase-by-phase approach would be cumbersome and counterproductive.

Instead, teachers make decisions based on an intuitive understanding of the situation, continuously reflecting on their actions and adjusting in real time during classroom interactions. When students are exposed to such decision-making processes regularly and witness their positive effects in class, they gradually absorb this decision-making model. Over time, they may adopt and imitate it naturally, without force.

A significant role in this decision-making process is played by tacit knowledge, which refers to practical know-how that lacks explicit formal definitions. Psychological studies show that tacit knowledge:

- Distinguishes a beginner from an expert.
- Determines the quality of immediate performance.
- Is independent of IQ and other cognitive or non-cognitive personality traits.
- Is relatively general within a field and across disciplines. In other words, people with extensive tacit knowledge in one area are likely to possess tacit knowledge in other relevant areas as well.

Therefore, tacit knowledge, when applied effectively, is crucial for fostering strong teacher-student interactions. It is best developed through sustained, intensive efforts, motivated training activities, and adequate resources over the long term. If we apply Sternberg's theory (20045) of expertise to teaching, the professional work of expert teachers can be characterized by the following points:

1. Experts spend more time assessing problems and less time solving them, whereas novices do the opposite.
2. Experts identify and categorize problems based on deep principles, while novices tend to categorize based on surface-level features.
3. Experts can process more information simultaneously than novices.
4. Experts have superior long-term and short-term memory for relevant information related to the problem at hand.

Cognitive Ease and Cognitive Effort in Teachers' Responses to Emergency Situations

Self-reflection, or the self-regulation of an individual's behaviour, naturally involves a wide range of cognitive processes through which the present and the past interact to correct and simultaneously shape the future. It is a demanding and complex process that requires sustained mental energy and continuous personal vigilance. In the context of teaching, self-reflection operates on two levels: it entails not only ongoing responsibility for oneself but also responsibility for students. Carrying this dual burden is extremely challenging, and like any complex skill, the ability to bear responsibility for students must be learned. When a teacher effectively manages this dual dimension of self-reflection, it becomes an invaluable motivational tool that indirectly enhances the quality of students' own reflective practices. Students tend to internalize the model of self-reflection demonstrated by an excellent teacher and later apply it in their own professional lives thus contributing to their success.

Within the process of self-reflection, the triggering of emergency activity at the subjective level can occur due to the influence of various mechanisms. At critical moments, the following phases of behavioral self-regulation can be identified:

Gradation Phase

The volume of stimuli gradually increases, leading to the reorganization of the internal system into a new pattern of activity. These stimuli may include physical forces, internal drives, motivations, or an accumulation of causes and evidence.

Critical Phase

This is the moment when the system reaches the threshold of change — about to "roll over" into a new pattern of functioning.

Reorganization

This phase marks the actual shift to a new pattern of activity. Typically, it is initiated by a triggering event, also referred to as a boundary point. This event can be internal (emerging from within the system) or external. Importantly, the same event may not elicit the same response in every individual; its effect depends on whether it coincides with the critical phase. If the individual is not in the critical phase, the event may fail to trigger any change.

Focal Activity

This phase represents a rapid behavioral response, which is often difficult to consciously control or slow down due to its immediacy and intensity.

Latency – The Phase of Calm

The transitional event ends, and a period of calm begins. Although the entire process may appear simple from the outside, in reality, extensive mental mechanisms are at work—mechanisms that either allow or prevent various motivational factors, threshold effects, and other phenomena from triggering emergency activity. According to renowned experts, the initiation of "emergency activity" is actually a highly adaptive and effective way of making decisions. The multitude of these processes—sometimes occurring within seconds or minutes—can lead an individual to purposeful behavior or immediate decision-making, producing outcomes that are both meaningful and effective in the given situation. The appropriate activation of emergency activity is therefore one of the crucial components in finding correct and expected solutions to situational problems (Sternberg, J. R. 2004).

For effectively resolving immediate situations in the teaching process, the latest findings from cognitive psychology on cognitive ease are of great importance to educators. The key parameters of cognitive ease can be categorized as

follows:

- *repeated experience*
- *clear presentation*
- *priming support*
- *positive perception*

From this, it follows that sentences with simple and understandable structure, printed or written in a clear font, with colorful emphasis on key content elements and repeated appropriately, can be processed with sufficient cognitive ease (Kahneman, 2019). However, cognitive ease is also associated with a higher likelihood of errors. In contrast, when reading texts that are complex in formulation, printed in blurry or faded fonts, unformatted, or lacking textual structure, we experience cognitive effort. This state demands full concentration and heightened brain activity, which in turn helps minimize errors.

Daniel Kahneman, along with Amos Tversky, was awarded the Nobel Prize for pioneering research in human decision-making. They identified and analyzed two systems of thinking and decision-making:

- System 1 – fast, automatic, intuitive
- System 2 – slow, deliberate, analytical

Each system clearly demonstrates different types of decision-making errors. However, through consistent application and practice of their dual-system model, it is possible to reduce errors in teachers' decision-making during their interactions with students. According to these authors, respecting the functioning of both systems enables teachers to account for predictability, a critical factor in solving not only educational but also broader life challenges.

A teacher requires sufficient experience to internalize and apply the dual-system model of decision-making System 1 and System 2 in real-life educational contexts. Graduates of additional pedagogical studies, particularly in subjects like *Professional Communication* and *Teaching Practice*, gain hands-on experience with this model. This experience proves essential for making immediate, high-quality decisions in the continuous sequence of choices that arise in the actual practice of high school or university teaching.

Seminar-based simulations are designed to support this development by allowing for targeted training in emergency decision-making. These activities aim to foster a highly adaptive decision-making style by:

- engaging students in ambiguous, ill-defined situations during classroom interactions, so that they gradually become accustomed to navigating uncertainty;
- focusing on the development of pedagogical management competencies, which are crucial in effective decision-making. This involves the meaningful application of expert teacher theory, enabling future educators to select the most suitable strategies and maintain continuous reflection.

Teachers at all educational levels ultimately shape both the trajectory and quality of education. Didactic literature defines educational outcomes in terms of knowledge, skills, and competencies. The value of education can be

precisely articulated by comparing these outcomes to individual abilities. While abilities enable a person to perform specific actions, education by itself does not grant such capability (Fiala, 2004).

This conscious distinction, supported by self-reflection, is what defines the strength of a truly civil society. In such a society, the most respected role belongs to the educated individual, whose behavior naturally reflects not only solidarity, love, peace, and truth but also the internalized boundaries that guide human conduct. Only teachers who, beyond imparting required knowledge, also foster respect for wisdom and intellectual effort in their students, can truly contribute to building a *knowledge society*.

By nurturing wisdom, the teacher opens the path to authentic human freedom, freedom grounded in mutual respect and an understanding of shared interdependence. Such authentic freedom is the cornerstone of a knowledge society, one that cannot be measured by economic or financial indicators. Rather, a knowledge society is defined by the determination to think, to seek harmony, with nature, with oneself, and with the broader human condition, including the vast inequalities across the globe.

Only when our collective efforts aim toward bridging these deep divides in quality of life can we genuinely claim to be a knowledge society. This transformation begins when solidarity is no longer just a media cliché, but becomes a deeply embedded value a human commitment to building a better world. Solidarity with the hungry, the thirsty, the freezing, those caught in senseless wars, the sick, and, importantly, those denied access to education. It is solidarity that allows us to transcend national, religious, and geographical differences, and instead deepen our shared response to human pain, degradation, suffering, and loss.

To communicate this message and guide young people in this direction is perhaps the most important mission of today's teachers.

Conclusion

John Dewey (1916), already at the beginning of the 20th century, in his theoretical reflections on pragmatism in education, identified education with philosophy. According to Dewey, philosophy can be defined as a general theory of education (Dewey J. (1916):

"If a theory makes no difference in educational endeavour, it must be artificial. The educational point of view enables one to envisage the philosophical problems where they arise and thrive, where they are at home, and where acceptance or rejection makes a difference in practice. If we are willing to conceive of education as the process of forming fundamental dispositions, intellectual and emotional, toward nature and fellow men, philosophy may even be defined as the general theory of education."

For over a century, we have known that education comprises both cognitive and emotional dimensions, and that it involves their awakening, shaping, and cultivation. This entire process culminates in self-reflection, with the expected outcome of adjusting one's own behaviour. Teachers are or should be the long-term, consistent compass guiding this correction.

The driving force of this correction is the continuous questioning and search for answers. Sometimes, the answers are direct and explicitly stated; other times, they are implicit or elusive in some situations, answers may be entirely absent. Yet, it is the very act of questioning that is essential, as it contributes to the cultivation of self-discipline and self-criticism. According to Socrates, these are fundamental attributes of an educated and virtuous person.

Thus, the teacher cultivates the student's personality through authentic dialogue. However, for this cultivation or rather meaningful feedback to take place, two preconditions should be met:

1. students must have respect for consistent critical thinking, and
2. they must be meaningfully motivated to study.

Unfortunately, both conditions are increasingly rare in today's schools. This makes the teacher's role even more challenging – and, by extension, more crucial. It also highlights the need to reflect this reality in teacher education, so that the mission of teachers – to meaningfully help shape the future of their students, can truly be fulfilled.

The only certainty is uncertainty – this insight from Michel de Montaigne (1995), taken from his *Essays*, perhaps best characterizes the future that awaits today's students. Teachers should not aim to provide clear roadmaps or detailed instructions for navigating this uncertain future. Instead, they should seek to ignite a spark of courage in their students. This courage must go beyond fulfilling personal ambition or ego, beyond intellectual blindness to the world's current realities – its failures, injustices, and transparent tragedies. It should be a courage born of inner unrest, a call for change, and a commitment to solidarity and tolerance. A courage that dares to name failures, confront them, and seek to reverse their impact. A courage to promote a vision of human freedom, one that is deeply rooted in responsibility – a freedom that serves as an endless and binding measure of human obligation.

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Interfaith Dialogue in Schools: A Framework for Promoting Religious Tolerance among Students

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Abstract: This study aims to (1) analyze the implementation of interfaith dialogue in schools as an effort to promote religious tolerance among students and (2) develop a comprehensive and applicable framework for interfaith dialogue within the context of formal education. This is a qualitative study. A total of 50 participants were involved, consisting of 30 students, 10 teachers, five high school principals, and five religious leaders. The city of Surakarta was selected as the research site due to its religious diversity. Data were collected through in-depth interviews with educators, focus group discussions with religious leaders and students, and participatory observation of interreligious interactions in schools. The findings indicate that the implementation of interfaith dialogue in schools is carried out through interreligious collaboration in the form of joint social projects, inclusive celebrations of religious holidays, and interfaith discussion forums. The holistic framework for interfaith dialogue includes (i) participatory student learning; (ii) neutral and competent facilitators, with the use of collaborative methods such as role-play and interfaith dialogue; (iii) the development of context-based dialogue modules grounded in socio-cultural realities; (iv) a continuous evaluation mechanism encompassing cognitive, affective, and psychomotor aspects; and (v) a partnership model among schools, families, and interfaith communities that can be implemented in schools as a model to promote religious understanding and tolerance. This study is expected to provide a valuable contribution to the development of educational strategies that foster religious tolerance and intercultural understanding in schools.

Keywords: Interfaith Dialogue; School; Framework; Religious Tolerance; Students

Introduction

Indonesia, as the world's largest multicultural nation, consists of more than 17,000 islands, approximately 700 ethnic groups, and six officially recognized religions. This diversity reflects the framework of a democratic state that upholds the principle of *Bhinneka Tunggal Ika* (Unity in Diversity), which, as noted by Walad et al. (2024) is not only a source of national strength but also presents complex challenges in fostering sustainable social cohesion. In the context of education, schools function not merely as venues for the transmission of knowledge but also serve as social laboratories for instilling the values of multiculturalism, including the promotion of interreligious tolerance.

Such a pluralistic condition should be managed through an inclusive approach that emphasizes interreligious dialogue, respect for cultural differences, and the practice of equality in daily life. Tolerance values integrated into the curriculum can serve as a strategic instrument to promote interfaith and interethnic understanding so that diversity is not merely perceived as a social reality but also as social capital for strengthening national unity. Accordingly, schools aim to cultivate citizens with a pluralistic awareness and a commitment to social harmony while also fostering individuals who are intellectually capable.

An ideal education system should integrate the transmission of knowledge with character development and the reinforcement of pluralistic values. Schools must function as safe, inclusive, and supportive spaces that facilitate healthy interactions among students from diverse religious backgrounds. The educational process should foster interreligious empathy, recognition of religious rights, and the capacity for conflict resolution through equitable dialogue. The implementation of tolerance values within the school environment should be active, reflective, and grounded in concrete social experiences rather than merely normative in nature. Empirical realities, however, reveal a gap between these ideals and actual educational practices in Indonesia. Data from the past five years highlight the complex challenges of religious life, marked by social polarization, marginalization of minority groups, and the escalation of religion-based hate speech. Findings by Evans et al. (2023) confirm that 57% of countries, including Indonesia, have experienced an increase in religion-related social tensions, significantly affecting the dynamics of interfaith relations among students.

"A report by Setara Institute (2023) on the state of tolerance among senior high school students in 2023 revealed that 20% of respondents disagreed with the idea of refraining from violence against those who insult their religion. Furthermore, a significant proportion (33%) agreed that dying while fighting people of different faiths would lead to paradise. While the report indicated that 70.2% of students generally exhibited tolerant attitudes, a considerable number demonstrated intolerant tendencies—24.2% were passively intolerant, 5% were actively intolerant, and 0.6% were categorized as susceptible to radical views. In addition, a survey by Link (2024) reported that 45% of students had been exposed to radical religious content on digital media. Notably, 23% of senior high school students admitted to experiencing religion-based discrimination, and approximately 34.2% expressed exclusivist attitudes toward followers of other religions (PPIM UIN, 2021). These data underscore a crisis of tolerance that takes root from an early age. This crisis is exacerbated by educational approaches that tend to be formalistic and ritualistic in managing religious diversity. Preliminary observations in several senior high schools in Surakarta in 2024 revealed that interreligious interactions were often superficial, limited to ceremonial events or symbolic gestures, without

meaningful dialogue. The Civics and Religious Education curricula have yet to integrate pluralistic values deeply. For instance, an analysis of the 2022 edition of the Pancasila Education textbook published by the Center for Curriculum and Books shows that only 12% of its content substantively addresses pluralism. This curricular gap contributes to the formation of stereotypes, prejudice, and even exclusivist attitudes among students."

The interfaith dialogue approach has begun to gain attention as a potential solution to address these issues. This concept refers to a process of cross-faith communication aimed at fostering understanding, appreciating differences, and building social cooperation. Positive interactions among individuals from different groups, when conducted under conditions of equality, can reduce prejudice. Meanwhile, Symbolic Interactionism emphasizes that the meaning of tolerance is constructed through intense and reflective social experiences. This approach aligns with the principles of multicultural education as developed by Nieto (2017), which underscores the importance of integrating cultural diversity and identity into the learning process. Research on the effectiveness of interfaith dialogue in enhancing student tolerance has shown promising results. For example, studies by Jackso (2011) in the United Kingdom and Engebretson (2009) in Australia demonstrated that well-facilitated interfaith dialogues can reduce interreligious tensions and foster mutual respect among adolescents. In the United States, the Interfaith Youth Core project developed by Pate (2012) successfully implemented campus-based programs that promoted interfaith tolerance through social projects. However, most of these studies were conducted in Western countries characterized by strong secular traditions and educational systems that differ significantly from those of Indonesia.

Research on interfaith dialogue in schools remains limited, both in quantity and in analytical depth. Several studies have focused solely on shared religious activities or passive forms of tolerance without addressing the pedagogical and interactional dimensions of dialogue. A clear research gap lies in the absence of a holistic framework that integrates the three main educational actors: schools, families, and religious communities. This gap poses a barrier to the sustainable and comprehensive implementation of strategies aimed at promoting tolerance. In light of the complexity of these challenges and the limitations of previous studies, the present research seeks to address these gaps by developing and examining an interfaith dialogue framework based on students lived experiences in multireligious secondary schools in Surakarta. This study explores forms of dialogue and constructs a collaborative model involving schools, families, and religious communities. Employing a qualitative approach, this research captures subjective experiences, social dynamics, and the challenges faced by students and teachers in cultivating dialogue-based tolerance.

Methods

This study employed a qualitative approach using a case study design to gain an in-depth understanding of interreligious interaction dynamics within the school environment. The research was conducted in the city of Surakarta, which is known for its multireligious society, providing a relevant context for exploring the practices of tolerance and interfaith harmony. A total of 50 participants were involved in the study, consisting of 30 students, 10 teachers, five school principals, and five religious leaders representing various faiths. Participants were selected purposively based on criteria such as direct experience with interfaith activities, strategic roles in education, and

representation of religious diversity in Surakarta. In addition, snowball sampling was used to identify religious leaders actively engaged in interfaith dialogue.

Data collection was carried out using three primary techniques: in-depth interviews, document analysis, and participant observation. In-depth interviews were conducted with teachers and school principals using semi-structured guides to explore their perceptions, policies, and experiences in addressing religious issues within the school setting. Document analysis was employed to examine various official school documents, including curricula, lesson plans, records of religious activities, and policy archives related to interfaith tolerance, as well as relevant photos and videos of school events. These documents provided a more comprehensive understanding of the policy context and actual practices within schools. Participant observation was conducted during various school activities, such as religious celebrations and student discussions, to capture direct interactions and social dynamics that may not emerge through interviews alone.

Results

Implementation of Interfaith Dialogue in School

Interfaith Collaboration in Joint Social Projects

Interfaith collaboration in joint social projects represents a strategic and effective approach to fostering tolerance, empathy, and cross-religious solidarity, particularly among young people. These activities serve not only as a means of enhancing social awareness but also as tangible platforms for practicing universal humanitarian values that transcend religious boundaries. At the secondary school level, such collaboration can take concrete forms, such as community service, fundraising for disaster victims, and participation in addressing social issues like poverty. For example, a case study conducted at a senior high school in Surakarta revealed that students from diverse religious backgrounds—Islam, Christianity, and Hinduism—were able to work together to organize relief efforts for flood victims. The students collectively designed the program, gathered donations, and distributed aid to affected communities, regardless of religious affiliation.

Based on observations and interviews with students and supervising teachers, several positive outcomes of these collaborative activities were identified. The most notable impact was the growth of interreligious empathy, as students began to realize that humanitarian values such as mutual assistance, pluralism, and social concern are universal and shared across religious traditions. Additionally, students developed teamwork skills, learned to appreciate differences, and aligned their efforts toward common goals. These findings indicate that interfaith social activities hold significant potential as a form of effective character education within a pluralistic society.

Nevertheless, such collaboration is not without challenges. One major challenge involves differences in religious rites and customs that can affect team dynamics. For instance, variations in dietary rules (e.g., halal and non-halal food), worship schedules, and religious dress codes must be carefully accommodated to ensure the smooth execution of activities. In this context, the role of teachers and facilitators becomes crucial in creating an inclusive atmosphere that

respects diversity and fosters constructive interfaith dialogue. Thus, interfaith collaboration in social projects has the potential to become a meaningful educational experience that strengthens social harmony in a diverse society.

Inclusive Religious Holiday Celebrations

Interfaith collaboration practices in Surakarta senior high schools are exemplified by inclusive celebrations of major religious holidays such as Christmas, Eid al-Fitr, Eid al-Adha, and Nyepi. These events involve the active participation of all students, regardless of their religious backgrounds. The inclusive model implemented in these celebrations creates opportunities for non-Muslim students to participate in distributing *takjil* (free meal) during the month of Ramadan, while Muslim students contribute to preparations for Christmas celebrations, exemplifying interfaith social cooperation. Such collaboration serves as a vital tool for introducing the values of tolerance, mutual respect, and cooperation among students from different religious affiliations. Students are encouraged to learn about the symbolic meanings embedded in the religious holidays of others.

The active involvement of non-Muslim students in *takjil* distribution—an important spiritual and social tradition for Muslims during Ramadan—becomes a significant moment for fostering empathy and social solidarity. These students engage directly in practices with deep spiritual meaning for their Muslim peers rather than merely observing them from a distance. Likewise, Muslim students' participation in Christmas preparations—such as planning events, decorating spaces, and helping prepare meals—demonstrates concrete examples of interfaith cooperation despite not celebrating the holiday themselves. Such interactions teach students the values of compassion, mutual assistance, and unity as universal humanitarian principles that transcend religious stereotypes.

These experiences can help reduce the emergence of interreligious stereotypes. Students involved in interfaith activities gain firsthand exposure to traditions and practices different from their own, thereby minimizing misunderstandings and prejudices that may arise from ignorance or entrenched stereotypes. Such collaborative efforts also enable students to recognize that while religious traditions may differ in symbols and rituals, the humanitarian values they convey can complement one another and enrich individual spiritual experiences.

However, the implementation of interfaith activities in schools requires careful guidance from teachers and facilitators to ensure that these practices are not misinterpreted as syncretism or the inappropriate blending of religious beliefs. The notion of syncretism may provoke controversy and resistance from certain groups. Therefore, teachers must act as facilitators who create constructive dialogue spaces and provide clear explanations about the meaning and intent of each activity. They must also ensure that all students' beliefs are respected. This guidance is crucial for maintaining interfaith initiatives within the bounds of respectful religious coexistence and preventing practices that may contradict doctrinal teachings.

Overall, these interfaith collaborative experiences in Surakarta's high schools function as effective character education. Students not only learn to appreciate religious diversity but also develop the ability to collaborate in broader contexts, ultimately contributing to enhanced social harmony in pluralistic school environments.

Interfaith Discussion Forum

The implementation of an interfaith discussion forum, facilitated by teachers at senior high schools in Surakarta, aims to address contemporary issues related to religion, such as shared values across religions, religious hoaxes, and historical interfaith conflicts. This forum is designed as a platform to foster interfaith understanding, with the primary goal of enhancing students' awareness of the importance of religious moderation and cultivating mutual respect among individuals with different religious beliefs. Teachers act as facilitators, guiding an open dialogue based on the principles of active religious moderation. One key principle applied is the avoidance of divisive debates, instead promoting the exploration of universal values shared by all religions, such as justice, peace, and compassion.

Active religious moderation, as an approach applied in this forum, plays a crucial role in ensuring that the discussions remain constructive and non-polemical. The teacher's role is to ensure that the conversation stays within the realm of human values that are acceptable to all religions while avoiding debates that could cause tensions. This approach allows students to see that, despite differences in theological teachings and religious doctrines, there are common values that can serve as a foundation for broader social cooperation. The discussion forum aims to minimize misunderstandings that often arise from religious differences and provides a space for students to openly dialogue about religious issues that are relevant to daily life.

The findings from this study show significant awareness among students regarding the importance of maintaining tolerance and mutual respect despite profound theological differences between religions. Students reported that through this discussion forum, they were able to understand that differences in religious beliefs should not hinder the formation of positive social cooperation. The directed discussions, guided by the principle of active religious moderation, allowed students to identify shared values across religions that are often overlooked, thus making them more open to ideas and religious practices that differ from their own. Furthermore, students also expressed that through this forum, they gained a deeper understanding of religious hoaxes that often circulate in society and their impact on interfaith relationships.

The importance of the teacher's role as a facilitator in this forum is also evident in their ability to create a safe and inclusive atmosphere where every student feels valued and free to express their views without fear of being judged or reprimanded. Teachers not only guide the discussion but also provide in-depth explanations of the principles of religious moderation and how students can apply them in their daily lives. This discussion forum serves not only as a means to understand religious differences but also as a character education tool that encourages the development of mutual respect and cooperation in a pluralistic society.

Overall, the results of this study emphasize that the interfaith discussion forum facilitated by teachers can be an effective tool in developing moderate, tolerant, and inclusive attitudes among students. The active religious moderation approach has proven to enhance students' awareness that, although there are theological differences between religions, universal human values can serve as a foundation for building harmonious and productive social relationships.

Framework for Interfaith Dialogue

Participatory Learning

The implementation of a holistic framework in interfaith dialogue applied in secondary education, with a focus on the participatory learning approach based on experiential learning, aims to enhance interfaith understanding and strengthen students' social awareness through direct involvement in activities that represent the realities of religious diversity and potential interfaith conflicts. In this context, participatory learning is realized through three main approaches: role-play simulations of interfaith conflicts, interfaith collaborative projects, and experience-based critical reflection.

First, role-play simulations are used as a medium to introduce the dynamics of interfaith conflict in an imaginative yet contextual manner. Students are placed in scenarios where they must represent characters from different religious backgrounds and respond to an issue that could potentially lead to tension. This method facilitates cognitive empathy, the ability to understand another religion's perspective without necessarily agreeing with it. Observations show that students who participated in this simulation tended to experience an increase in critical thinking skills regarding issues of intolerance and were more inclined to consider the perspectives of others.

Second, the interfaith collaborative project is designed to create a concrete space for cooperation between students from different religious backgrounds. This project can take the form of social activities such as interfaith fundraising, environmental campaigns, or religious anti-hoax training, all carried out collaboratively. Through this process, students learn that universal values such as social justice, concern for others, and solidarity are not the monopoly of any particular religion but are part of shared humanity. Interaction in these projects also strengthens social skills, inclusive leadership, and an understanding of the dynamics of working in a diverse team.

Third, experience-based critical reflection is carried out in the form of reflective journals, focused group discussions (FGDs), and presentations of personal experiences. This reflection becomes a key element in internalizing the values gained from real-life experiences. Students are encouraged to re-analyze their attitudes toward religious differences and relate them to the learning they have undergone. In practice, reflection helps deepen ethical and spiritual awareness and fosters an inclusive attitude toward plurality.

Professional Facilitator

Having a professional facilitator to organize interfaith dialogue in secondary education environments is crucial. The role of the facilitator as a learning agent, group dynamic manager, and guarantor of healthy, fair, and inclusive interactions extends beyond merely moderating discussions. An effective facilitator must possess a set of professional competencies that maintain the integrity of the dialogue process and ensure that all participants, regardless of their religious background, feel respected and psychologically safe.

The competency standards required for a professional facilitator in interfaith dialogue encompass three main aspects. First, religious neutrality refers to the ability to maintain a position that is impartial to any particular religious doctrine

or institution. This neutrality does not mean disregarding personal identity but instead positioning oneself objectively in the dialogue space so that all perspectives are fairly accommodated. A non-neutral facilitator has the potential to create bias, undermine participants' trust, and damage the spirit of mutual understanding, which is the primary goal of interfaith dialogue.

Second, the facilitator must possess conflict mediation skills, which include the ability to manage tension, craft peaceful narratives, and navigate conversations that may provoke theological confrontations. Latent or explicit conflicts are likely to arise in discussions that touch upon beliefs. Therefore, facilitators must have the right intervention strategies, including conflict de-escalation techniques, reformulating questions, and utilizing reflective pauses to calm the atmosphere.

Third, it is important for facilitators to have comparative religious knowledge, which is a deep, cross-religious understanding of doctrines, moral values, and key religious practices. This knowledge enables the facilitator to bridge differences intellectually while avoiding generalizations or misinterpretations of any religious teachings.

Observations and evaluations of interfaith dialogue activities guided by facilitators with professional competencies show a significant improvement in the quality of dialogue and students' perceptions of interfaith experiences. Students report feeling more comfortable expressing their views, and discussions are more equitable, and sensitive issues can be discussed without escalating tension.

Contextual Module Based on Socio-Cultural Reality

The Contextual Module Based on Socio-Cultural Reality is designed to meet the needs of learning that is adaptive, inclusive, and relevant to the social realities of students. A comprehensive contextual needs analysis is required to design a learning module that is relevant, adaptive, and able to address real challenges. This analysis includes mapping the characteristics of the school, such as the religious composition of students, local issues affecting social dynamics, and the dominant culture that shapes interfaith interactions. Based on these findings, the module can be structured to combine theoretical studies and practical activities, thereby not only enhancing religious understanding but also promoting the application of values of harmony in daily life.

Table 1. Components of the Contextual Module Based on Socio-Cultural Reality

Components	Description	Examples of Implementation
Contextual parts	Case Studies, Adaptive Content, and Critical Reflection on Contemporary Issues.	Conflict analysis among ethnic groups in Village X; the use of local language and learning material.
Learning components	Interactive learning activities and intergroup collaborative projects aimed at fostering the application of multicultural values	The 'Harmony Trail' Project; Ethical Dilemma Simulations based on Everyday Conflict Scenarios.

Multidimensional Evaluation System

The evaluation system within the contextual religious education module is designed comprehensively using a multidimensional approach that encompasses cognitive, affective, and psychomotor domains. In the cognitive dimension, evaluation focuses on assessing students' understanding of the concept of tolerance and their knowledge of other religions through objective tests and case analyses conducted on a monthly basis. The affective dimension is measured through indicators such as attitudes toward differences and the level of interreligious empathy, utilizing Likert-scale surveys and student reflection journals administered quarterly. Meanwhile, the psychomotor dimension is evaluated through the observation of dialogue skills and assessments of inclusive behavior during project-based activities conducted formatively throughout the learning process.

Table 2. Multidimensional Evaluation System

Domain	Indicators	Instruments	Frequency
Cognitive	- Understanding of the concept of tolerance - Knowledge of other religions	- Objective tests- - Case analysis	Monthly
Affective	- Attitudes toward religious differences - Interreligious empathy	- Likert scale surveys - Student reflection journals	Quarterly
Psychomotor	- Dialogue skills - Inclusive behavior	- Observation - Project assessment	Formative

The evaluation process was conducted through three main stages. The initial assessment stage involved mapping students' baseline tolerance levels using the Religious Tolerance Index (RTI) and identifying specific classroom needs. In the process evaluation stage, data were collected through teachers' anecdotal records during role-play activities, analysis of students' reflective portfolios, and monitoring of group dynamics. The summative assessment stage included conflict resolution simulations, participant satisfaction surveys, and collaborative project presentations aimed at measuring holistic competency achievement. This multidimensional evaluation approach enables comprehensive monitoring of student development while providing feedback for the continuous improvement of the learning process.

Table 3. Assessment Steps

Dimension	Indicator	Instrument	Frequency
Initial Assessment	- Mapping students' baseline tolerance using the Religious Tolerance Index (RTI) - Identification of class-specific needs	- Objective test - Case analysis	Monthly
Process Evaluation	- Attitudes toward difference - Interfaith empathy	- Likert scale - Reflective Journal	Quarterly

Dimension	Indicator	Instrument	Frequency
Psychomotor	- Dialogue skills - Inclusive behavior	- Observation - Project assessment	Formative

Multi-Stakeholder Partnership Model

Table 4. Multi-Stakeholder Partnership Model

School	Family	Religious Community	Coordination Mechanism
Functions: - Program coordination - Provision of human resources and facilities - Integration into the curriculum	*Engagement Mechanisms:* - Family learning modules - Monthly parent forums - Home-based religious projects	*Forms of Collaboration:* - A Day at the House of Worship" program - Guest speakers from various religions - Use of community facilities	*Coordination Mechanisms:* - Quarterly tripartite meetings - Integrated reporting system - Collaborative problem-solving - Clearly defined roles in the guidance document
Concrete Examples: - Establishment of a School Harmony Team - Allocation of 2 hours/ week for interfaith dialogue - Core teacher training	*Supporting Instruments:* - School-family communication book - Online quiz: "Tolerance at Home" - Family dialogue video tutorials	*Work Protocols:* - MoUs with religious councils - Integrated activity calendar - Regular communication forums	

Table 4 illustrates the Triadic Partnership Model, a collaborative structure that integrates three key sectors: schools, families, and religious communities. This structure is designed to foster tolerance through a comprehensive approach. The school takes on the role of program organizer by providing human resources facilities and integrating the curriculum. Families participate through modular learning systems, parent meetings, and home-based projects that emphasize values of tolerance. Meanwhile, religious communities offer practical support, including programs such as visits to places of worship and the provision of interfaith speakers.

This structure is further supported by organized coordination mechanisms, ensuring sustainability and effectiveness. Quarterly meetings are held as a platform for collaborative evaluation and planning among school representatives, communities, and religious organizations. An integrated reporting system is in place to monitor the progress of

programs, while problem-solving is carried out collaboratively through open discussions. Clear documentation of roles ensures that each party is aware of their responsibilities. Work protocols, such as memorandums of understanding (MoUs) with religious institutions and a coordinated activity calendar, strengthen the collaborative commitment in program execution. Through this systematic approach, the model not only promotes active participation but also minimizes the potential for miscommunication, contributing to the creation of a peaceful and welcoming environment for all parties involved.

Discussion

The Implementation of Interfaith Dialogue in School

The findings of this study highlight the implementation of interfaith dialogue in the form of interfaith collaboration in social projects as a strategy to foster tolerant attitudes among adolescents. This aligns with the study by Shani et al. (2023), which developed the "Together for Tolerance" intervention in secondary schools in Germany. This intervention leverages the social influence of individuals in central positions within social networks to spread norms of respect based on equality, with the goal of enhancing intergroup tolerance. Although the results indicated that the intervention did not significantly improve overall tolerant behavior, there was evidence suggesting that exposure to peer-led actions could have a positive short-term effect on intergroup tolerance.

In addition to building empathy, interfaith social activities also serve as a medium for character education based on universal values such as social justice and solidarity. Research by Murrar et al. (2020) demonstrates that exposure to pro-diversity attitudes from peers can increase inclusion and reduce academic achievement gaps among students. This underscores the importance of a supportive social environment that promotes inclusive values in shaping the attitudes and behaviors of adolescents.

However, challenges such as differences in worship rituals, dietary rules, and clothing practices require the presence of facilitators who are able to bridge these differences inclusively. Research conducted by Paluck & Shepherd (2012) emphasizes the importance of social reference groups in changing collective norms and behaviors within the school environment, demonstrating that individuals who are respected within social networks can influence the attitudes and behaviors of the group as a whole.

This study also reaffirms the importance of the local context in designing tolerance education approaches. Gjorgjevski (2020) evaluated the effects of descriptive norms on political tolerance and found that perceptions of social norms can influence an individual's level of tolerance towards other groups. This suggests that interventions that consider the prevailing social norms in local communities may be more effective in promoting tolerance.

Conceptually and empirically, these findings have significant implications for the future development of interfaith education. Future research could be directed toward longitudinal studies to evaluate the long-term effects of involvement in interfaith social projects on sustained attitudes of tolerance. Additionally, the exploration of interfaith engagement models through digital platforms such as social media or virtual campaigns also represents a promising area for research. Practically, such collaboration could be integrated into secondary school curricula through

approaches within Pancasila and Citizenship Education. This integration is also supported by research by Sutarti et al. (2024), which highlights that the Merdeka Curriculum places significant emphasis on developing tolerance attitudes within education.

The process of internalizing tolerance values is carried out through inclusive, dialogical, and experiential learning approaches. Furthermore, schools, through the central role of teachers, play a vital role in reinforcing tolerance values among students. These research findings provide a deeper understanding of educational practices that support the internalization of tolerance values in the Merdeka Curriculum and contribute to the development of a more inclusive curriculum oriented toward humanistic values in Indonesia. The development of digital media to promote tolerance in diversity within Pancasila and Citizenship Education has also been conducted by Trisiana et al. (2025) and shows effective results in fostering tolerance attitudes, as demonstrated through learning outcomes related to citizens' rights and obligations in maintaining the integrity of the Republic of Indonesia. The availability of specialized training for teachers as facilitators of interfaith dialogue is also crucial in creating an inclusive and responsive educational environment that accommodates religious diversity.

The active participation of non-Muslim students in activities such as distributing iftar meals during Ramadan not only fosters solidarity but also provides a firsthand experience of the spiritual values inherent in Islamic traditions. This finding is reinforced by research by Murrar et al. (2020), which shows that direct involvement in activities reflecting social inclusivity values can reduce stereotypes and strengthen mutual respect within diverse groups.

In the same context, the contribution of Muslim students in preparing for Christmas celebrations represents a practice of interfaith collaboration rooted in universal human values. This highlights the importance of meaningful intergroup contact, which, according to Beelmann and Heinemann (2020), is effective in reducing prejudice when it occurs in an equal and collaborative environment.

Moreover, this practice opens space for students to understand the symbolic significance of religious holidays of other faiths, which is central to experiential interfaith education. According to a study by Morgan & Sandage (2016), experiential interreligious education that emphasizes direct engagement and critical reflection has a significant impact on changing adolescents' attitudes toward other religious groups. Activities like this also reflect the application of shared ritual participation, which, according to Amin et al. (2023), is considered a powerful strategy in building prosocial relationships among groups with a history of ideological differences.

Thus, collaboration in inclusive religious holiday celebrations not only strengthens social cohesion within schools but also provides transformative pedagogical experiences in shaping an inclusive citizenship identity grounded in cross-religious human values. Moving forward, the integration of such approaches into national education policies and interfaith curricula could become a long-term strategy in shaping a youth generation that is tolerant, empathetic, and capable of coexisting in a pluralistic society.

The implementation of interfaith discussion forums at Surakarta High School demonstrates a strategic approach to fostering religious tolerance and moderation among adolescents. This forum, facilitated by teachers, focuses on

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contemporary issues related to religion, such as interfaith common values, religious hoaxes, and historical religious conflicts. The role of teachers as effective facilitators of interfaith dialogue is also emphasized by research by (T. J. Barnas (2022) shows that active involvement in interfaith dialogue programs can strengthen tolerant attitudes and encourage concrete actions to combat religious intolerance. This approach aligns with the findings of Suparjo et al. (2022), which stress the importance of inclusive religious education in developing religious tolerance among adolescents through harmonious interactions among students from different religious backgrounds.

The role of teachers as facilitators in this forum is crucial. They guide open dialogue with the principle of active religious moderation, avoiding pluralistic debates that could provoke division and focusing on the exploration of universal values such as justice, peace, and compassion. According to Mufi et al. (2023), this approach reflects an effective strategy for internalizing the values of religious moderation, ensuring that the discussion remains constructive and non-contentious.

This discussion forum also provides students with the space to understand that, despite differences in theological teachings and doctrines among religions, there are shared values that can serve as a foundation for broader social cooperation. Research by Kusmayani (2023) highlights the role of interfaith dialogue among Indonesian youth in facilitating social cohesion and civil participation through an understanding of religious pluralism. Thus, the religious discussion forum facilitated by teachers at Surakarta High School functions as an effective platform for building students' awareness of the importance of religious moderation and mutual respect between individuals with different religious beliefs. According to Aneas et al. (2024), participation in such forums strengthens students' interreligious competencies, which include the ability to recognize, respect, and include individuals of different religious beliefs. This practice can serve as a model for the implementation of religious tolerance education in other secondary schools within a multicultural society.

Framework for Interfaith Dialogue

Interfaith dialogue is a vital need at the personal level, as it enables intellectual and spiritual growth for individuals. Similarly, in Italy (Scuderi, 2015), interfaith dialogue tends to develop bilateral knowledge aimed at building friendly relationships with the goal of facilitating the spiritual progress of each individual. Contributions are found in interfaith dialogue in education in general. A recent analysis of international literature (Edwards, 2018) reveals three intriguing areas: theoretical frameworks, context of application, and methodology.

Regarding the theoretical framework, there are two main relevant topics. On the one hand, Essomba et al. (2023) found papers supporting the ethical need for education on interfaith issues, with a strong emphasis on social justice. The need for a holistic framework for interfaith dialogue in schools arises to anticipate the gap between what is set in law and what happens in everyday practice. According to Alibašić (2020), this is possible because moral and ethical texts in the constitution are only theoretically binding in law. Thus, the holistic framework for interfaith dialogue in schools is based on a multicultural education paradigm that views diversity as a strength. Based on the research results, the following is the framework for holistic interfaith dialogue in schools.
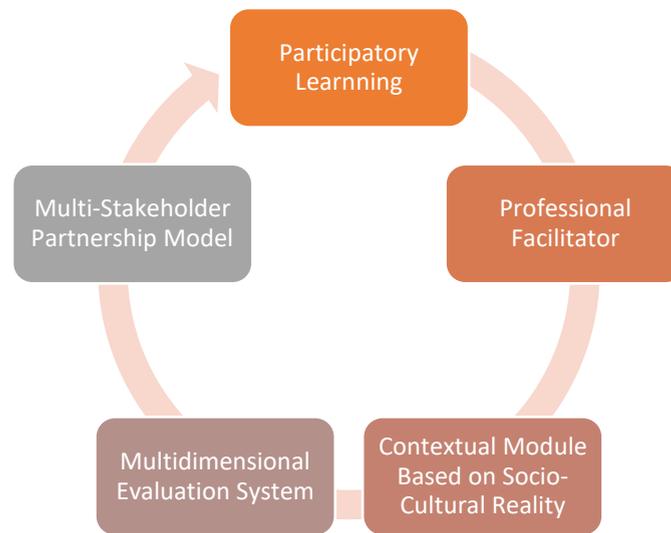
Figure 1. Framework for Interfaith Dialogue in School

A comprehensive contextual needs analysis is a vital foundation for building an effective and sustainable interfaith dialogue framework in schools. Identifying needs through mapping religious diversity within the school environment, pinpointing sensitive local issues, and conducting assessments of teachers and students to consider the characteristics of students and the readiness of teachers to implement participatory learning are essential steps. The capacity of educators/facilitators also determines whether the designed learning strategies can be effectively implemented or not. An effective facilitator needs a set of professional competencies that can maintain the integrity of the dialogue process and ensure that every participant, regardless of their religious background, feels valued and psychologically safe. Therefore, it is necessary to develop a module as a guide and reference for facilitators to achieve the learning objectives.

A contextual module based on socio-cultural realities and local wisdom becomes one of the alternatives that can be designed to meet the needs of adaptive, inclusive, and socially relevant learning. Previous research by the Japar et al. (2022) shows that local wisdom values used as a multiculturalism learning model have implications for the culture of cooperation among students in collaborative activities. This includes how a relevant learning approach can be applied and evaluated holistically. The learning approach involves a systemic approach that integrates cognitive (knowledge), psychomotor (skills), and affective (attitudes and values) aspects. In the cognitive aspect, the participatory learning approach based on experiential learning (Abu-Nimer & Smith, 2016) is one alternative to facilitate cognitive empathy, which is the ability to understand the perspectives of other religions without necessarily agreeing with their beliefs. Teachers can use role-play simulations of interfaith conflicts for this purpose.

The observation results indicate that students who participated in this simulation tend to show improvement in their critical thinking skills regarding intolerance issues and exhibit a greater inclination to consider others' perspectives. In terms of psychomotor (skills) aspects, teachers can implement collaborative interfaith project-based learning by creating collaborative spaces for students from different religious backgrounds. These projects can include social activities such as interfaith fundraising campaigns, environmental awareness campaigns, or anti-religious hoax training sessions carried out collectively. Through these project activities, students better understand universal values

such as social justice, concern for others, and solidarity as part of shared humanity. This aligns with research by Pudjiarti (2025), which emphasizes that the collaborative project paradigm focuses on practical cooperation to solve problems such as social and humanitarian issues. In the affective aspect, teachers can encourage students to engage in critical reflection based on their experiences through reflective journals, focus group discussions, and personal experience presentations. These activities serve as efforts to internalize values derived from students' real-life experiences. They reassess the attitudes they took during the learning process in the context of religious differences.

The most crucial stage, the unity model, leads to the awareness that all religious traditions have universal aspirations that can unite people despite differences in expression and practice. According to Cush & Robinson (2020), building lasting positive relationships among religious communities requires knowledge of various levels of discourse. The components in the module include contextual sections such as case studies, adaptive content, and critical reflection on current issues, as well as learning components like interactive activities and collaborative projects for applying multicultural values. A holistic evaluation system is essential to monitor the success and sustainability of the program. The evaluation system in the contextual religious education module is designed comprehensively with a multidimensional approach, encompassing cognitive, affective, and psychomotor aspects.

The evaluation process is carried out in three main stages: the initial assessment stage, which includes mapping the baseline tolerance of students using the Religious Tolerance Index (RTI) and identifying specific class needs; process evaluation; and psychomotor evaluation. During the process evaluation stage, data is collected through anecdotal notes from teachers during role-play activities, analysis of students' reflective portfolios, and monitoring group dynamics. The summative assessment stage includes conflict resolution simulations, participant satisfaction surveys, and collaborative project presentations aimed at measuring holistic competency achievement.

The assessment instruments are tailored to the aspects being measured, with frequency variations including monthly, quarterly, and formative assessments. Lastly, there is a collaborative network. The research results indicate that the collaborative network with the Triadic Partnership model, a collaborative structure integrating three main sectors—school, family, and religious communities—is designed to promote tolerance through a comprehensive approach. Schools not only teach tolerance theory but also create spaces for real-life practice; families serve as the foundation for values, and communities provide a space for practice. This collaboration model demonstrates that tolerance is not merely a subject matter but a way of life that must be cultivated through the synergy of the entire educational ecosystem. When schools, families, and communities share a common mission and purpose, it will create a generation that not only understands diversity but celebrates it as a national strength.

The dialogue, framed in a broader perspective of interfaith dialogue, has received special attention in the context of our society over the last two decades. Interfaith dialogue is understood as a process that occurs between people from different religious backgrounds, guided by willingness, respect, and openness (Essomba et al., 2023); a dialogue that is equal. In line with this, according to Pope (2020), interfaith dialogue allows people with different worldviews and perspectives to work and live together. Interfaith dialogue naturally arises as a reactive position in the face of realities that need to be managed.

Conclusion

This study highlights the potential of interfaith dialogue in secondary education to promote tolerance, inclusivity, and religious moderation. Through activities like interfaith social collaborations, inclusive religious celebrations, and teacher-facilitated dialogue forums, students not only gain a deeper understanding of interfaith values but also develop empathy, cross-cultural communication skills, and social awareness. The research shows that direct involvement in interfaith activities helps reduce stereotypes and prejudices that often lead to interfaith conflicts. Experiential activities, such as role-play, collaborative projects, and open discussions, foster the internalization of universal values like justice, compassion, and peace, which go beyond doctrinal boundaries. Teachers play a crucial role as facilitators of dialogue, creating a safe and equitable space to nurture mutual respect. The study emphasizes the importance of developing contextual modules based on students' social realities and a multidimensional evaluation system covering cognitive, affective, and psychomotor aspects. Furthermore, a multi-party partnership model involving schools, families, and religious communities is essential for fostering a culture of tolerance. The findings suggest that interfaith dialogue is a transformative pedagogical strategy that addresses intolerance and social polarization. The study recommends further longitudinal research to assess the program's long-term impact and the integration of this model into national curriculum policies as part of citizenship education rooted in universal human values and Indonesian identity.

Recommendations

The government should consider integrating the interfaith dialogue forum model into the Pancasila and Citizenship Education curriculum, religious education, or extracurricular activities. This aims to systematically equip students with interfaith dialogue and tolerance skills. Given the positive impact demonstrated in the study, it is recommended that this model be replicated in other schools across Indonesia, taking into account local contexts and regional diversity. Local governments and education departments can support this replication through pilot projects and cross-school partnerships. Longitudinal studies are needed to assess the long-term impact of interfaith dialogue forums on students' attitudes and behaviors. This research would help determine if the changes in tolerance, empathy, and openness achieved in the short term can be maintained in students' future social and educational lives. Additionally, a longitudinal approach would allow for the evaluation of the forum's effectiveness in preventing the re-emergence of stereotypes and intolerance in the future.

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Exploring Faculty Engagement with Simulation Technologies in Medical Education: Current Practices, Challenges, and Training Needs

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Abstract: Simulation centres are essential in medical education, providing a controlled environment for clinical skill development. Despite their benefits, the integration of simulation technologies into teaching practices remains inconsistent across faculties. This study investigates how simulation-based education is currently used at a medical university, focusing on usage patterns, simulator preferences, and faculty training needs. Survey results reveal that although a variety of simulators are available, their use remains limited due to factors such as lack of awareness, insufficient training, and time constraints. Many faculty members expressed interest in incorporating simulation into their teaching if provided with accessible, structured information and targeted support. A centralized database is under development to address this gap by offering detailed and user-friendly information on simulator specifications and applications. Findings also show a preference for high-fidelity simulators, particularly in the Faculty of Medicine, highlighting the need for department-specific procurement strategies. Additionally, the study identifies a strong interest in using simulators for both skills training and assessment. The results support the hypothesis that structured training and synthesized information can enhance adoption and inform the development of faculty-specific, time-efficient programs. These findings have significant implications for improving the adoption and effectiveness of simulation-based education in medical training.

Keywords: Simulation-Based Training, Medical Education, Educational Technologies, Medical Faculty, Faculty Engagement

Introduction

Simulation centers are pivotal in modern medical education, providing a controlled environment where learners can develop clinical skills and decision-making competencies (Koukourikos et al., 2021). By simulating real-life medical scenarios, these centers enable healthcare students and professionals to practice procedures and teamwork in a safe and structured setting (Lee et al., 2020). The growing recognition of their importance underscores their role in bridging the gap between theoretical knowledge and practical application, especially as the healthcare landscape becomes increasingly complex.

Historically, simulators were limited to basic procedural training, such as practicing intramuscular injections on oranges or intravenous cannulation with plastic arms. These approaches, while foundational, offered limited scope. With technological advancements, simulation applications now encompass broader skills, including communication, decision-making under pressure, teamwork, and ethical patient interactions (Gelis et al., 2020; Krishnamurthy et al., 2022; Andersson et al., 2022; Lee et al., 2024). The expanded use of simulation also aligns with the growing emphasis on patient-centered care, where communication and teamwork are just as critical as technical proficiency in improving patient outcomes.

The Simulation centers at the Medical Universities integrate diverse simulators to support healthcare education. These include high-fidelity mannequins replicating physiological responses for emergency scenarios, task trainers for specialized technical skills, and software-based simulations for virtual diagnostic training. Beyond technical training, simulation allows learners to encounter and manage rare but clinically significant conditions they might not see during their clinical rotations, enhancing their preparedness for real-world challenges. Moreover, simulation training improves patient safety by allowing students to practice and refine their skills without risking harm to actual patients (Chernogorova et al., 2019; Kennedy et al., 2023).

While simulation technologies have proven benefits, their potential remains underutilized. Observations indicate that the same educators repeatedly use the simulators, often relying on limited scenarios without exploring the full potential of the equipment. This underutilization can limit students' and specialists' exposure to diverse and complex clinical situations, reducing the overall impact of their training (Maffucci et al., 2023).

Faculty engagement is a key factor influencing the extent to which simulation-based training is integrated into curricula. While many studies focus on student attitudes and experiences with simulation, the effectiveness and scope of its application depend significantly on the faculty's engagement and proficiency with these technologies. Faculty members play a crucial role in determining how widely simulators are used and the variety of scenarios explored in the training process. When fully utilized, simulation-based training can bridge the gap between theoretical knowledge

and clinical practice. It prepares students to handle critical medical situations confidently and adapt to unexpected scenarios, ultimately improving patient outcomes. Studies have identified key barriers to the wider utilization of simulation, including the lack of information and targeted training opportunities (Savoldelli et al., 2005). These challenges highlight the need for increased efforts to support faculty and promote the broader application of simulation technologies in medical education.

Building on this foundation, two hypotheses are sought to be tested: (a) that providing easy access to synthesized, user-friendly information about simulators could increase their usage, and (b) that organizing time-efficient, targeted training courses could enhance faculty engagement with simulation-based education. The findings will provide valuable insights into the management and optimization of simulation-based training programs, contributing to the enhancement of simulation-based medical education and training across various centers.

Method

Ethics

The study protocol was reviewed and approved by the Research Ethics Committee at the Medical University of Varna (Protocol No. 4/12.09.24). All participants were fully informed about the purpose of the study, and their participation was voluntary. Informed consent was implied upon completion of the online survey, with participants assured of the anonymity and confidentiality of their responses throughout the process.

Study Design

A descriptive quantitative study was conducted using a correlational and comparative design to examine faculty members' awareness, perceptions, usage patterns, and training needs regarding simulation-based education in medical training. The study focused on faculty at the Medical University of Varna who are directly involved in conducting practical teaching exercises. Participants in this study were selected based on specific inclusion and exclusion criteria. Faculty members who were responsible for teaching practical exercises, regardless of whether they currently used simulation tools, were included in the study. Faculty who are primarily involved in lecture-based teaching, without any responsibility for practical or simulation-based instruction, were excluded. This approach ensured that the sample represented individuals with direct or potential experience with simulation technologies, providing insights into their usage and needs.

Data Collection and Survey Instrument

The study was conducted between 15 October and 30 November 2024 using a structured online survey administered via the Google Forms platform, ensuring ease of access, anonymity, and confidentiality. The survey was designed to assess faculty members' experiences and perceptions of simulation-based education and to identify their training needs. The survey was divided into four main sections:

1. *Awareness* – Exploring faculty members' familiarity with the available simulation tools and

technologies.

2. *Current use* – Identifying the extent to which faculty members currently incorporate simulation tools into their teaching practices.

3. *Potential use* – Investigating faculty members' willingness and potential interest in integrating more simulation-based education into their teaching.

4. *Training needs* – Assessing the specific training requirements and preferences of faculty members to effectively use simulation technologies in their teaching.

Statistics

The collected data were analyzed using IBM SPSS version 26.0 software. Descriptive statistics were employed to summarize the demographic characteristics of the sample and the responses to each survey item. To assess the relationships between categorical variables, the Chi-square (χ^2) test was utilized, with a significance level set at $\alpha = 0.05$. This statistical approach allowed for the identification of any significant differences in responses based on demographic variables, such as age, academic rank, and faculty affiliation, providing insights into how different faculty characteristics might influence their engagement with simulation-based education.

Results

The survey included 123 faculty members, comprising 30.1% men (n=37) and 69.9% women (n=86). Participants were categorized by age as follows: 15.4% were under 30 years old (n=19), 43.1% were between 31 and 45 years old (n=53), 33.3% were aged 46 to 60 (n=41), and 8.1% were over 60 years old (n=10). Regarding academic rank, most were non-habilitated faculty members (60.9%, n=75), while 34.1% were habilitated (n=42). The respondents represented various faculties and a college within the Medical University …: 46.3% were from the Faculty of Medicine (FM) (n=57), 8.9% from the Faculty of Dental Medicine (FDM) (n=11), 17.9% from the Faculty of Pharmacy (FP) (n=22), 17.1% from the Faculty of Public Health (FPH) (n=21), and 6.5% from the Medical College (MC) (n=8). Four participants (3.2%) chose not to disclose their affiliation.

Awareness and Use of Simulation Technology

The survey revealed varying levels of awareness and use of simulation technology among faculty members. While the majority (70.7%, n=87) reported being aware of available simulators and mannequins for practical exercises, the knowledge of where to access detailed information about these resources varied. Only 46.3% (n=57) knew where to find detailed resources on simulation technologies, indicating a gap in accessible support systems. Despite this awareness, the integration of simulation technology into teaching practices remains limited. Only 29.3% (n=36) of faculty members actively use it in their exercises, while 70.7% do not (see Figure 1).
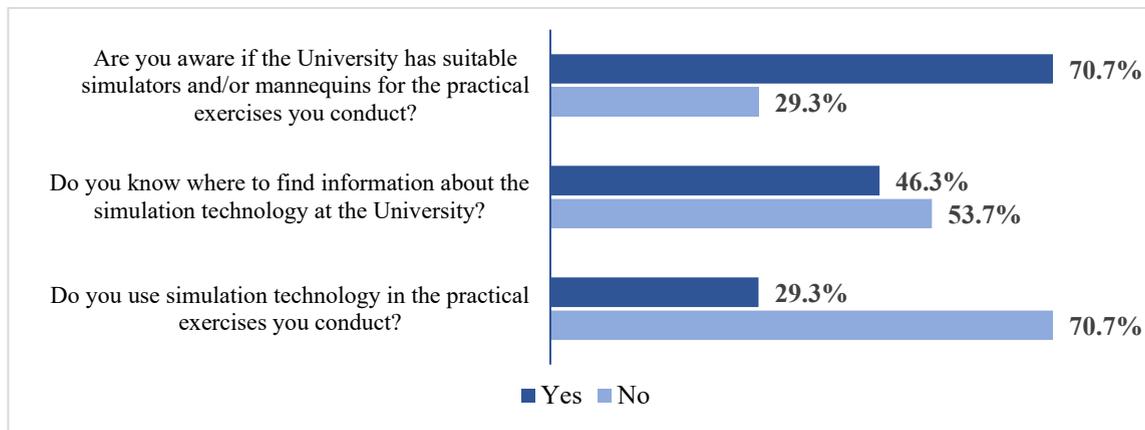
Figure 1. Awareness and utilization Of Simulation Technology In Medical Training

Types of Simulators Used

The types of simulators varied widely among the faculty members who currently use simulators and those who anticipate their use. More than half (55.6%, n=20) utilize high-fidelity mannequins, making them the most commonly used simulation tool. In contrast, 31.0% (n=27) of faculty members who do not use simulation technology but consider it suitable for their exercises identified high-fidelity mannequins as an appropriate option.

Complex task trainers are used by 33.3% of respondents, who actively incorporate simulation technology in their teaching. An equal proportion (33.3%, n=29) of faculty members who have not yet used task trainers but consider them relevant also view these devices as suitable for their practical exercises. Basic task trainers are the most popular tool, with 44.4% (n=16) of faculty members incorporating them into their teaching practices. Among those who do not currently use simulators but view them as useful, 28.7% (n=25) indicated that they would consider using basic task trainers in their training. Software-based simulation platforms are employed by 30.6% (n=11) of faculty members who currently use simulation technology. Among faculty members who do not use these platforms but consider them suitable for their practical exercises, 41.4% (n=36) expressed an interest in utilizing them. The least utilized method is standardized patients, with only 13.9% of faculty members who actively use simulation technology incorporating them into their teaching. However, among the 34.5% of faculty members who do not currently use simulation technology but would consider using it in the future, a significant portion expressed interest in incorporating standardized patients into their teaching sessions.

The distribution of simulator types used and preferred among faculties is presented in Table 1. This table provides a detailed breakdown of the data by faculty, highlighting the differences between current users and those who anticipate using simulators in their teaching practices.

Table 1. Distribution of Simulator Types Currently Used and Preferred by Faculty Members Across Faculties

Simulator type	High-fidelity simulators		Complex task trainers		Basic task trainers		Software simulators	
Faculty	Users	Non-users	Users	Non-users	Users	Non-users	Users	Non-users
FM	22.2%	18.4%	16.7%	21.8%	16.7%	19.5%	16.7%	18.4%

FDM	19.4%	2.3%	2.8%	1.1%	2.8%	1.1%	-	2.3%
FP	-	2.3%	-	3.4%	-	2.3%	-	10.3%
FPC	11.1%	3.4%	11.1%	5.7%	22.2%	3.4%	11.1%	4.6%
MC	2.8%	3.4%	2.8%	1.1%	2.8%	2.3%	2.8%	3.4%
Unknown	-	1.1%	-	-	-	-	-	2.3%
TOTAL	55.6% n=20	31.0% n=27	33.3% n=12	33.3% n=29	44.4% n=16	28.7% n=25	30.6% n=11	41.4% n=36

FM – Faculty of Medicine

FDM – Faculty of Dental Medicine

FP – Faculty of Pharmacy

FPC – Faculty of Public Health

MC – Medical College

Educational Purposes of Simulation Technology

Further analysis explored how faculty members use or would consider using simulation technology for various educational purposes, including skill development, knowledge assessment, and practical skill evaluation. Faculty members who currently use simulation technology primarily utilize it for skill development, with 94.4% (n=34) incorporating simulation tools for this purpose. Comparatively, 85.1% (n=74) of faculty members who do not use simulation technology but believe it could benefit their teaching also expressed interest in using it for skill development. When it comes to assessing students' knowledge, 55.6% (n=20) of faculty members who use simulation technology apply it for this purpose. Notably, a significantly higher percentage of faculty members who do not currently use simulation technology but consider it suitable for their exercises (75.9%, n=66) indicated they would utilize it for knowledge assessment. A statistically significant difference was identified between the two groups regarding the use of simulators for knowledge assessment ($\chi^2 = 4.992$; $p = 0.025$). For evaluating practical skills, 50.0% (n=18) of faculty members using simulation technology incorporate it into their teaching. On the other hand, 63.2% (n=55) of faculty members who do not use simulation technology but see its value for their teaching would use it for evaluating practical skills (see Figure 2).
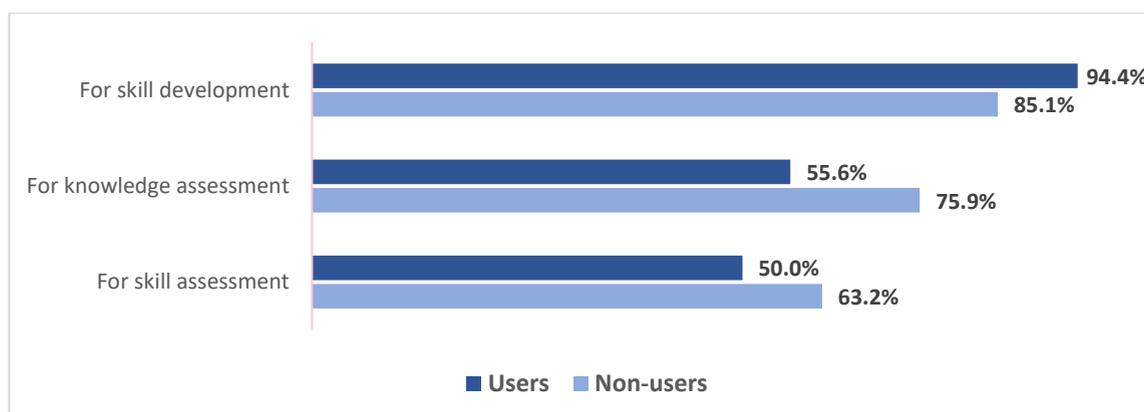

Figure 2. Current and Potential Applications Of Simulators

In addition to using simulation technology for student training, faculty members were also asked about its potential

incorporation into various courses or training programs. Among the responses, 9.8% of participants currently use simulators in their courses, while 22.8% plan to start using them. A promising 34.1% (n=42) had not considered it before but are now open to the idea. In contrast, 21.1% stated they do not plan to use simulation technology in their courses, and 12.2% reported that they do not conduct courses or other forms of training.

Confidence in Using Simulation Technology

Another area of interest was how effectively faculty members feel they are using the full potential of simulation tools in student training. Only 25.0% (n=9) of those currently using these technologies feel confident that they are fully utilizing the technology's capabilities. In contrast, more than twice as many (55.6%, n=20) believe they are not tapping into their full potential, while 19.4% (n=7) remain uncertain.

Perspective on Incorporating Simulation Technology

Faculty members who do not currently use simulation technology were asked whether they would start using it in practical student training if they had easy access to structured information about suitable simulators and mannequins. The majority (86.2%, n=75) indicated that they would begin incorporating simulation tools under these circumstances. A small proportion (2.3%, n=2) stated that they would not use simulation technology even with such information, while 11.5% (n=10) were undecided.

Interest in Professional Development

The final section of the survey focused on training, specifically gauging faculty interest in further professional development related to simulation technology. An overwhelming 96.7% (n=119) of participants expressed interest in attending thematic training on simulation technology tailored to their needs if offered at the Medical University of Varna. Only 3.3% (n=4) of respondents indicated they would not participate in such training. Regarding the time needed to learn to operate a new simulator, 49.6% (n=61) of respondents estimated that one to two hours would be sufficient, while 39.0% (n=48) believed they would need between 30 and 60 minutes. Only 11.4% thought they would require more than two hours to master a new simulator.

In addition to the results presented, statistically significant differences based on demographic characteristics were revealed, providing deeper insights into faculty engagement with simulation technologies. The findings highlight significant differences in the awareness and utilization of simulation technologies among faculty members across faculties. These disparities point to the need for targeted interventions to improve the integration of simulation tools in teaching practices (see Table 2).

Table 2. Statistical Associations Between Faculty Characteristics and Simulator Use

	Gender	Age	Academic rank	Faculty affiliation
Current use				(χ^2 =23.285; p=0.000)
Type of simulators				

- *High-fidelity*   (χ^2 =7.846; p=0.049)   (χ^2 =10.827; p=0.004)   (χ^2 =18.105; p=0.003)
- *Complex trainers*   (χ^2 = 11.776; p = 0.038)
- *Basic trainers*   (χ^2 = 13.709; p = 0.018)

Educational purposes of simulation
- *Skills*   (χ^2 =4.391; p=0.036)
- *Confidence*   (χ^2 =6.770; p=0.034)

Training time   (χ^2 =11.968; p=0.003)   (χ^2 =10.827; p=0.004)

Discussion

The study revealed that many faculty members are not utilizing the available simulators. Several factors may explain the limited use of available simulators. These include lack of awareness about existing technologies (Alshehri et al., 2023), absence of protected time for faculty (Lamé & Dixon-Woods, 2020), insufficient understanding of simulation applications (Bienstock & Heuer, 2022), and perceptions that simulation is not suitable for teaching due to concerns about artificiality, time and cost, or low knowledge retention without frequent practice (Pezel et al., 2021). However, the responses indicate a strong willingness among non-users to integrate simulation tools into their teaching practices if they have easy access to structured and clear information. These findings validate the first hypothesis that providing synthesized, user-friendly information about simulators could significantly increase their adoption.

To bridge this informational gap, a centralized database is currently under development. It will offer structured, up-to-date information on each simulator's specifications, capabilities, and applicable scenarios. Advanced search filters tailored to departmental or pedagogical needs will facilitate efficient access and decision-making. Regular updates will ensure the inclusion of new simulators and features, enhancing awareness and promoting the effective integration of simulators into teaching practices.

An interesting finding from the survey is the clear preference for high-fidelity simulators, particularly among faculty members from the Faculty of Medicine. This contrasts with previous studies where software simulators were reported as the most commonly used (Qayumi et al., 2014). The prevalence of high-fidelity simulators in this study may be attributed to the significant proportion of respondents from the Faculty of Medicine, where advanced simulators are more frequently integrated into teaching. These results suggest that decisions regarding simulator procurement should consider the specific needs of each department and the types of simulations faculty members require. Recognizing these unique needs is essential to ensuring that simulators are selected based on their relevance to the teaching context. This perspective is supported by Herrera-Aliaga & Estrada, who emphasize that simulations must align with educational goals to maximize their impact (Herrera-Aliaga & Estrada, 2022).

Additionally, more than half of faculty members reported not fully utilizing the capabilities of the simulators, suggesting inadequate training and preparation. This finding aligns with previous research and highlights missed opportunities for diversifying teaching methods and maximizing simulator use (Jin et al., 2022). Effective training is essential for increasing the adoption of educational technologies (McKenna et al., 2015).

Furthermore, the results indicate that faculty members who have not yet used simulators express different preferences

for simulator types than current users. Possible explanations include fear of high-technology tools, as reported in previous studies (Al-Ghareeb & Cooper, 2016), lack of familiarity with simulator capabilities (Bienstock & Heuer, 2022), and varying simulation needs across faculties and educators (Elshama, 2020). The first two challenges can be addressed through targeted courses designed to familiarize faculty with simulation technologies and build confidence in their use. The third challenge implies that a one-size-fits-all approach is inappropriate for selecting educational simulators. Instead, simulator selection should align with specific learning objectives, supporting the principle of matching fidelity requirements to training needs (Lazzara et al., 2014). These findings highlight the necessity of considering faculty members' diverse requirements when implementing simulation-based teaching tools, as not all types of simulation are equally suitable for every teaching context (Elshama, 2020).

The survey also reveals a strong desire among faculty members for simulators to be used not only for skill development but also for assessing knowledge and competencies. Effective assessment is a core component of simulation-based training, measuring both procedural and interpersonal skills to ensure comprehensive development in clinical education (Elendu et al., 2024). This suggests that faculty members will require specific information in the proposed database, which should include details about simulators' technical features as well as their suitability for knowledge assessment and skills evaluation. These insights emphasize the need for training programs that address both the technical and pedagogical aspects of simulator use. Given the broad range of potential applications, from skill development to assessment, faculty training should incorporate guidance on integrating simulators into diverse educational scenarios. The lack of skilled personnel impacts operational efficiency and presents challenges in integrating simulation into healthcare curricula.

Encouragingly, the survey results show strong faculty interest in specialized courses on simulator use. These courses should prepare faculty not only for effective teaching but also for objective student assessment using simulation technologies. However, most respondents preferred short and focused courses when asked about their preferred training duration. This finding aligns with previous research, suggesting that educators, particularly in high-pressure academic environments, favor time-efficient learning opportunities that fit their schedules (Dleikan et al., 2020). The preference for concise, practical training sessions has significant implications for program development, suggesting that lengthy theoretical courses may be less effective. Instead, training should be designed to be directly applicable, adaptable to specific faculty needs, and time-efficient. Herrington underscores the importance of ongoing in-house training for educators, especially when introducing new simulation technologies (Heinrichs & Alinier, 2019). The second hypothesis, proposing that targeted training courses could increase engagement with simulation-based education, is supported by the findings. Faculty members expressed a need for structured training and professional development opportunities, with a clear preference for short sessions (up to two hours) due to time constraints and heavy workloads.

Additional statistically significant differences in simulator use based on faculty affiliation, age, gender, and academic rank should be considered in the analysis of results. Variations in simulator preferences across faculties highlight the need for tailored procurement strategies aligned with specific educational requirements. The uneven distribution of high-fidelity simulators in certain faculties calls for targeted interventions, such as a centralized database, to improve access to information and facilitate the adoption of simulation technologies (Branch, 2013). Gender differences in the

use of simulation for skill enhancement and training duration preferences indicate the need for equal training opportunities. Differences based on academic rank further emphasize the importance of diverse training formats to ensure the effective integration of simulation technologies into education.

Despite the valuable insights provided by the findings, this study is limited by several factors, including its cross-sectional design, which captures faculty perceptions at a single point in time, and the sample being drawn from a single medical university. Additionally, as the study primarily focused on usage patterns and preferences for simulators, it did not specifically investigate barriers faced by faculty members who do not currently use simulators. Future research could explore these barriers in more detail, identifying specific challenges that may prevent certain faculty members from adopting simulation-based education, even when they recognize its potential value. This would allow for a deeper understanding of the factors that hinder simulator adoption and inform more tailored interventions aimed at overcoming these obstacles. Furthermore, longitudinal studies across multiple institutions could offer valuable insights into how faculty engagement with simulation-based education evolves over time and how various support mechanisms, such as training and resource availability, influence the long-term integration of simulation into medical curricula.

Conclusion

This study aims to investigate faculty members' engagement with simulation-based education in medical training, focusing on usage patterns, preferences for simulators, and training needs. Findings indicate that access to clear, synthesized information about simulators significantly improves their adoption, while targeted, time-efficient training programs are crucial for enhancing faculty engagement and confidence. Addressing the variability in faculty experience and simulation needs will be crucial for the success of future initiatives. Differentiated training approaches, structured around faculty members' prior exposure and intended simulation use, could maximize the effectiveness of professional development efforts. Furthermore, the implementation of the centralized database should be guided by continuous feedback from users to ensure its usability and relevance. By aligning support mechanisms with the practical realities of academic teaching, institutions can more effectively promote the integration of simulation into health education. This research contributes to a better understanding of the barriers to effective simulator use and highlights the need for structured resources to bridge the gap between simulator availability and actual usage. Future research is needed to assess the impact of such training programs and databases, including their long-term effects on teaching quality and curriculum integration.

Recommendations

Based on the study findings, the following recommendations are proposed to improve the adoption and effective use of simulation-based education in medical training:

1. A centralized platform should be developed and maintained to provide faculty with clear, structured, and regularly updated information about available simulators, their capabilities, and appropriate educational uses. This would improve awareness and support informed integration into teaching.

2.   Training initiatives should be short, practical, and tailored to the prior experience and specific needs of faculty members. These programs should cover both technical operation and pedagogical strategies for simulation use, including its application for assessment purposes.

3.   Future research should explore the long-term impact of training and support mechanisms on faculty engagement and simulator integration. Expanding studies beyond a single institution would provide more generalizable data and inform broader implementation strategies.

Acknowledgements or Notes

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A Comparative Analysis of Artists in AI Assisted Artistic Practices: The Design Subject and the Sculptural Form

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Abstract: This study examines the transformative role of artificial intelligence (AI) in contemporary art through a comparative analysis of the artistic practices of Refik Anadol and Sougwen Chung. By focusing on two artists who integrate AI not merely as a technical tool but as a co-creative agent, the research explores how algorithmic systems reshape the ontology of art, artistic authorship, and the perception of creativity. Adopting a qualitative and interpretive approach, the study analyzes selected AI based artworks such as Anadol's *Machine Hallucinations* (2019) and *Quantum Memories* (2020), and Chung's *Drawing Operations* (2017 ongoing) and *GENESIS* (2024) through document analysis and case study methods. The findings reveal that both artists redefine the relationship between human and machine as a collaborative and participatory process, in which data, algorithms, and aesthetic decisions are intertwined. While Anadol aestheticizes collective memory through data visualization and digital immersion, Chung emphasizes the performative, emotional, and bodily dimensions of human machine collaboration. The study concludes that AI functions as an epistemological paradigm rather than a mere technological aid, expanding the cognitive and aesthetic boundaries of art and establishing a new model of shared creativity in the posthuman era.

Keywords: Artificial Intelligence, Contemporary Art, Refik Anadol, Sougwen Chung, Digital Aesthetics

Introduction

Throughout history, art and technology have continuously evolved through a dynamic and reciprocal relationship (Ciddi, 2025; Coskun, 2025; Çakır et al., 2019; Gulnar, 2025; Kara, 2020; Kibici, 2021, 2022, 2025; Kibici & Sarıkaya, 2021İ; Kilincer, 2021; Ozdemir, 2022; Ozkan, 2022; Öztürk et al.,, 2021; Ünal & Çakır, 2023; Tekin, 2025). This interaction constitutes a phenomenon as ancient as the history of art itself. Milestones such as the invention of photography, the emergence of cinema, and the rise of digital art exemplify the transformative power of technology over artistic production and perception. In the contemporary era, this transformation has reached a new and complex dimension through the integration of artificial intelligence. Artificial intelligence not only reshapes the processes of artistic creation but also provokes profound discussions concerning the very nature, purpose, and definition of art (Yüksel & Yüksel, 2024).

Since the 1990s, with the incorporation of digital technologies into the field of art, digital art has transformed contemporary knowledge, perception, and states of consciousness through the theoretical concepts associated with technology (Özel, 2010: 214). During this period, art entered into an active dialogue with disciplines such as physics, chemistry, optics, and electronics, paving the way for the emergence of new forms such as internet art, software art, and multimedia. The advancement of digital technologies not only transformed the tools of artistic production but also redefined the very nature of art itself, reshaping its relationship with originality, time, and space. Consequently, digital art has become not merely a tool for artistic creation, but also a distinct medium and form of expression within contemporary art practice (Özel, 2010: 214-215). Indeed, the pioneering experiments conducted in the field of computer based art during the 1970s constituted the first concrete examples of integrating artificial intelligence into artistic production (Büyükkaragöz, 2025: 1379).

In the second half of the 2010s, the growing socio political influence of artificial intelligence facilitated the expansion of AI based art. Supported by major technology companies such as Google and OpenAI, as well as by various academic programs, this form of artistic production gained significant momentum and achieved broad visibility ranging from online exhibitions to established art galleries (Grba, 2022: 1-2). Since the 1970s, artists have begun to experiment with artificial intelligence, producing works that explore the relationship between humans and machines. During the 1990s and 2000s, the accessibility of AI research tools enabled the creation of artworks that critically examined this interaction. In the latter half of the 2010s, with the rise of deep learning technologies and the growing socio political influence of artificial intelligence, AI art became increasingly widespread. Supported by major technology corporations and academic institutions, it gradually gained visibility and recognition within the mainstream art world.

This demonstrates that artificial intelligence has evolved from being merely a technical aid in contemporary art production to becoming a direct component of the creative process itself. In this context, the role of the artist has shifted from that of a "*designer*" who directs production to that of a co-creator collaborating with artificial intelligence. Consequently, the boundaries of art are being redefined beyond a human centered understanding of creation, giving rise to a new aesthetic paradigm based on human machine collaboration. According to Yüksel and Yüksel (2024),

> *"In contemporary art, AI based artworks have manifested themselves across multiple disciplines not only in visual and auditory arts but also in many other creative domains through the use of algorithms and data sets. These works are evaluated in terms of both technical skill and creative expression, while also raising debates about whether artificial intelligence serves merely as a tool for artists or constitutes the creative process itself."* (Yüksel & Yüksel, 2024: 263).

This demonstrates that artificial intelligence has moved beyond being merely a technical tool in contemporary art production, redefining the ontological structure and boundaries of art itself.

Today, AI algorithms are capable of learning from existing artistic data to generate new visual and auditory compositions, thereby introducing an additional creative layer into the process of artistic production. For example, in *The Next Rembrandt* project, deep learning algorithms were employed to produce an original portrait in the style of Rembrandt, prompting debates about the capacity of artificial intelligence to create artistic outputs independently of human intervention (Yüksel & Yüksel, 2024: 268).

With the development of AI assisted digital art, not only the processes of artistic production but also the modes of perceiving art have undergone a profound transformation.

> *According to Özselçuk (2023), "Multisensory artworks, accompanied by algorithmic data, are presented to audiences through giant screens, creating a fictional universe that offers an impossible experience while simultaneously providing an environment in which distance ceases to exist."* (Özselçuk, 2023: 9-10).

This statement illustrates that AI based art transforms the viewer from a passive observer into an active participant in the artistic experience. The interaction between the artwork and the audience now occurs not through physical encounter but via an algorithmic interface. This shift has altered the communicative nature of art and has given rise to a new mode of perception defined as an "*interactive experience*." (Arslan, 2018: 411, Aktaran: Özselçuk, 2023:10). Thus, contemporary art has evolved into a new aesthetic paradigm in which artificial intelligence has become a decisive collaborator not only in the processes of production, but also in those of perception, interpretation, and participation within the framework of human machine collaboration.

In recent years, AI assisted artistic practices have profoundly transformed the position of the artist, the modes of artistic production, and our understanding of the very nature of art. This transformation becomes particularly evident in the works of new media artists such as Refik Anadol, who utilize big data and machine learning techniques in their creative processes. According to Büyükkaragöz (2025),

> *"Anadol expands the boundaries of digital aesthetics through the use of large data sets and machine learning techniques, thereby necessitating an interdisciplinary dialogue concerning the role of artificial intelligence in art."* (Büyükkaragöz, 2025: 1379-1380).

This statement reveals that artificial intelligence in contemporary art is not merely a technical tool but has become a guiding component of the creative process itself. Consequently, art has been carried to a new intellectual and experiential plane at the intersection of data, algorithms, and aesthetic interaction, grounded in human machine collaboration.

Anadol's data driven projects, which expand the boundaries of digital aesthetics, and the performative works of artists such as Sougwen Chung, who explore human AI collaboration through robotics and artificial intelligence, represent different approaches within this field. In this study, the practices of these two artists will be comparatively examined to analyze how AI support is positioned within artistic production and what kinds of aesthetic outcomes it generates.

Method

This research was designed as a comparative study that adopts a qualitative approach to examine in depth the AI assisted artistic practices of two artists. Within the scope of the study, selected artworks by Refik Anadol and Sougwen Chung that integrate artificial intelligence were analyzed using the case study method. The data were collected through document analysis, including project descriptions, exhibition catalogues, artist interviews, and relevant academic publications.

During the research process, the focus was placed on the most notable works of both artists. Refik Anadol's installations based on digital data aesthetics (for instance, the *Machine Hallucinations: Space* series) and Sougwen

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Chung's AI supported drawing and sculptural performances (particularly her work *GENESIS*) were evaluated from a comparative perspective. The qualitative data obtained were analyzed using descriptive and thematic analysis techniques, and the findings were interpreted in relation to the similarities and differences in the creative practices of the two artists.

Findings

Refik Anadol: The Aestheticization of Data and Algorithm

In Refik Anadol's works, artificial intelligence functions not merely as a computational tool but as a domain of aesthetic productivity. Anadol treats large data sets as "*visual raw material*," transforming them into sensory experiences through algorithmic processes. As Büyükkaragöz (2025: 1379–1380) states, "*Anadol expands the boundaries of digital aesthetics through the use of large data sets and machine learning techniques, thereby necessitating an interdisciplinary dialogue concerning the role of artificial intelligence in art.*" The findings indicate that the artist elevates artificial intelligence to the position of a "*co-creative agent*," making human machine interaction the fundamental dynamic of artistic form. In this respect, algorithmic decision making processes in Anadol's works directly determine aesthetic outcomes, offering the viewer a multisensory and interactive field of experience (Özselçuk, 2023:10).

Refik Anadol: Machine Hallucinations – NYC (2019)

Figure 1. Refik Anadol, Machine Hallucinations: NYC (2019).
Source: URL 1

As seen in *Figure 1*, *Machine Hallucinations NYC* (2019) is a work in which Refik Anadol employs digital technology as a sculptural medium, shaping form through data. The artist processes millions of photographs and datasets related to New York City using artificial intelligence algorithms, creating an immersive "*data sculpture*" composed of light and sound that envelops the entire space. There are no traditional sculptural materials such as stone, bronze, or clay; yet, much like a sculptor shaping form, Anadol molds data itself. The images behave as a fluid material moving surfaces across the walls, ceiling, and floor generate the sensation of an abstract mass in motion within the space. As the viewer navigates this digital sculpture, they perceive that the form is composed simultaneously of data and light. In this respect, the work transcends the material nature of sculpture, transforming into a "*sculpture of light and data*"

and symbolizing a new aesthetic understanding born from human machine collaboration.

Sougwen Chung: The Performative Dimension of Human Machine Collaboration

Sougwen Chung's artistic practice establishes a symbiotic relationship of production between human and artificial intelligence. She creates drawings using AI systems that record her hand movements in real time and synchronize them with robotic arms. In this process, the human and the machine become "*simultaneous co-creators.*" In Chung's *Drawing Operations* series, algorithms analyze the artist's previous gesture data to generate new drawing suggestions, thereby interweaving human intervention with machine prediction. This directly corresponds to the debate articulated by Yüksel and Yüksel (2024: 263) concerning "*whether artificial intelligence serves merely as a tool for artists or constitutes the creative process itself.*" By sharing the act of creation with the audience, Chung's performances render the production process transparent and dynamically redefine the boundary between artist and algorithm.

According to Özdal (2025), Sougwen Chung's "*Life Lines*" represents a mode of artistic production in which the artist's bodily gestures are integrated with AI assisted robotic systems, constructing a symbiotic field of creation between human and machine. This approach transforms the artistic process from a purely physical act of performance into a multilayered form of creation redefined through digital algorithms. In this context, artificial intelligence mediates the emergence of a previously unobserved model of collaboration within the domains of sculpture and digital art. It repositions the artist's identity as a "*design subject,*" elevating aesthetic production to a shared plane of consciousness (Özdal, 2025: 97-99).

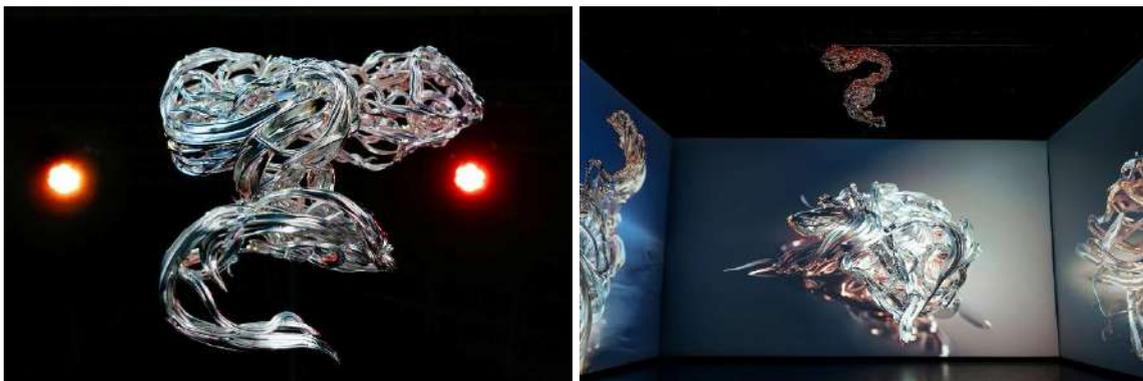*Sougwen Chung – GENESIS (2024)*

Figure 2. *Sougwen Chung, GENESIS* (2024). **Source:** URL 2

As shown in *Figure 2*, the installation consists of a large scale sculptural composition produced through 3D printing, chrome plating, and robotic drawing data. In this work, the artist employs a data driven production process that translates human movements and machine gestures into a digital environment. *GENESIS* transforms the temporal and bodily traces of drawing into a spatial form, representing an aesthetic synthesis that emerges from human machine collaboration. The forms shaped by algorithmic decision making processes establish a kind of "*data materiality*" that redefines and transforms the traditional understanding of sculpture.

Common Findings: Ontological Transformation

Both artists' practices demonstrate that artificial intelligence has transformed the ontological boundaries of contemporary art. The artwork is no longer a fixed "*object,*" but a continuous process grounded in data. This transformation weakens the position of the human as the absolute subject in the stages of artistic production, perception, and interpretation, shifting the identity of the artist toward a collective and distributed field of consciousness. Thus, it can be argued that artificial intelligence emerges in contemporary art not merely as a technical instrument, but as an epistemological paradigm.

Comparison of the Artists' AI Based Artistic Approaches

An examination of the artistic practices of Refik Anadol and Sougwen Chung reveals that both artists position artificial intelligence not merely as a tool, but as an active component of the creative process. In this sense, AI plays a decisive role both in the generation of aesthetic decisions and in the formation of artistic meaning. However, the two artists construct their relationship with artificial intelligence upon different conceptual foundations. While Anadol digitalizes collective memory through the aesthetics of data, Chung transforms human machine collaboration into a field of bodily and emotional production. These differences can be observed more concretely in the comparative table below, which outlines the AI based artistic approaches of the two artists (see Table 1).

Table 1. Comparison of AI-Based Artistic Approaches of Refik Anadol and Sougwen Chung

Comparison Criterion	Refik Anadol	Sougwen Chung
Art Discipline / Field of Production	New media art, digital installations, data visualization, architectural scale projections	Performance art, drawing, sculpture, robotic art, human machine interaction
Form of AI Use	Integrates machine learning and deep learning algorithms with large data sets; processes data as an artistic material	Uses artificial intelligence as a real time performance partner; creates with robotic systems that learn human hand movements
Conceptual Focus / Thematic Framework	Data aesthetics, digital memory, collective consciousness, virtualization of architectural space, the visual dream metaphor	Human machine collaboration, shared creativity, body algorithm relationship, ethics of co-creation
Key Works	*Machine Hallucinations* (2019), *Machine Memories: Space* (2021), *Quantum Memories* (2020)	*Drawing Operations* (2017 ongoing), *Life Lines* (2024), *GENESIS* (2024), *Omnia per Omnia* (2019)
Technical Methods / Tools Used	Generative algorithms, neural networks, big data analytics, media servers, parametric architectural software	AI-assisted robotic arm systems, motion sensors, camera based learning, deep learning based drawing algorithms
Artist Machine	Defines AI as a "co-creative agent";	Views AI as a "collaborative body"; establishes

Comparison Criterion	Refik Anadol	Sougwen Chung
Relationship	transforms the machine's learning capacity into an aesthetic instrument	an emotional and physical connection between human movement and algorithmic response
Aesthetic Approach	Transforms masses of data into abstract, fluid visualities, creating an immersive multidimensional aesthetic	A hybrid aesthetic combining hand drawing, sculpture, and robotic movement; unites human touch and machine trace on the same plane
Relation to the Audience	The audience becomes part of the data flow and spatial experience, engaging in an environmental and sensory participation	The audience acts as both witness and sometimes participant; the creative process is live, visible, and based on real-time interaction
Position of the Artist	The artist is positioned as a data organizer and conceptual framework designer	The artist is a "co-producer" with AI, navigating between control and surrender during the creative process
Understanding of Creativity	Data oriented creativity grounded in collective consciousness; seeks to transcend human cognitive limits	Shared creativity combining human emotional intuition with the computational power of the machine
Purpose and Message of Art	To make invisible phenomena visible through data; to represent the artistic consciousness of the machine	To build an emotional bridge between human and machine; to translate empathy and intuition into an algorithmic language in art
Critical Dimension / Philosophical Depth	Examination of collective memory, digital archives, and posthumanist aesthetics through technology	Exploration of body, identity, and human-centered creativity; discussion of emotional intelligence in posthumanist art

This table has been prepared to compare the AI oriented artistic approaches of Refik Anadol and Sougwen Chung from disciplinary, technical, aesthetic, and philosophical perspectives.

Sougwen Chung's work *GENESIS* (2024), which combines 3D printing technology with artificial intelligence data to materialize the union of human and machine, is particularly noteworthy in demonstrating that AI possesses not only computational power but also emotional and intuitive creative potential.

When compared with Refik Anadol's data driven modes of production, Chung's practice operates on a more bodily, performative, and intuitive plane. In this respect, the two artists represent complementary aspects of the multifaceted role of artificial intelligence in contemporary art.

Discussion

The examples of Refik Anadol and Sougwen Chung demonstrate that artificial intelligence technologies can be positioned as a "*creative partner*" within artistic practice. Both artists move beyond using AI as a mere tool,

transforming it into an active agent in the process of creation. This shift indicates that the relationship between the artist and technology has moved away from the traditional master instrument hierarchy toward a more egalitarian and interactive structure. Indeed, contemporary art scholarship also recognizes this phenomenon as evidence that artificial intelligence generates a transformation in art and carries the concept of creativity into a new dimension.

Current research focuses not on whether artificial intelligence serves as a "*new brush*" for the artist, but rather on whether it can function as a partner that collaborates in the creative process (Yüksel & Yüksel, 2024: 263). This perspective suggests that the relationship between AI and the artist extends beyond the technical level, establishing AI as a direct component of the creative process itself. As Büyükkaragöz (2025: 1379) emphasizes, Refik Anadol expands the boundaries of digital aesthetics through large data sets and machine learning techniques, thereby "*necessitating an interdisciplinary dialogue on the role of artificial intelligence in art.*" Within this framework, AI is positioned not merely as a technological aid to the artist's production process, but as a creative collaborator that actively shapes aesthetic decisions. Consequently, contemporary art is evolving toward a new paradigm in which the boundaries between human and machine become increasingly permeable, and aesthetic production emerges as a form of shared intelligence.

In Anadol's works, artificial intelligence is perceived as a collaborator that expands the artist's intent and vision, while in Chung's performances, AI participates in the process almost as a second artist. From this perspective, AI assisted art practices challenge the boundaries of human creation and compel a redefinition of the concept of "*creative genius.*" The fusion of human aesthetic judgment with the machine's computational capacity gives rise to the idea that creativity, at its core, is a shared experience embodied within the artwork itself.

On the other hand, with the growing prevalence of artificial intelligence in art, some researchers argue that the role of human creativity has become even more significant. As technological routine tasks are delegated to AI, the artist's ability to generate original ideas and conceptual creativity comes to the forefront. "*The more artificial intelligence technologies are employed in the creation of artworks, the more valuable a concept or idea becomes*" (Trach, 2021: 170).

This perspective indicates that as AI assumes technical execution, the artist's responsibility for original thinking and conceptual innovation increases. In AI generated art, the success of the algorithm largely depends on the quality of the human idea behind it. For instance, when training an algorithm, it is the artist who determines which data sets to use, what style to pursue, and how to present the resulting output. Therefore, the artist contributes to the process not through traditional craftsmanship but through intellectual insight and aesthetic vision. Ultimately, artificial intelligence does not replace the artist; rather, it becomes a tool that supports and expands the scope of human creativity.

Conclusion

Artificial intelligence has brought about a profound transformation within the layers of artistic production, perception, and meaning. In today's art world, the artist is no longer defined merely as a producer of works, but as a thinker who

processes data, directs algorithms, and constructs conceptual frameworks. As illustrated by Refik Anadol and Sougwen Chung, artificial intelligence has evolved from a technical instrument into an active component of the creative process. This transformation reconfigures the relationship between the artist and the machine into one of collaboration, redefining creativity as a shared, participatory, and evolving process.

Yet, the human factor continues to lie at the heart of artistic creation. The essence of creativity still depends on the human capacity to generate ideas, question reality, and construct meaning. In this respect, artificial intelligence should not be perceived as a force that replaces the artist, but as a collaborator that extends intellectual boundaries and opens up new aesthetic and expressive possibilities. The future of art, therefore, will be built upon a multilayered aesthetic paradigm that emerges from the interplay between human sensitivity and machine intelligence where data and emotion, algorithm and imagination, coexist in creative harmony.

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Artificial Intelligence and Abstraction: Algorithmic Visual Representations of Concepts

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Abstract: The emergence of AI has significantly transformed the landscape of art production, enabling the creation of complex artworks that challenge traditional notions of creativity and authorship. This paper explores the implications of AI-generated art by focusing on the aesthetic, technical, and ethical dimensions of this new field. Through an examination of various application processes, we examine how AI tools facilitate new artistic expressions while raising critical questions about human agency in the creative process. The ability of AI to produce artworks that are often indistinguishable from those created by humans has prompted discussions on the perception and appreciation of AI-generated art. Furthermore, the importance of critical engagement with AI in art is emphasized, advocating a reflective approach to understanding its impact on artistic practices and social norms. The paper also considers how AI can serve as a collaborative partner in the artistic process, enhancing rather than replacing human creativity. Through case study and literature review methods and by synthesizing insights from various studies, this research highlights the transformative potential of AI in the arts, while calling for an ongoing discourse on its implications for the future of creativity and artistic expression. In this context, artistic productions have been made through widely used AI models, and these images have been examined and evaluated in the context of abstract concepts.

Keywords: Artificial Intelligence, Artificial Intelligence Art, Creativity, Generative Competitive Networks, Artistic Expression, Visual Representation

Introduction

Scientific and technological advancements have brought about technical variety, the development of new forms, and the rise of new fields in the arts (Ciddi, 2025; Öztürk,2023). From past to present, art has also benefited from the technology of its time (Tekin 2025). Even technologies considered traditional today were new and modern at the time they emerged. Therefore, it can be argued that the use of digital printing technologies in painting, discussed in this research, will be considered a traditional method for many years to come (Özmen & Dalkıran, 2017). The social and political functions of visual creators in society are a widely debated and ongoing topic among modern designers, and it will continue as long as valid arguments and counterarguments persist (Ünsür, 2019). This debate has taken on a

new dimension with the introduction of artificial intelligence technologies into the field of design and art. Questions are now being raised not only about the social responsibility of visual artists, but also about the extent to which AI-powered systems can intervene in the creative process, how ethical boundaries will be drawn, and how the distinct place will be redefined vis-à-vis technological production. As AI-based visual production tools usher in an era where aesthetic decisions are handed over to machines, the role of the designer is evolving from a "producer" to a "led" one. This necessitates a reevaluation of the concepts of art's originality, innovation, and social impact.

The emergence of artificial intelligence as a creative agent has fundamentally challenged traditional boundaries between human and machine-generated art. Among the most intriguing developments in this domain is AI's capacity to generate abstract visual representations of conceptual ideas—a capability that seemingly requires both semantic understanding and aesthetic judgment. From text-to-image systems that translate linguistic descriptions into visual forms to style transfer algorithms that reimagine content through abstract aesthetic filters, AI technologies are increasingly engaged in the process of abstraction.

Abstraction in art has historically represented a departure from literal representation toward the expression of ideas, emotions, and concepts through form, color, and composition (Kandinsky, 1977). When computational systems engage in abstraction, they raise profound questions: Can algorithms truly understand concepts, or do they merely simulate understanding through pattern matching? What distinguishes machine-generated abstraction from human creative practice? How do AI systems encode and decode the relationship between language, thought, and visual form?

This paper investigates these questions by examining the technical mechanisms underlying AI-generated visual abstractions and situating them within broader theoretical frameworks of creativity, cognition, and representation. The study contributes to emerging scholarship at the intersection of computer science, cognitive science, and art theory, offering critical perspectives on computational approaches to abstract visual representation.

Abstraction as Cognitive and Artistic Practice

Abstraction operates simultaneously as a cognitive process and an artistic methodology. Cognitively, abstraction involves extracting essential features from particular instances to form general concepts—a fundamental operation in human reasoning (Barsalou, 1999). Artistically, abstraction emerged in the early twentieth century as artists sought to represent inner realities rather than external appearances, emphasizing formal elements over mimetic representation (Worringer, 1997). Arnheim (1969) characterized visual abstraction as a process of simplification that reveals structural essentials, arguing that abstraction is not merely a reduction but a transformation that highlights meaningful patterns. This perspective suggests that successful abstraction requires both analytical capability—identifying salient features—and synthetic judgment—composing these features into coherent visual statements.

Computational Approaches to Semantic Understanding

Contemporary AI systems approach semantic understanding through distributional semantics, learning relationships

between concepts by analyzing their co-occurrence patterns in large datasets (Mikolov et al., 2013). Word embeddings, such as Word2Vec and GloVe, represent words as vectors in high-dimensional space, where geometric relationships correspond to semantic relationships (Pennington et al., 2014).

Recent advances in transformer architectures, particularly models like BERT and GPT, have demonstrated remarkable proficiency in capturing contextual meaning and generating coherent text (Vaswani et al., 2017; Devlin et al., 2019). The extension of these architectures to multimodal learning, exemplified by CLIP (Contrastive Language-Image Pre-training), enables AI systems to learn joint representations of text and images, creating a shared semantic space across modalities (Radford et al., 2021).

Visual Representation in Neural Networks

Neural networks learn visual representations through hierarchical feature extraction, with early layers detecting simple patterns and deeper layers recognizing complex structures (LeCun et al., 2015). Convolutional neural networks (CNNs) have proven particularly effective for image processing, automatically learning relevant features through training rather than requiring hand-crafted feature engineering (Krizhevsky et al., 2012).

Generative models extend this capability by learning to produce new images rather than merely classifying existing ones. Generative Adversarial Networks (GANs) achieve this through adversarial training between generator and discriminator networks (Goodfellow et al., 2014), while diffusion models learn to reverse a gradual noising process, generating images through iterative denoising (Ho et al., 2020).

Mechanisms of Algorithmic Abstraction

Text-to-Image Generation

Contemporary text-to-image systems, including DALL-E, Midjourney, and Stable Diffusion, represent the current state-of-the-art in algorithmically generating visual representations of concepts (Ramesh et al., 2022; Rombach et al., 2022). These systems combine language understanding capabilities of transformer models with image generation capabilities of diffusion models, mediated by cross-attention mechanisms that align textual and visual representations.

The process operates through several stages. First, textual input is encoded into a high-dimensional representation capturing semantic content. This encoding then conditions the image generation process, guiding the diffusion model toward outputs consistent with the textual description. Through training on millions of text-image pairs, these models learn statistical associations between linguistic descriptions and visual patterns.

Crucially, when generating abstract representations, these systems rely on learned associations between abstract terms and visual styles present in training data. A prompt requesting "the concept of freedom" generates imagery drawing on visual metaphors and symbolic representations encountered during training—birds in flight, open landscapes, breaking chains—rather than from any experiential understanding of freedom itself.

Style Transfer and Visual Transformation

Neural style transfer algorithms offer another approach to abstraction, transforming representational images through the application of abstract aesthetic styles (Gatys et al., 2016). These methods separate content and style representations within neural networks, enabling the recombination of content from one image with stylistic elements from another.

The technique operates by matching feature statistics at multiple layers of a CNN. Content is preserved by maintaining high-level feature representations, while style is transferred by matching lower-level statistical patterns such as texture and color distributions. This computational approach to style bears similarity to formalist art theory's emphasis on formal elements, yet operates through statistical correlation rather than aesthetic judgment.

Latent Space Manipulation

Generative models create internal representations—latent spaces—where points correspond to possible outputs. These spaces often exhibit meaningful structure, with smooth paths between points corresponding to gradual transformations in generated images (Radford et al., 2016). Exploring latent space enables generation of abstract variations, interpolations, and conceptual transformations.

Recent research has demonstrated that latent spaces of well-trained models encode interpretable semantic dimensions (Härkönen et al., 2020). Identifying these dimensions enables controlled manipulation of specific attributes, facilitating systematic exploration of abstract variations. This capability suggests that neural networks develop internal conceptual structures, though whether these constitute genuine understanding remains philosophically contested.

Comparative Analysis: Human vs. Algorithmic Abstraction

Embodied Cognition and Machine Learning

A fundamental distinction between human and algorithmic abstraction concerns embodiment. Theories of embodied cognition emphasize that human understanding is grounded in sensorimotor experience (Lakoff & Johnson, 1999). Conceptual metaphors—understanding abstract ideas through concrete physical experiences—pervade human thought and language. Love is a journey, arguments are buildings, time is space—these metaphorical structures shape how humans conceptualize and represent abstract concepts.

AI systems lack embodied experience, learning instead from statistical patterns in training data. Their "understanding" of concepts is fundamentally distributional—based on patterns of co-occurrence rather than grounded experience. This raises questions about whether AI-generated abstractions can capture the experiential richness that informs human abstract art, or whether they remain sophisticated simulations without genuine conceptual depth.

Intentionality and Creative Agency

The study of aesthetics aims to discover the beautiful and beauty, and it examines the reasons for the beauty produced by this pursuit. Additionally, it analyzes the inner and outer rules of pleasing beauty. From an aesthetic perspective, the items brought into a concrete shape are analyzed and judged by the standards of beauty that have been established beforehand (Öztürk & Öztürk, 2022). Human abstract art typically involves intentional communication—artists deliberately choose forms, colors, and compositions to express specific ideas or evoke particular responses (Goodman, 1976). This intentionality reflects conscious decision-making informed by cultural context, personal experience, and aesthetic theory.

Algorithmic systems lack intentionality in this sense. Their outputs result from optimization processes aimed at matching statistical patterns in training data rather than communicating specific meanings or experiences. While humans may interpret algorithmic outputs as meaningful—finding significance in generated forms and colors—this meaning is imposed through interpretation rather than arising from authorial intent.

Creativity and Constraint

Boden (2004) distinguishes between combinational creativity—combining existing ideas in novel ways—and transformational creativity—transforming conceptual spaces to enable fundamentally new possibilities. Current AI systems excel at combinational creativity, synthesizing elements from training data in novel configurations. However, whether they achieve transformational creativity—genuinely expanding conceptual possibilities rather than recombining existing elements—remains debatable.

Moreover, human creativity often emerges from constraint and limitation, with restrictions on materials, techniques, or conventions stimulating innovative solutions (Stokes, 2006). Algorithmic systems face different constraints—computational resources, training data quality, architectural limitations—but lack the lived experience of material engagement that shapes human creative practice.

Method

This study employed a systematic literature review methodology to investigate artificial intelligence systems' approaches to generating abstract visual representations of concepts. The research was designed as a comprehensive analytical review synthesizing findings from computer science, cognitive science, art theory, and philosophy to characterize the mechanisms, capabilities, and theoretical implications of algorithmic abstraction.

The literature review followed established guidelines for systematic reviews in interdisciplinary research (Booth et al., 2016), incorporating both technical publications on AI architectures and theoretical works on creativity, cognition, and visual representation. This approach enabled critical synthesis of technical capabilities with conceptual frameworks necessary for understanding the nature and significance of machine-generated abstraction.

Literature searches were conducted across multiple academic databases to ensure comprehensive coverage of relevant interdisciplinary scholarship:

> Computer Science and Engineering: IEEE Xplore, ACM Digital Library, arXiv
>
> Cognitive Science and Psychology: PsycINFO, Web of Science
>
> Arts and Humanities: JSTOR, Project MUSE, Arts & Humanities Citation Index
>
> Multidisciplinary: Google Scholar, Scopus, Web of Science Core Collection

This multi-database approach addressed the interdisciplinary nature of the research topic, ensuring capture of relevant literature from diverse fields.

Case Studies

DeepDream: Pattern Amplification as Abstraction

Google's DeepDream algorithm demonstrated an early form of algorithmic visual abstraction through pattern amplification (Mordvintsev et al., 2015). By iteratively enhancing patterns detected by neural networks, DeepDream transforms images into surreal, highly patterned abstractions. The algorithm reveals the network's internal representations, visualizing what patterns it has learned to recognize.

DeepDream's abstractions are pareidolic—the network finds and amplifies patterns resembling trained categories even in random noise. This approach to abstraction differs fundamentally from human practice, revealing more about the network's training than expressing conceptual ideas. Yet the resulting imagery possesses aesthetic qualities that resonate with traditions of psychedelic and surrealist art.

CLIP-Guided Generation: Semantic Steering

CLIP-guided generation techniques use the CLIP model's understanding of text-image relationships to steer generative processes toward desired concepts (Galatolo et al., 2021). By iteratively adjusting generated images to maximize alignment with textual prompts in CLIP's semantic space, these methods create abstract visual representations of conceptual descriptions.

This approach demonstrates AI's capacity to navigate semantic space, translating between linguistic and visual modalities. However, the results reflect CLIP's learned associations rather than genuine conceptual understanding. Abstractions of concepts like "justice" or "consciousness" draw on visual metaphors present in training data rather than philosophical reflection on these concepts.

Neural Style Transfer: Abstraction Through Form

Neural style transfer enables transformation of representational content through abstract stylistic filters (Johnson et al., 2016). Applying styles from abstract expressionist paintings to photographic content demonstrates the technique's capacity to abstract representational imagery while preserving recognizable forms. This computational approach to style parallels art historical practices of stylization but operates through statistical pattern matching rather than artistic interpretation. The algorithm identifies and transfers formal properties—texture, color relationships, brushstroke

patterns—without understanding the aesthetic or expressive intentions behind these formal choices.

Philosophical and Aesthetic Implications

The Nature of Machine-Generated Meaning

When AI systems generate abstract visual representations, questions arise about meaning and interpretation. If meaning requires intentionality—an agent deliberately creating work to communicate something—then machine-generated abstractions lack intrinsic meaning, acquiring significance only through human interpretation (Bringsjord et al., 2003).

Alternatively, if meaning can emerge from pattern and structure regardless of authorial intent, then algorithmic abstractions may possess meaning independently of human interpretation. This perspective aligns with post-structuralist views emphasizing reader interpretation over authorial intention (Barthes, 1977), suggesting that meaning resides in the interpretive encounter rather than originating from a creating subject.

Authenticity and Algorithmic Art

Concerns about authenticity in algorithmic art often center on questions of originality and genuine creativity. If AI systems merely recombine elements from training data, can their outputs be considered truly original? This critique assumes originality requires breaking with precedent—creating something genuinely new rather than synthesizing existing elements. However, human creativity also builds on existing knowledge, techniques, and cultural forms. No human artist creates in a vacuum; all creative work emerges from engagement with tradition and context (Eliot, 1919). The difference may be one of degree rather than kind—humans can transform conceptual frameworks and challenge conventions in ways current AI systems cannot, but both human and machine creativity involve building on existing foundations.

The Sublime and Algorithmic Aesthetics

Some machine-generated abstractions evoke responses associated with the sublime—a sense of overwhelming vastness or complexity beyond rational comprehension (Burke, 1757). The intricate patterns of DeepDream imagery or the unexpected juxtapositions in AI-generated compositions can produce aesthetic experiences characterized by fascination and disorientation. This algorithmic sublime differs from natural or artistic sublimity in its source—arising not from nature's power or human creative achievement but from computational complexity and pattern recognition at scales exceeding human perception. It suggests new aesthetic categories particular to computational media, requiring frameworks beyond traditional aesthetic theory.

Applications and Future Directions

Design and Creative Industries

AI-driven abstraction tools are increasingly deployed in design contexts—generating logos, creating visual identities,

exploring aesthetic variations. These applications leverage AI's capacity for rapid iteration and stylistic synthesis, augmenting human designers' capabilities (Davis, 2020). However, questions persist about appropriate human oversight and the risk of homogenization if many designers rely on similar AI tools trained on similar data.

Scientific Visualization

Abstracting complex data into visual representations constitutes a crucial scientific practice. AI systems offer new approaches to scientific visualization, identifying patterns in high-dimensional data and generating visual abstractions that make complex information accessible (Hohman et al., 2019). Machine learning visualization techniques reveal how neural networks represent information, providing insights into algorithmic decision-making processes.

Education and Accessibility

AI tools for generating abstract representations may democratize creative expression, enabling individuals without formal artistic training to visualize concepts and ideas. Text-to-image systems lower barriers to visual creation, though concerns remain about whether this represents genuine democratization or creates new dependencies on proprietary platforms and algorithms (Crawford, 2021).

Theoretical Development

Future research should continue investigating fundamental questions about machine understanding, creativity, and meaning. Developing AI systems that engage with abstraction in qualitatively different ways—perhaps through embodied robotic systems that learn through physical interaction, or through architectures designed to model conceptual metaphor explicitly—may yield new insights into both machine and human cognition.

Limitations and Ethical Considerations

Bias and Representation

AI systems learn patterns from training data, inevitably reflecting biases present in that data (Bolukbasi et al., 2016). When generating abstract representations of concepts, these biases may reinforce problematic associations or marginalize non-dominant perspectives. An AI system trained predominantly on Western art may generate abstractions reflecting Western aesthetic conventions and conceptual frameworks, potentially erasing or misrepresenting non-Western approaches to abstraction.

Environmental Costs

Training large-scale AI models requires substantial computational resources, generating significant carbon emissions (Strubell et al., 2019). The environmental cost of AI-generated art raises ethical questions about the sustainability of these practices and the responsibility of researchers and practitioners to consider ecological impacts.

Intellectual Property and Attribution

Legal and ethical questions surrounding AI-generated content remain unresolved. When AI systems are trained on copyrighted artworks and generate outputs resembling those works, issues of derivative creation and fair use arise (Sobel, 2017). Additionally, questions about attribution—who deserves credit for AI-generated work, and how should human and machine contributions be acknowledged—require careful consideration.

Labor and Economic Implications

Automation of creative tasks through AI raises concerns about displacement of human artists and designers. While some argue AI tools augment rather than replace human creativity, economic pressures may incentivize substitution of human labor with cheaper algorithmic alternatives (Frey & Osborne, 2017). Ensuring that AI development supports rather than undermines creative professionals requires thoughtful policy and ethical frameworks.

Conclusion

This investigation of artificial intelligence and abstraction reveals both remarkable technical capabilities and fundamental limitations in current approaches to algorithmic visual representation. AI systems demonstrate impressive proficiency in generating abstract imagery from textual descriptions, transferring stylistic properties between images, and exploring variations within learned conceptual spaces. These capabilities emerge from sophisticated architectures that learn statistical patterns across massive datasets, creating internal representations that encode meaningful semantic and visual relationships.

However, algorithmic abstraction differs fundamentally from human creative practice in crucial respects. AI systems lack embodied experience, operating through distributional rather than grounded understanding. They generate outputs through optimization processes rather than intentional communication, excelling at combinational creativity while remaining limited in transformational innovation. Their abstractions reflect statistical patterns in training data rather than arising from personal experience, philosophical reflection, or aesthetic judgment. These differences need not diminish the value or interest of AI-generated abstractions. Machine-generated imagery offers new aesthetic experiences, productive tools for human creativity, and insights into computational approaches to visual representation. Understanding AI systems' capabilities and limitations enables more nuanced appreciation of their outputs and more thoughtful integration into creative practices.

Future developments in AI technology may narrow some gaps between human and machine creativity. More sophisticated architectures, richer training approaches, and perhaps embodied AI systems could develop more robust conceptual understanding. However, questions about consciousness, intentionality, and the experiential basis of understanding suggest that fundamental differences may persist, at least with current computational paradigms.

Ultimately, AI-generated abstraction represents not a replacement for human creativity but a new form of visual production with its own characteristics, possibilities, and limitations. Recognizing both the achievements and

constraints of algorithmic abstraction enables productive engagement with these technologies, fostering collaborations between human and machine capabilities that expand creative possibilities while remaining grounded in realistic understanding of what current AI systems can and cannot do.

As AI systems become increasingly prevalent in visual culture, ongoing critical engagement with their technical mechanisms, philosophical implications, and social impacts remains essential. This paper contributes to that ongoing conversation, offering frameworks for understanding algorithmic approaches to abstract visual representation and highlighting questions requiring further investigation as these technologies continue evolving.

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