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Table of Contents

Dear TOJDE Readers,

Welcome to Volume 26 Issue 1 of TOJDE.

There are 14 articles in the January 2025 issue of TOJDE. 36 authors from 11 different countries contributed to the issue. These countries are Colombia, India, Indonesia, Italy, Kazakhstan, Malaysia, Mexico, Singapore, South Africa, Turkiye and Vietnam.

UNBOXING MICRO-CREDENTIALS FOR ODL UNIVERSITIES: COMPETENCY DEVELOPMENT FOR HUMAN CAPITAL, authored by Santhi RAGHAVAN, Nantha Kumar SUBRAMANIAM and Ahmad Izanee AWANG, is the first article. This paper investigates the role of micro-credentials in competency development and employment opportunities and the trends and challenges in offering micro-credentials. According to this article, Open and Distance Learning universities implementing micro-credentials must consider the acceptance and stackability of micro-credentials from different higher education institutions, with clear validation metrics, and allow transferability among Open and Distance Learning institutions in different countries.

The title of the 2nd article is ACADEMIC SUCCESS IN SYNCHRONOUS ONLINE LEARNING ENVIRONMENTS. The authors are Oronzo MAZZEO, Lucia MONACIS and Paolo CONTINI. This study aims to analyze the influence of such factors, as cognitive engagement, learning strategies and social support on academic success and student satisfaction in online learning environments. The findings provide professionals in the field of education with suggestions for synchronous online-based teaching about ways to plan a community learning space where teacher-student interactions as well as peer interactions are fostered. This more collaborative-constructivist perspective could improve students' academic achievements.

The 3rd article, BEYOND GENRES: EXPLORING THE RELATIONSHIP BETWEEN GAMER TYPES AND THE FIVE-FACTOR MODEL OF PERSONALITY, is written by Ayse ULUTAS and Sezan SEZGIN. This study explores connections between gamer personalities and motivations by examining relationships between personality traits and player types. Results highlight Player, Disruptor, and Socializer types are the most common when considering both single and combined player profiles, indicating strong drives for rewards, boundary-testing, and social connections.

DEVELOPMENT OF STEAM-BASED E-MODULES ON HUMAN CIRCULATORY TOPICS CONTAINING CRITICAL REASONING AND INDEPENDENT CHARACTERS is the title of the 4th article, and the authors are Esty Setyo UTAMININGSIH and ELLIANAWATI. This research aims to develop a STEAM-based e-module containing critical and independent reasoning characters. The method used in this study is Research and Development. The validation of e-modules is assessed based on three aspects, including aspects of content, construction, and language. The authors discuss the results in the article.

Azmi FITRIATI, Subuh ANGGORO, Corrienna Abdul TALIB and Tin Lam TOH are the authors of the 5th article titled THE INTENTION OF GENERATION Z TO USE MOBILE LEARNING: THE ROLE OF SELF-EFFICACY AND ENJOYMENT. This study aims to formulate Technology Acceptance Model as a model of m-learning acceptance for Generation Z. Technology Acceptance Model developed based on self-efficacy and enjoyment is expected to explain the behavior of Generation Z in accepting m-learning. The results contribute to the formulation of a successful m-learning implementation model for Generation Z.

The title of the 6th article is TEACHING SELF-REGULATED LEARNING STRATEGIES ON EFL STUDENTS IN MOOCS: A CASE STUDY IN VIETNAM. Cao-Tuong DINH and Hoang-Yen PHUONG are the authors. The study provides practical insights for incorporating Self-regulated Learning training into Massive Open Online Courses-based learning and offers a theoretical foundation for promoting Self-regulated Learning across diverse educational systems.

INTENTION TO ADOPT INNOVATION CULTURE AMONG EMPLOYEES IN ONLINE DISTANCE LEARNING HIGHER EDUCATION INSTITUTIONS is the 7th article. Liana MOHAMAD and Zahir OSMAN are the authors. The objective of the study is to evaluate both direct and indirect relationships among organizational culture, attitude, intention, and adoption of the innovation culture in Malaysian Open and Distance Learning higher education institutions. The findings of this study are crucial for Open and Distance Learning institutions to maximize employee performance by adopting an innovation culture for their survival and sustainability.

The authors of the 8th article are Duong Minh TUAN and Le Thi Diem LAN. The title is MODELING THE NEXUS BETWEEN STUDENTS' INTERACTION, SATISFACTION, AND ACCEPTANCE OF ONLINE LEARNING. This study is intended to examine the effects of various types of interaction on student satisfaction and the impact of student satisfaction on their behavioral acceptance of online learning. The study also aims to examine the mediating role of student satisfaction in the relationship between interaction and perceived acceptance. The results emphasize the importance of fostering meaningful interaction activities between teachers and students, as well as among students themselves, in enhancing student satisfaction and further boosting the prospects of online education in today's digital world.

Yesim OZANSAK TOPCU, Buket KARADAG and Gul GULER are the authors of the 9th article. The title of this article is INVESTIGATION OF PRESERVICE TEACHERS' METAPHORIC PERCEPTIONS REGARDING THE MEASUREMENT AND EVALUATION TOOLS IN DISTANCE EDUCATION. The study uses phenomenology to examine teacher candidates' metaphorical perceptions for measurement and evaluation practices in distance education. The most remarkable finding is that using written exams and multiple-choice tests does not deliver effective feedback, unlike assignments. By conducting seminars for academics, experts should promote the utilization of feedback for other tools.

The 10th article which is authored by Eko SUHARTOYO, Rida AFRILYASANTI and Nur MUKMINATIEN is titled ONLINE CLASSROOM-BASED READING ASSESSMENT: COMPREHENSION AND PRACTICE DEVELOPMENT. This study aims to develop an online classroom-based reading assessment and evaluate its efficacy in measuring students' reading skills. The study contributes valuable insights into the benefits of online classroom-based reading assessments and their potential to enhance traditional assessment methods in English as a Foreign Language settings in this technologically advanced era.

PRACTICAL DIMENSIONS OF THE METAVERSE IN DISTANCE EDUCATION: CASE STUDY WITH INDIGENOUS STUDENTS FROM A COMMUNITY IN MEXICO is the 11th article authored by Victor del Carmen Avendano PORRAS, Iris Alfonzo ALBORES and Sergio Andres Correal CUERVO. This research aims to explore the dimensions and implications of the early use and integration of metaverses in public high schools in the region of the Altos de Chiapas, Mexico, through a sequential mixed methods approach. The findings provide empirical background and practical recommendations to guide the progressive incorporation of these digital pedagogical innovations, grounded in the needs and visions expressed by student protagonists, mitigating possible biases through the participatory design of culturally sensitive educational metaverses.

The 12th article THE BLENDED LEARNING STATION ROTATION MODEL IN EFL TEACHING: OPINIONS OF THE IMPLEMENTER is authored by Meruyert SEITOVA and Ziyoda KHALMATOVA. The study's purpose is to reveal the implementer's opinions toward the use of the Station Rotation Model of blended learning, in terms of features, challenges and effectiveness of the model including further implementation and suggestions for the station rotation model. The findings reveal that the implementer mostly mention fulfilling hobbies as a feature of the model, and most students face challenges in the group working station, while the pair working station is identified as the most effective.

Nazarana MATHER and Liesl SCHEEPERS are the authors of 13th article titled FEEDBACK ON FEEDBACK: AN EXPLORATORY CASE STUDY OF ONLINE FACILITATORS' PERCEPTIONS REGARDING THEIR FEEDBACK PRACTICES IN HIGHER EDUCATION. This study explores the perceptions of online facilitators regarding meaningful feedback in a Higher Education online learning

environment. According to findings, the researchers have made suggestions that future research and professional development initiatives should focus on addressing these barriers and finding practical ways to provide accessible feedback to students more meaningfully and efficiently.

The 14th article titled IMPACT OF E-LEARNING ON ENGINEERING EDUCATION DURING THE COVID-19 PANDEMIC: A STUDY IN THE NORTHEASTERN REGION OF INDIA is authored by Bijoy Kumar UPADHYAYA, Apurba SAHA and Pijush Kanti DUTTA PRAMANIK. This article aims to assess the impact of e-learning on engineering education during the pandemic in the Northeastern region of India. The findings highlight the need to address technological challenges, enhance online instructional design, and consider individual preferences and needs in shaping the future of engineering education.

I wish a happy new year for all of you. Hope to meet again in the April 2025 issue of TOJDE.

Cordially,

Dr. T. Volkan YUZER

Editor in Chief

UNBOXING MICRO-CREDENTIALS FOR ODL UNIVERSITIES: COMPETENCY DEVELOPMENT FOR HUMAN CAPITAL

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ABSTRACT

The rising prominence of micro-credentials started during the COVID-19 pandemic, where online resources offered competency-building opportunities for the work-from-home (WFH) human capital. During this pandemic, traditional universities faced total halt to face-to-face lectures, but ways paved for open and distance learning (ODL) universities to showcase their prowess in higher education by successfully continuing to offer programmes digitally. Lesson learnt from the lockdown, higher education institutions (HEIs) have begun implementing online programmes, including micro-credentials. This paper investigates the role of micro-credentials in competency development and employment opportunities and the trends and challenges in offering micro-credentials. This study employed a triangulation approach for data collection from the workforce, universities, employers and statutory bodies. The findings indicated that the workforce desired more options to upgrade and upskill themselves, opting for shorter durations and lower fees. Employers surveyed, prefer employees with high-value skills and competencies. The findings also indicated that conventional HEIs have started to actively engage in short-term programmes for adult learners via ODL too. The implication of these findings indicates that ODL universities implementing micro-credentials must consider the acceptance and stackability of micro-credentials from different HEIs, with clear validation metrics, and allow transferability among ODL institutions in different countries, through AAOU as an international consortium.

Keywords: Micro-credentials, competency development, human capital, open and distance learning, ODL.

INTRODUCTION

Increasing cost of higher education for both learners and education providers, accelerated labour market changes, rapid skills obsolescence, growing pressure for more flexible learning opportunities and ultimatum for global experiences, has generated the expansion of alternative credentials for the workforce. One form of alternative credentials that is gaining increasing recognition is the micro-credential, that not only increases employment opportunities but also enhances skills and competencies to confront the new world. Recent reviews indicate that government agencies, higher education institutions (HEIs), statutory bodies, corporate sector and the workforce seem drawn into micro-credentials, particularly after the COVID-19 pandemic.

Malaysian Qualifications Agency (MQA) (2020) defines micro-credential as "digital certification of assessed knowledge, skills and competencies in a specific area or field which can be a component of an accredited programme or stand-alone courses supporting the professional, technical, academic and personal development of the learners". One of the most common definition being cited in recent times would be that of Prof. Beverley Oliver who says "a micro-credential is a certification of assessed learning that is additional, alternate, complementary to or a formal component of a formal qualification" (Oliver, 2019). These definitions, though broad, highlights that micro-credentials are additional forms of (short-term) certification, that can complement existing educational provisions provided by formal programmes, or may be taken as alternatives to facilitate the competency development of the learner. This can be further attested by the definition given by the European Commission (2022, p. 10) that "a micro-credential is a proof of the learning outcomes that a learner has acquired following a short learning experience".

LITERATURE REVIEW

Through a collaboration between the Malaysian Ministry of Human Resources and Ministry of Higher Education, the Human Resource Development Corporation Micro-credential Initiative was launched in Malaysia in April 2022. These first ever comprehensive industry-based micro-credential courses are to assist Malaysians across all backgrounds to obtain stackable certifications through short-term learning to facilitate their competency development. These certifications or credentials will enable learners to acquire officially recognised qualifications through personalised learning pathways. Currently, the Human Resource Development Corporation (HRD Corp) is aimed at encouraging employers to provide learning and development opportunities for their employees and shoulders the responsibility to drive Malaysia's talent development. HRD Corp has initiated the HRD Corp Micro-credential Initiative which holds the largest repository of courses in Malaysia, with 10,000 courses across 24 skill areas. It is aimed to create 50,000 micro-credential training places for Malaysians by the end of 2022 and over 3 million micro-credential training places is to be added within the next five years. To support this initiative, MQA, which launched the "Guidelines on Micro-credentials" in March 2019, provides the Higher Education Institutions (HEIs) and other stakeholders in Malaysia with information on the principles and guidelines to good practices (GGP) in the implementation of micro-credentials. This has led many HEIs, including Open University Malaysia (OUM), to offer micro-credentials.

Talent Corporation Malaysia Limited (TalentCorp), is another key agency in complementing the capacity-building ecosystem in Malaysia. Established under the Prime Minister's Department in 2011, it is a national agency driving Malaysia's talents toward becoming a dynamic talent hub. TalentCorp collaborates with public and private sectors, industry leaders, and professionals to bridge the talent supply-demand gaps across various sectors.

In a world that is demanding a greater level of flexibility, micro-credential courses are more accessible to a broader range of people in a short time. Micro-credentials fulfil the urgent need for upskilling and retraining, by not replacing the current methods of conventional education, but rather offer an option to those interested in earning a formal qualification through a flexible education system. It is noticeable that national and international initiatives on policy documentations to stimulate global higher education policies on micro-credentials have continued to be produced. These include UNESCO's Global Convention on Recognition and the Council's Recommendation on Micro-Credentials for Lifelong Learning and Employability, published by the European Commission in 2022. The Organisation for Economic Co-operation and Development (OECD) too, in 2023, has published a perspective paper drawing on evidences to form some views on the impact of micro-credential initiatives and policies. In a nutshell, micro-credentials are found to have macro values to assist in upskilling for employability and therefore will encourage meaningful participation from the workforce as it provides for both life-long and life-wide forms of learning.

Brown, M., Mhichil, M., Beirne, E. and Lochlainn, C. (2021) developed the chart in Figure 1 to map out the emerging credentials landscape differentiating the bundled from unbundled credentials and credit-bearing from non-credit bearing. Brown et al. (2021, p. 235) consider micro-credentials as a way of meeting the projected growth in demand for higher education worldwide.
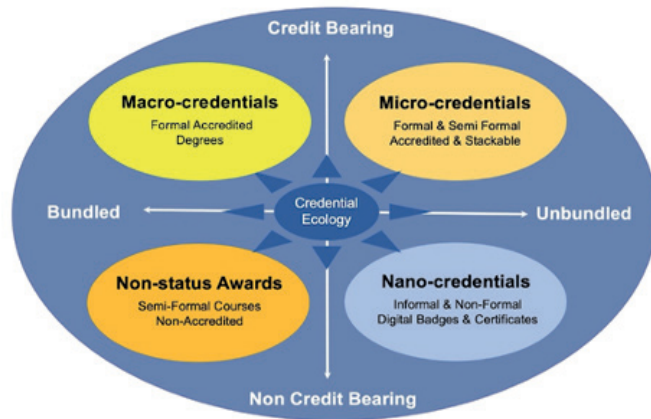
Figure 1. The New Credential Ecology

Source: (Brown et al, 2021, licensed under a Creative Commons Attribution 4.0 International License)

Figure 1 depicts four credential quadrants across two axes:

- The x-axis differentiates between bundled and unbundled credentials.
- The y-axis distinguishes between credit-bearing and non-credit-bearing credentials.

On one end of the y-axis, conventional macro-credentials and credit-granting micro-credentials are situated, earned through formal and semi-formal learning. The x-axis illustrates the extent to which credentials and corresponding study units are packaged together by the awarding body or institution, as opposed to scenarios where learners exercise significant discretion in assembling their individual learning packages. According to this classification, micro-credentials are distinguished from traditional macro-credentials, non-status awards like short courses, and nano-credentials such as digital badges or certificates, as they are unbundled, credit-granting, and stackable credentials. However, the boundaries between quadrants in this credential map are not always as distinct in practice. For example, a learner could possess a non-credit-bearing badge in project management, but this badge can be evaluated as 'recognition of prior learning' (RPL) or 'accreditation of prior learning' (APEL) by a HEI or incorporated into a professional portfolio, which subsequently contributes to a credit-bearing micro-credential course, making the micro-credentials suitable for HEIs entry requirement as well as credit transfers.

Many individuals actively pursue educational credentials for future job opportunities or to enhance their existing employment prospects. As shown in Figure 2, there are several types of educational credentials, all of which are closely tied to employability.
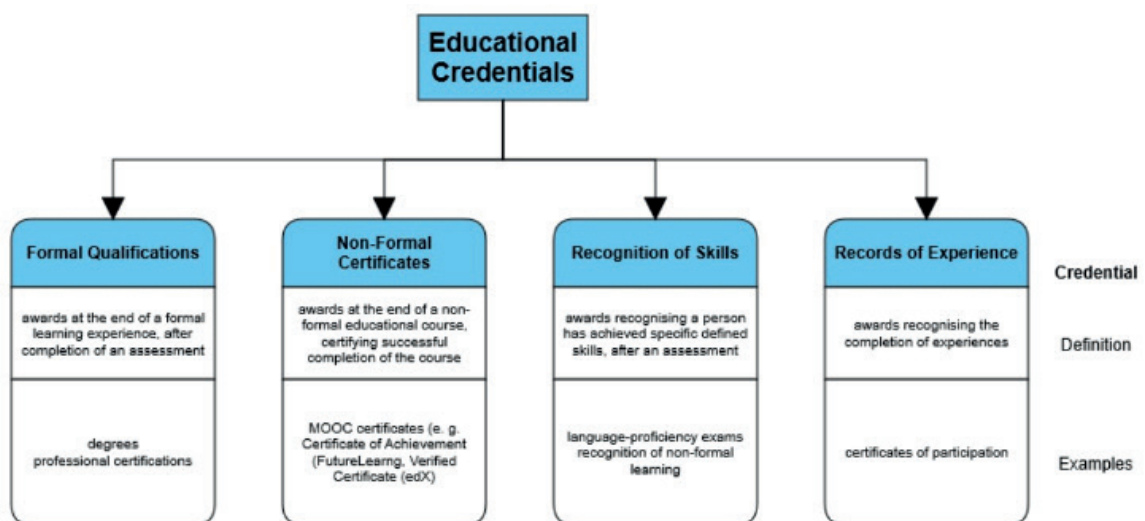
Figure 2. Types of educational credentials (Source: Camilleri and Rampelt, 2018, p. 7

Currently, employability has emerged as an area of concern, a trend that is expected to persist for the foreseeable future. To counteract this, suitable credentialing is seen as a potential solution to address certain skill shortages (Calonge et al., 2019). For example, it is mentioned that Malaysia is not experiencing a labour shortage (William, 2022). The country has around 2.4 million underemployed individuals, both in terms of skills and time, and another 642,000 people who are unemployed. This equates to approximately three million Malaysians ready for employment! So, does the problem lie in the lack of specific talents that the job market demands? Why aren't their degrees and diplomas fully addressing their employment needs? Is it possible that they are lacking in a particular knowledge or skills that consequently do not meet industry expectations? The challenge goes beyond simply finding individuals willing to work; they also need to possess the skills that are aligned with their prospective roles within the organisation. Robert Half Talent Solutions' research in 2022 suggests that 95% of executives find it somewhat or extremely difficult to locate employees with the required skills and talents. This enduring stalemate is commonly referred to as the "skills gap". In this context, micro-credential programmes could play a crucial role in bridging this skills gap.

Figure 3. Potential vs. Reality: 97% of Malaysians Show Interest in Learning, Yet Only 36% Have Access to Training Opportunities.

Source: www.randstad.com.my/hr-trends/employer-brand/2022-malaysia-rebr-download/

According to Figure 3, the majority of Malaysian employers do not prioritise learning and development, despite a high level of interest among Malaysians. Various reasons could account for this. Micro-credential programmes, offering concise, targeted learning and development experiences, could bridge this gap, fitting conveniently into the schedules of employees at any career stage.

Consequently, economic, health and geo-political uncertainties have created divergent outcomes for labour markets globally in 2023. It is mentioned that low- and lower-middle-income countries continue to see higher unemployment than before the COVID-19 pandemic. The labour market outcomes are also worrisome, as workers with only basic education and women are facing lower employment. At the same time, wages are declining as a result of ongoing cost-of-living crisis, and changing worker expectations are becoming more prominent issues globally (World Economic Forum, 2023).

OBJECTIVES OF THE STUDY

The objectives of the study are given below:

1. To explore the role of micro-credentials in facilitating competency development for human capital and employment; and
2. To investigate the current trends and challenges in developing and implementing micro-credentials in Malaysia

METHOD

This study explored the potential of micro-credentials in facilitating competency development among the workforce as well as investigated the current trends and challenges in developing and implementing micro-credentials. The study used triangulation approach to determine the present experiences and future expectations of a sample from the workforce, universities, employers as well as statutory bodies governing talent acquisition among the working population in various industries. This study involved literature reviews, interviews with industry professionals and workforce surveys to address the research objectives.

All standard research method processes and practices were observed including obtaining permission, using third-party individuals between the researcher and respondents to collect responses, seeking voluntary participation and ensuring research ethics are not compromised during the distribution and collection of the questionnaires.

There were two (2) stages using quantitative and qualitative approaches to obtain data from respondents as explained below.

- *Stage 1: Sourcing from the workforce using questionnaire on the role of micro-credential courses offered locally, factors contributing to take-ups*

  The first stage, which is quantitative in nature, deals with the identification of the key variables that influence the micro-credential course offerings locally and factors contributing to take-ups. A questionnaire was developed by using adapted survey instrument comprising closed-ended and open-ended questions. It was divided into three main sections: a demographic profile in the first section and the factors contributing to take-ups for micro-credential programmes in the second section. The third section consisted of open-ended questions that sought information from the respondents as to what the challenges are and how they believe the micro-credential courses should be deployed. The authors employed purposeful sampling, which involves selecting participants who possess specific characteristics or traits relevant to the study.

- *Stage 2: Sourcing from the Focus Group Discussion (FGD) sessions with Head of Departments of selected Malaysian universities, HRD Corp and TalentCorp on the trends of offerings micro-credential courses and challenges in developing, as well as implementing micro-credentials*

  This stage is qualitative in nature and begins with Focus Group Discussion sessions. Data was collected from the seven (7) Focus Group Discussion sessions, each consisting of 3-5 participants. As mentioned above, the members of the Focus Group Discussion sessions comprised of deans, deputy deans, academics and senior managers from HRD Corp and TalentCorp. During the Focus Group Discussion sessions, interviews were recorded with the consent of the participants but the identity of the participants were withheld.

Table 1 outlines the means that were used to achieve the research objectives.

Table 1. Means used to achieve the research objectives

RESEARCH OBJECTIVES	INSTRUMENTS	DATA SOURCES
To explore the role of micro-credentials in facilitating competency development for human capital and employment	Survey	Local Workforce
To investigate the current trends and challenges in developing and implementing micro-credentials in Malaysia	Focus Group Discussion	Selected Malaysian Universities HRD Corp TalentCorp

The validity and reliability of all questions is ensured as they were taken from established questionnaires that have been tested and re-tested. Quantitative data collected from the survey was analysed using SPSS by using various statistical tests. The focus group discussion was analysed through thematic constructs.

FINDINGS

The survey that garnered responses from 1,464 employed adults (against the targeted 2,000) across various sectors. The data on respondents reveals that 17.2% possess a high school certificate, 25.8% have a bachelor's degree, 32.3% hold a diploma, and 9.9% have obtained a master's degree, with the remaining individuals having other, lower qualifications. Regarding age, 22% of respondents fall within the 26-30 year age range, followed by 18.4% in the 21-25 range, and 16.9% in the 31-35 range, with smaller percentages for other age ranges. Employment-wise, the majority of respondents (51%) work in the private sector, with 27% in the public sector, 10% employed by others, and the rest are self-employed. The other details of the respondents are illustrated in Figures 4 to 7.
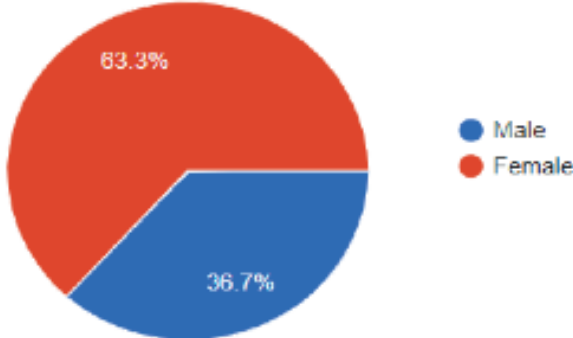
Figure 4. The percentage of the gender of the respondents
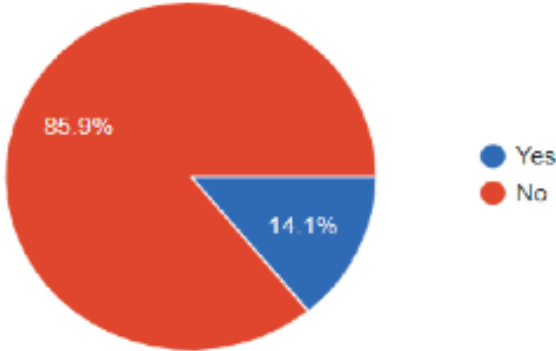
Figure 5. Exposure to the micro-credential courses
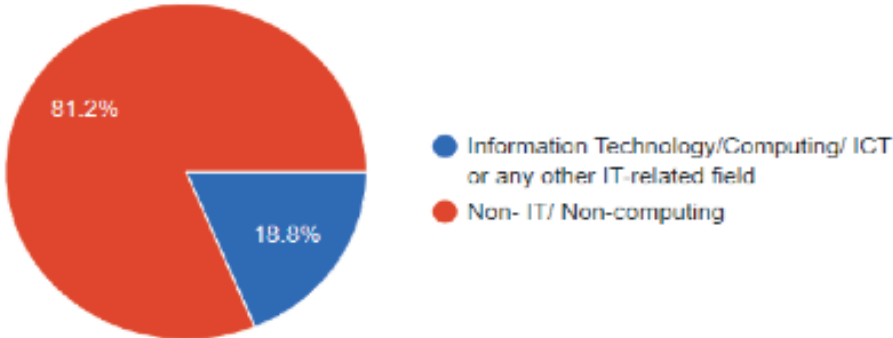
Figure 6. Professional background of the respondents
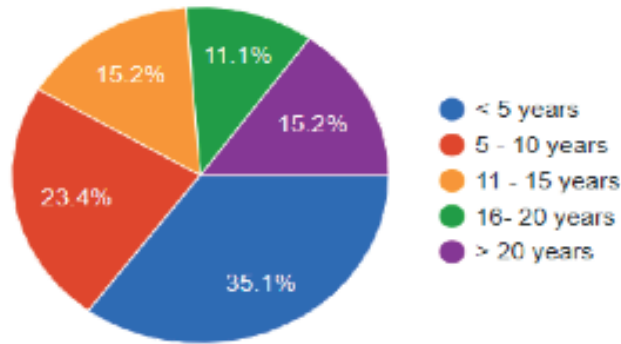
Figure 7. Numbers of the years in workforce

Surveyed respondents agreed that micro-credentials offer broader opportunities for upskilling, allowing both employers and employees to engage with learning experiences that can better equip their organisations for the future. This concept, known as a 'learning organisation' in human capital development, encourages individuals to continuously improve themselves for the benefit of the organisations they serve. Micro-credentials are poised to enhance employee engagement and foster a culture of lifelong learning, thereby supporting the organisations they are part of.

Role of Micro-credential in Facilitating Competency Development for Human Capital and Employment

Respondents were prompted to prioritize their reasons for selecting micro-credential courses, ranking them from the most to the least significant. The analysis revealed that the three main factors motivating enrollment in micro-credential courses, according to survey findings, are career development, the enhancement of knowledge or skills, and personal interest, as illustrated in Figure 8.
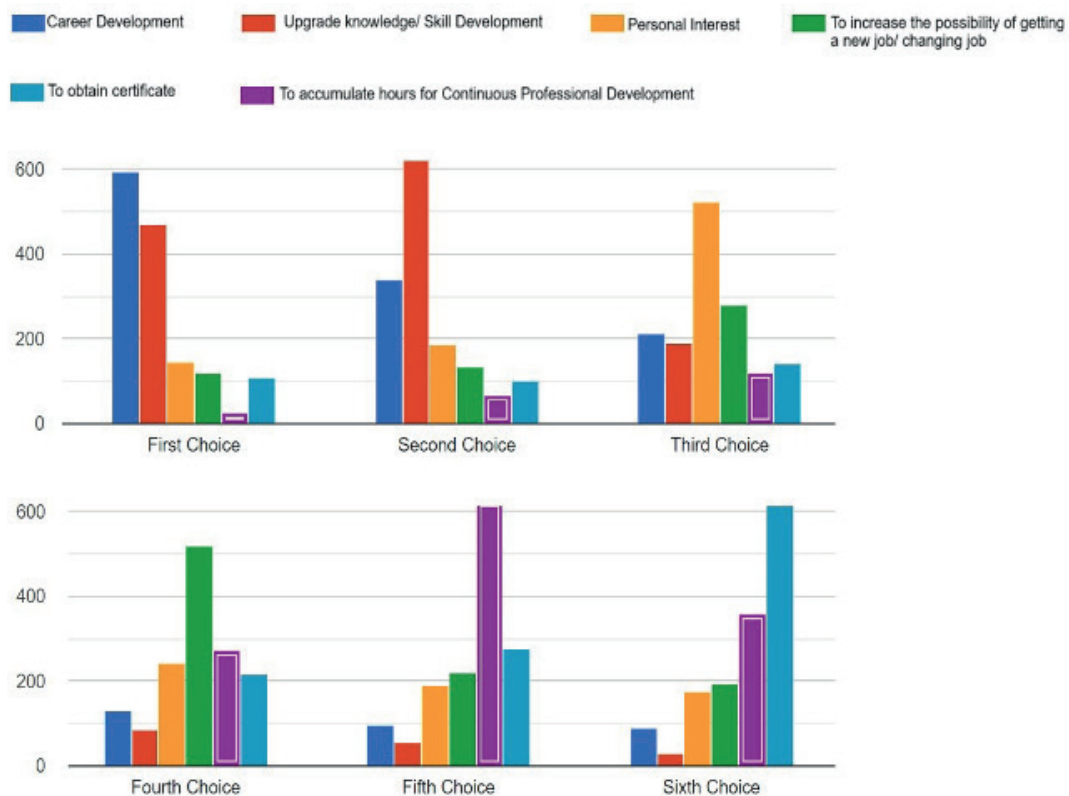
Figure 8. The motivations or factors that influenced respondent's decision to pursue a micro-credential course

These motivations echoed global trends and demonstrated a clear alignment with the worldwide responses (Figure 9).
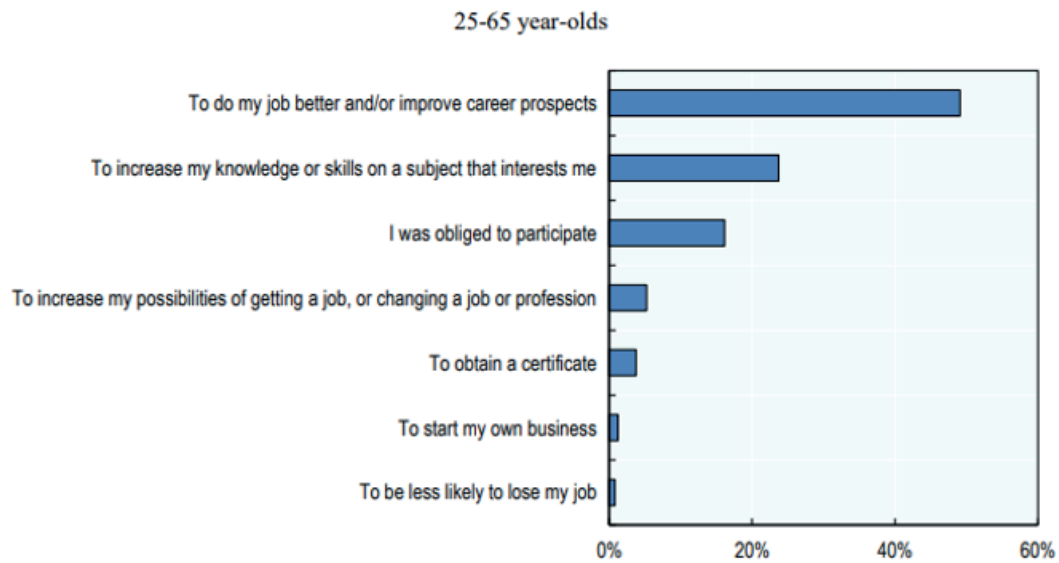
Figure 9. Reasons for participating in non-formal education and training in OECD countries and economies (2012, 2015 and 2018)

Source: OECD [2019], Survey of Adult Skills [PIAAC], www.oecd.org/skills/piaac/

Further insights from the survey of 1,464 respondents revealed that many of them consider micro-credential courses as a significant factor in enhancing their employability or career prospects (Figure 10).
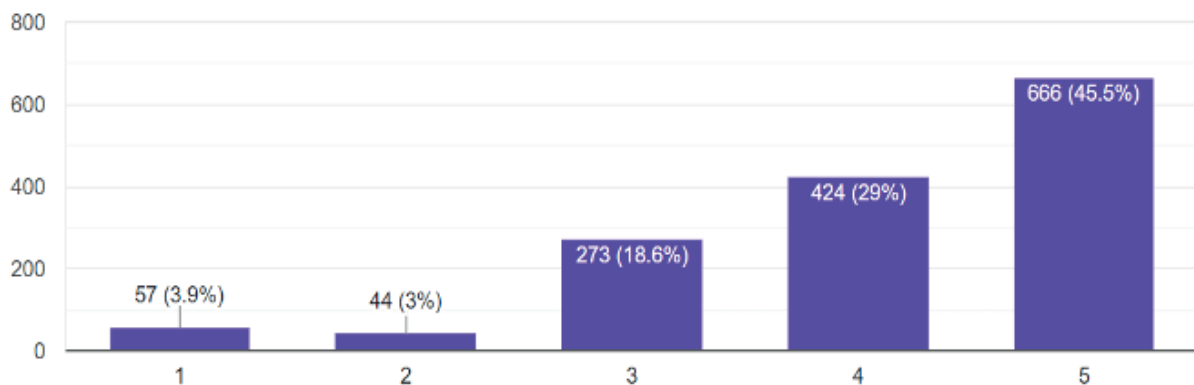
Figure 10. Respondents' feedback on whether micro-credential course can enhance their employability or career prospects (Likert Scale: 1 [strongly disagree] – 5 [strongly agree])

The reputation and credibility of micro-credential courses and their providers stood out as pivotal considerations for these respondents when contemplating enrolment in such programmes (Figure 11).
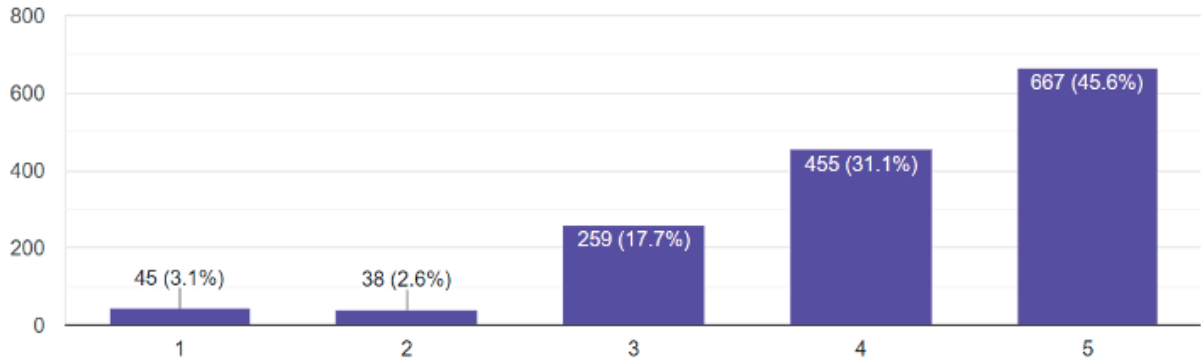
Figure 11. Respondents' feedback on whether the recognition and credibility of micro-credential courses and their providers is important for them when considering enrolling in such a course (Likert Scale: [1 strongly disagree] – 5 [strongly agree])

Respondents pointed out the crucial role employers should play in facilitating the uptake of micro-credential courses among their workforce as indicated in Figure 12. They outlined key employer responsibilities such as offering career development opportunities tied to micro-credentials, providing financial incentives for course completion, and allowing dedicated time-off for pursuing these educational initiatives. Additionally, the survey participants stressed the importance of the accessibility of micro-credential courses in influencing their decision to enrol. They particularly emphasized the value of features like online learning, self-paced courses, and modular content, indicating that these factors make such courses highly suitable for working professionals balancing work commitments and continuous learning aspirations.

Figure 12. Respondents' feedback on the role employers should play in supporting and promoting the uptake of micro-credential courses (Note: only the top three responses are given)

Thus, employee objectives for earning a micro-credential appear motivated predominantly by internal progression and the enhancement of skills and knowledge for their current role. Less emphasis was placed on micro-credentials as a means of furthering formal education or in seeking a new role. Furthermore, when asked what they might do with a micro-credential, only 31% said they would look into using it as a pathway to a larger qualification. Similarly, employers saw micro-credentials to recognise and reward personal growth and progression among the workforce, rather than quantify existing skills or increase competitiveness. Connecting micro-credentials with strategic competence and continuing professional development was notable in its absence by employer respondents. Additionally, the survey participants stressed the importance of the accessibility to micro-credential courses in influencing their decision to enroll. They particularly emphasized the value of features like:

- online learning
- self-paced courses
- modular content

All of above indicate that these factors make micro-credential courses highly suitable for working professionals balancing work commitments and continuous learning aspirations.

Thus, employee objectives for earning a micro-credential appear motivated predominantly by internal progression and the enhancement of skills and knowledge for their current role. Less emphasis was placed on micro-credentials as a means of furthering formal education or in seeking a new role.

The workforce surveyed highlighted that micro-credentials are very effective as they help in developing professional skills and academic knowledge in a shorter time, and is able to facilitate human capacity development through four (4) areas: upskilling, reskilling, lifelong learning and supporting formal education for school leavers as highlighted by Abd Karim (2021) (Figure 13).
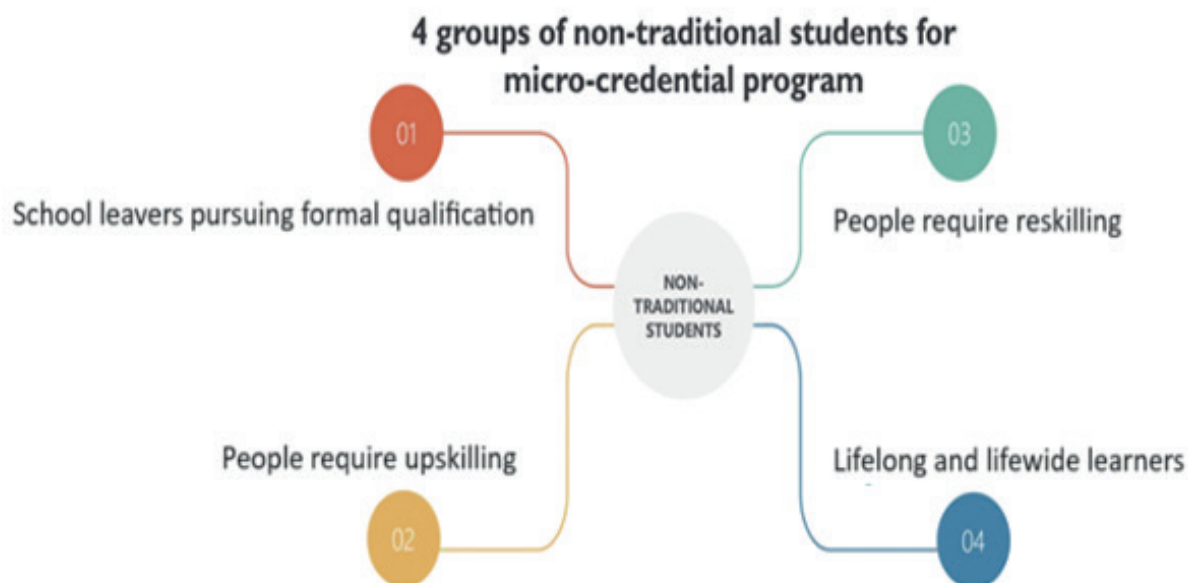
Figure 13. Micro-credential roles in supporting and complementing human capital development
(modified from Abd Karim, 2021)

Micro-credential courses serve as a key asset in human capital development by promoting upskilling and reskilling among the workforce, thereby enhancing their competencies and skills. Moreover, their flexibility facilitates lifelong and life-wide learning, supporting continuous knowledge acquisition among employees. Findings indicate that micro-credential courses play a crucial role in complementing the capacity-building ecosystem. These courses offer targeted skill development opportunities and allow individuals to enhance their knowledge and competencies in specific areas. Local universities were found to offer a range of micro-credential courses, catering to diverse professional needs.

This supports the findings by Varadarajan, S., Koh, J., & Daniel, B. (2023) who presented a systematic review of literature on micro-credentials. Van der Hijden and Martin's work in 2023 also presents similar conclusions, offering insights into the worldwide evolution of micro-credentials. Their study particularly emphasizes the relevance of these developments in developing and emerging countries which brings us to the next findings in our study.

Current Trends and Challenges in Developing and Implementing Micro-credential in Malaysia

The findings from these focus group discussions at selected universities highlight that the micro-credential courses positively influence the participants' learning experiences and understanding of the subject matter.

The selected universities, as well as HRD Corp and TalentCorp view micro-credentials through various lenses, recognising their potential to foster lifelong learning, provide alternative education paths, expand access to education, and offer stackable credentials that enable progression in learning. Micro-credentials

are seen as a pivotal tool in the lifelong learning continuum. In the context of widening access to education, micro-credentials remove several barriers typically associated with traditional degree programmes, such as time, cost, and geographical constraints. They thereby, help reach out to marginalized groups, offering them an opportunity to gain recognised qualifications and enhance their career prospects. Additionally, the stackable nature of micro-credentials provides a stepping-stone for learners. Individuals can accumulate these credentials over time to achieve higher qualifications, making the process of higher education more manageable and less overwhelming.

The findings also indicated that micro-credential courses can be offered as online courses and further enhanced by open and distance learning (ODL) technology, as an alternative to widen their learning opportunities. Learning at their own pace, time and through their preferred methods, resulting in continuous learning for certification opportunities and make lifelong learning a reality for competency development for Malaysia's human capital. This supports the findings by Kumar, J., Richard, R., Osman, S., & Lowrence, K. (2022) through their quantitative analysis which indicated that learners valued the micro-credential in particular for its professional relevance as a facet of digital learning identity (p. 18). According to Kumar et al., their study highlighted the fact that self-motivation and efficacy might be required for learners taking micro-credentials. The authors indicated that the participants were comfortable and competent using technology for autonomous learning. This indicates that micro-credentials via ODL is an option to upgrade and upskill human capital and is a practical choice as working adults can choose to work and study at their own time and pace with maximum flexibility.

The study also explored practices and identified various factors contributing to the take-up and demand for micro-credential courses. Factors such as the need for career development and the quest for knowledge and relevance to job requirements emerged as key drivers of demand. Additionally, the research revealed a significant interest among working adults in pursuing micro-credentials, suggesting potential growth in this area for ODL institutions that mainly caters for working adults.

Due to its flexible and positive take-up factors, ODL universities can also encourage both local and international participants to enroll in the micro-credentials courses and enhance their employability in the global market. ODL universities can offer a wide range of micro-credentials to help local and international learners acquire the necessary skills and knowledge, to keep up with the rapidly evolving industry. Micro-credentials provide these learners with the opportunity to acquire in-demand skills quickly, making them valuable assets in the job market. These courses can be targeted at both beginners and experienced professionals looking to expand their skillset. In summary, these micro-credentials can be an effective way to stay competitive and relevant in their chosen field.

This study also highlighted challenges faced by Malaysian universities in developing and implementing micro-credential courses. These challenges, which can be extended to ODL universities, included:

    a. identifying suitable micro-credential courses for niche markets

    b. getting the right expertise

    c. recognition of the micro-credential courses by professional bodies and employers

    d. deciding on the correct assessment and evaluation for the micro-credential courses

    e. training for the educators

    f. management of the micro-credential learning management platforms

Addressing these challenges is crucial to ensure the successful implementation and sustainability of micro-credential courses in the Malaysian higher education landscape.

LIMITATION OF STUDY

Despite the valuable insights provided by this study, there are some limitations in terms of:

    a. *Scope of study:* Our focus has been on selected Malaysian universities, including Open University Malaysia and this may limit the generalizability of our findings to other ODL universities worldwide.

    b. *Challenge coverage:* The exploration of challenges faced by these selected Malaysian universities may not be exhaustive or fully representative.

DISCUSSIONS AND CONCLUSION

This study was undertaken to provide a contrasting perspective to the substantial amount of grey literature and digital content that frequently reiterates the alleged benefits of micro-credentials, often without a solid evidence base. Our aspiration, and indeed our expectation, was that this study would serve as a valuable tool reflecting the dynamic global trend of micro-credentials within universities.

There is also a need to tie micro-credentials more explicitly to Sustainable Development Goal 4 (SDG) on "relevant skills for decent work". By 2030, there is a need to substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship and specifically in SDG 4.4: "increase the number of people with relevant skills for financial success".

The findings also indicated that conventional colleges and universities worldwide have actively started to engage in conducting short-term programmes for adult learners via digital education. The implication of these findings indicates that ODL institutions implementing micro-credentials must consider the acceptance and stackability of credentials from different HEIs worldwide, with clear validation metrics.

Malaysia, through MQA, has taken many tangible steps to unleash the full potential of micro-credentials. In fact, MQA acknowledges the importance of recognising non-formal and informal learning. Many individuals acquire valuable skills outside of formal education settings. Micro-credentials offer a platform to validate and recognise these skills, improving visibility for such learning and subsequently enhancing individuals' employability and career prospects. By embracing the concept of micro-credentials, MQA is helping shape an education system that caters to the 21st century and beyond. To further accelerate micro-course courses, the Accreditation of Prior Experiential Learning for Micro-credentials (APEL-M) by the Malaysian Qualifications Agency (MQA) is an initiative designed to recognise and validate the knowledge, skills, and competencies obtained through various learning experiences for the award of qualifications under the Malaysian Qualifications Framework (MQF). This innovative approach focuses on "unbundled" or stand-alone micro-credentials, allowing individuals to gain recognition for small, specific skill sets or competencies. APEL-M offers a pathway for learners to acquire qualifications in a flexible, personalized manner that aligns with their unique learning journeys and professional development needs. It acknowledges the importance of both formal and informal learning, providing a robust system for recognizing a wide range of skills and competencies that are essential in the modern workforce. By doing so, APEL-M contributes to creating an inclusive, dynamic, and responsive education system that caters to the diverse needs of learners and the ever-evolving demands of the job market.

This study also provides valuable insights into the role of micro-credential courses in the capacity-building ecosystem for the workforce. It sheds light on the roles of micro-credential courses, factors driving demand, and employability prospects. The findings also highlighted the trends and challenges faced by Malaysian universities in developing and implementing micro-credential courses. The discussions and conclusions derived from this study can serve as a guide for universities and policymakers to develop and implement effective micro-credential courses that meet the needs of the human capital and support the professional development of individuals in this their chosen fields.

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ACADEMIC SUCCESS IN
SYNCHRONOUS ONLINE LEARNING ENVIRONMENTS

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ABSTRACT

The study aimed to analyze the influence of such factors, as cognitive engagement, learning strategies and social support on academic success and student satisfaction in online learning environments. Data were collected in a cross-sectional survey carried out in the Winter semester of 2023. Participants were 523 students recruited from universities located in Southern Italy, where the synchronous online learning modality was adopted. The questionnaires included self-reported measures assessing student satisfaction and academic achievement, social support (teacher and peer presence), and deep and shallow cognitive engagement, in an effort to collect data regarding the dynamics of online learning experiences with respect to the three interdependent presences of teaching, cognitive and social, as put forth by the Community of Inquiry (CoI) framework (Garrison et al., 2001). Descriptive analysis, bivariate associations, and regression analyses were applied to the data. Data showed different patterns of relationships between academic success and predictors. Deep cognitive engagement was positively associated with academic achievement but unrelated to satisfaction, whereas no significant associations emerged between shallow cognitive engagement, academic achievement, and satisfaction. Furthermore, social presence was found to be unrelated to students' satisfaction, deep cognitive engagement, or shallow cognitive engagement. The findings of the current study provide professionals in the field of education with suggestions for synchronous online-based teaching about ways to plan a community learning space where teacher-student interactions as well as peer interactions are fostered. This more collaborative-constructivist perspective could improve students' academic achievements.

Keywords: Academic success, synchronous online learning, social support, cognitive engagement.

INTRODUCTION

The European Union's Lifelong Learning Program invites higher education and adult learning institutions to consider ways of providing stimulating learning experiences to people at any stage of their lives, taking into account current societal transitions. As the educational landscape evolves, it accommodates a more diverse audience of individuals accessing educational content. It is essential to ensure these individuals have equal access opportunities to promote the quality of their educational experience, considering factors such as age, work and family commitments, or distance, which may hinder participation in physical educational activities.

In the current dynamic educational landscape, proposals have emerged, advocating the use of digital technologies to enhance the flexibility and accessibility of educational resources geared toward diverse and extensive groups of learners (Cain, 2015). Asynchronous communication systems serve as a technological solution that blurs the boundary between in-person and remote educational models. The systems continue to improve in terms of functionality and efficiency, paving the way for new hybrid synchronous approaches, known as blended approaches (Alexander et al., 2014; Bower et al., 2015). As a result, contemporary education policies now consider the prospect of multi-campus learning and inter-institutional collaboration through connecting virtual groups and classrooms with traditional physical classrooms (Raes et al., 2020).

In the period 2020-2021 the introduction of safety measures to contain the spread of the COVID-19 has led to social/physical distancing and sudden lifestyle changes, such as deprivation of social contact with peers and isolation, school closures for more than 1 billion learners worldwide - almost 70% of the world's student population (UNESCO, 2019) - and distance learning, thus affecting quality of life, mental health and learning achievement (Vaillancourt et al., 2021; Bonvino et al., 2023). In facing several phases of lockdowns, teachers and educators had to quickly transition from face to face to online lessons and to adopt new forms of online teaching in order to maintain student engagement. Among them, the synchronous online learning environment is believed to become "a learning paradigm shift in the post-corona era" (Ji, Park, & Shin, 2022, p.1).

Therefore, in light of the emergency transition to online learning during the COVID-19 pandemic, the main aim of this investigation was to evaluate if synchronous online learning positively affected students' learning process and their academic achievement and satisfaction. To this purpose, the study draws upon two frameworks, the community-based model and the engagement framework.

The Link between the Synchronous Online Learning Environment and the Community of Inquiry Model

Within online educational research, previous studies have generally shown positive effects of blended learning modality (van der Stap et al., 2024) and virtual learning (asynchronous and/or synchronous online learning) not only on academic success (Zou et al., 2021), but also on social components such as a decrease in learners' feelings of isolation (Wise & Cui, 2018). As for social components, they are rooted in Vygotsky's social constructivist theory (1978) according to which knowledge is co-constructed and individuals learn from one another in a knowledge community. Under the umbrella of the generic community definition and in line with John Dewey's (1938) examination of the nature of knowledge formation, the Garrison and colleagues' (2001) conceptual framework of the Community of Inquiry (CoI) was used in this investigation as a guide to structure the online course. It was assumed that, in the lack of face-to-face interaction, individuals in online learning environments must exert efforts in recreating the social and knowledge building mechanisms present in in-person classrooms, such as the moment by moment negotiation of meaning. Therefore, the CoI approach could perfectly be adopted to the synchronous online learning modality, as a form of learning in which participants interact with each other and instructors in real time.

Defined as the ability of participants in a community of inquiry to project themselves socially and emotionally as 'real' people (i.e., their full personality) through the medium of communication being used" (Garrison et al., 2000, p. 94), social presence is essential for collaborative learning and, therefore, it could represent

the core element of this framework. Indeed, students need to feel the affective or psychological presence of others to avoid feeling isolated and demotivated (e.g. Ali & Smith, 2015; Bouilheres et al., 2020; Rasheed et al., 2020). In this direction, when social presence is established, it acts as a support for cognitive presence, indirectly facilitating the process of critical thinking carried on by the community of learners (Garrison et al., 2000; Gutierrez-Santiuste et al., 2015).

The CoI model posits a collaborative-constructivist perspective which is useful to understand the dynamics of an online learning experience taking into account the following three interdependent presences: teaching, cognitive and social. The first (TP) comprises three areas of responsibility, i.e., design, facilitation, and direct instruction, associated with the integration of social and cognitive processes. The second (CP), which consists of four phases – triggering event, exploration, integration, and resolution/application (Garrison, Anderson, & Archer, 2001) – mirrors the purposeful nature of collaborative knowledge construction foreseen by constructivist educational experiences. Finally, the third presence (SP) includes three categories: open communication, group cohesion, and personal/affective projection.

Although the three presences are interconnected and their effects overlap, Garrison and colleagues (2004) assumed a sort of hierarchical sequence among them: TP serves as the pivotal dimension leveraging SP, which activates and propels the collaborative process of CP. Therefore, SP could play a mediating role between TP and CP, fostering open communication and group cohesion in line with the constructivist perspective.

Community of Inquiry and Online Learning Outcomes

A recent qualitative synthesis based on 23 studies adopting the CoI framework and carried out before the pandemic period (Kim and Gurvitch 2020) found that the majority of university courses based on CoI were in the field of Education, followed by Business, Nursing, Engineering, Computer Science and Science and that the asynchronous online courses were the most common delivery type throughout the educational level, accounting for 72% of all delivery types. In addition, when examining the learning outcomes related to the application of CoI, the same systematic review categorized the type of the learning variables according to two criteria: the first as a subjective estimation reported by students themselves or as an objective/external rater; the second one as the learning process or product. By interacting the two criteria the structure of the observed learning outcomes revealed four main sections: (a) subjective learning product referred to students satisfaction and self-reported achievement (b) objective learning product, such as exam score or assignment score, (c) subjective learning process including meta-cognition, engagement, efficacy and self-regulation, and (d) objective learning process involving time spent on task or frequency of tool use. The review showed a significant increase of interest in the online teaching environment among researchers given the positive effects of the CoI model and suggested plans for future studies during the pandemic or post-pandemic period to assess students' academic success.

In this vein, a recent investigation showed that, although all the three elements of CoI were good predictors of course satisfaction, social presence was the strongest determinant to students' satisfaction. Social presence had a role as facilitator in cognitive development and critical thinking in online learning (Yandra et al., 2021). In line with this result, others data indicated that, when students are involved in synchronous online learning environments, social presence positively correlated with higher levels of satisfaction (Andel et al., 2020; Ji, Park, & Shin, 2022; Zhong et al., 2022) and academic achievement (Al-dheleai et al., 2020).In addition, teaching presence was found to be positively associated with students' satisfaction (Turk, Heddy, & Danielson, 2022; Yoo & Jung, 2022). Finally, a recent meta-analysis (Yu & Yu, 2021) concluded that online learning outcomes were significantly higher than the traditional learning outcomes during the pandemic period.

However, the role of cognitive learning processes associated with the social and teaching presence in online synchronous learning has been less investigated during the pandemic period. This is an important aspect, since cognitive processes underlying learner engagement could impact academic achievement and satisfaction.

Learning Engagement and Academic Success in Online Learning

The literature on online learner engagement is continually developing, despite years of research on this topic. In distance and online learning literature it is defined as "the student's psychological investment in and effort directed toward learning, understanding, or mastering the knowledge, skills, or crafts that academic work is intended to promote" (Newmann, Wehlage, & Lamborn, 1992, p. 12). Lear and colleagues (2010) supported the idea that interactions with content, peers, and instructors help online learners become active and more engaged in their courses, and that the emerging sense of community leads to a high-quality instruction and more effective learning outcomes.

The pandemic period characterized by transactional distance between learner and instructor had added another barrier to learner engagement, thus leading to much efforts to increase the amount of dialogue, structure, and autonomy between course participants. In psychological literature engagement is conceptualized as a complex and multidimensional construct and it includes behavioral, cognitive, and affective aspects (e.g., Fredricks et al., 2004). The first typically focuses on students' learning behaviors such as effort, persistence, attention, and concentration; the second on the cognitive processes of learning such as the applications of deep or shallow strategies during learning activities and the last one on students' feelings toward learning activities, such as positive or negative emotions. In line with this conceptualization, the current study is focused on the second aspect as a further determinant of academic success. Operationalized as cognitive engagement, this concept refers to self-regulated or strategic learning (Fredricks et al., 2004) and includes two components, deep and shallow (Greene, 2015) strategies. The former involves high-order or meaningful processing strategies linking new material to prior knowledge (Greene, 2015; Ravindran, Greene, & DeBacker, 2005) and thus positively influencing learning performance (Bolliger & Halupa, 2018; Liu et al., 2022); the second involves more mechanical memorization strategies and other rote processing actions (Xie, Heddy, & Greene, 2019), thus negatively influencing learning performance (Greene & Miller, 1996).

However, limited research investigated the effects of students' cognitive engagement on satisfaction and academic achievement in online learning environments. Dinh (2023) has recently reported that deep learning strategies were found to be positively related to academic achievement but unrelated to students' satisfaction, as well as no significant associations between shallow learning strategies and academic success. Furthermore, when focusing on the associations between learner cognitive engagement and the key elements of the CoI model, previous studies showed that a positive direct effect of teaching presence on deep processing strategies in blended synchronous learning environments (Zhang et al., 2016; (Shi, Tong, & Long, 2021; Zhong et al., 2022; Wang and Stein, 2021), while social presence was unrelated to cognitive engagement in synchronous learning environments (Shi, Tong, & Long, 2021). However, other studies revealed that social interactions played an important role in enhancing students' satisfaction and learning engagement in asynchronous and synchronous courses (Cheng & Chau, 2016; Zhong, Wang, Lv, Xu, & Zhang, 2022), students' outcomes and satisfaction (Richardson, Maeda, Lv, & Caskurlu, 2017; Andel et al., 2020).

Research Aim and Hypotheses

Previous studies examined academic success in association with the core elements of CoI in online learning, but limited studies focused on the examination of the learner engagement in community-based online learning. Therefore, with reference to reviewed literature the current study further contributed in this direction by integrating the community based model with the learner engagement framework underlying students' cognitive processes. In line with the above-mentioned categorization of learning outcomes defined by Kim and Gurvitch (2020), the research examined the effects of the online synchronous environment incorporating the two core elements of the CoI model (teaching and social presence) on the subjective measures of the learning product, which is referred to academic achievement and students' satisfaction, by taking into account the role of students' cognitive learning strategies in such relationships. Hence, the following hypotheses were postulated:

H1: positive associations between the two key elements of the CoI model, social presence and teaching presence;

H2: positive associations between students' cognitive engagement, namely deep and shallow learning strategies, and students' satisfaction and academic achievement;

H3: teaching and social presence are linked to both learning strategies;

H4: academic success is predicted by the two constructs of the CoI framework and by the two learning strategies.

METHOD

Procedure

The study was conducted in the second semester of 2021 and in accordance with the European Code of Conduct for Research Integrity (ECCRI) on human experimentation. In conducting this investigation, the researchers adhered to the ethical standards set forth in the Ethical Code of the Italian Association of Psychology (AIP).In addition, the local Ethics Commission of the University approved the survey protocol (with code number: 51/022021). The anonymity of the data was guaranteed, and no personal information was gathered from the participants. All participants signed an online informed consent to agree to be voluntary respondents for the study without any coercion. They could withdraw from the survey at any time and for any reason. In order to understand the students' satisfaction and academic achievement on the basis of the online course, the survey was completed by students after their end-of-semester examination.

Data Analysis

Cross-sectional design was applied to test the hypotheses. Before testing the hypothesized associations, those instruments without any translated were subjected to a translation process into Italian language by two independent native English professional speakers with previous experience in education research and according to the forward and backward method. The two translated versions were then unified into a single version and reviewed against the original one to identify any discrepancies in meaning or mistranslations. No inconsistencies were found. The last step consisted of a pilot testing among a small group of participants to assess the easy readability and understanding of the items.

The empirical assessment of the soundness of the constructs, that is the face validity of the instruments, was checked by researchers of the current study. For the content validity, the Content Validity Index (S-CVI) of the overall scale was calculated on the basis of Lawshe's method (1975). The critical CVI value - which allows accepting or rejecting the content validity of the instrument - is equal to 0.80 (Davis, 1992). For each instrument it was ascertained the construct reliability by assessing the convergent validity with average variance extracted (AVE) value and the Composite Reliability index (CR), and the internal consistency value with Cronbach's alpha coefficient.

To test the supposed relationships of associations bivariate correlations between the constructs were conducted. Finally, linear regression analysis was used to assess factors associated with students academic success (considered as a composite score). Responses to the survey were aggregated and applied to statistical analysis using SPSS.

Participants

Participants were 523 students recruited from universities located in Southern Italy, where synchronous online learning modality was adopted (convenience sampling; Robinson, 2014). They received a link to a Consent Form and to the Questionnaires. Only 447 respondents (Males = 208, Females = 239; Mage = 21.30, SD =2.1) completed all questionnaire scales and were eligible for data analysis, thereby meeting the

minimum sample size required for a significance level of 5%. Most participants were studying in the discipline of education (55.5%),the remaining part in arts and humanities sciences (14.5%). Table 1 shows students' characteristics.

Table 1. Respondents' Demographic Profile

Gender	Age (mean)	Frequency	Percentage
Male	22.20	208	46.54%
Female	29.80	239	56.46%
TOTAL	---	447	100.00%
Educational Science			
- Male		178	46.59%
- Female		204	53.40%
- TOTAL		382	85.50%
Art and Humanities Science			
- Male		30	46.15%
- Female		35	53.84%
- TOTAL		65	14.5%

Instrument and Data Collection

The questionnaire consisted of two parts. The first part included questions related to the participant's demographic characteristics – age, gender, and degree course. The second part consisted of 41 items underlying different factors that participants responded to in the form of a 5-point Likert scale, response options ranging from strongly disagree to strongly agree. The questionnaire was adapted from prior research.

The Italian translation of the 22-item questionnaire of the CoI survey including the two dimensions of social and teaching presence was adapted from Arbaugh et al. (2008). The first component, Teaching presence (TP)**,** included 13 items. Some sample items are: "The instructor clearly communicated important due dates/time frames for learning activities", "The instructor provided feedback that helped me understand my strengths and weaknesses relative to the course's goals and objectives", and "The instructor clearly communicated important course goals". The second component, Social Presence (SP)**,** comprises 9 items. Some examples of items are: "The way the class meets is an excellent medium for social interaction", "I felt comfortable disagreeing with other course participants while still maintaining a sense of trust", and "I felt comfortable interacting with other course participants".

The Cognitive Engagement Scale (CES): the translated version of the 11-item questionnaire referred to students' cognitive engagement (Miller et al., 1996) was used to assess deep and shallow learning strategies. Students make direct estimates of how much effort they expended.for their study with multiple choice item with 5 alternatives: "Extremely high (probably as much effort as I've ever put into a class)" to "Extremely low (probably the least amount of effort I've ever put into a class)." The middle choice was "About average." The deep strategy subscale was composed of seven items. Examples of items are "When studying, I try to combine different pieces of information from course material in new ways" and "I draw pictures or diagrams to help me solve some problems". The second strategy subscale consists of four item, e.g., "I try to memorize the steps for solving problems presented in the text or in class£" amd "When I study for tests I use solved problems in my notes or in the book to help me memorize the steps involved".

The translated version of the 8-item questionnaire referred to students' satisfaction and academic achievement was adapted from Ejubovic and Puska (2019). The first instrument assesses whether students will use online technology for learning purposes and their level of satisfaction with online learning. Some examples of

items are "I will continue learning online in the future" and "Learning online is a pleasant experience". The second instrument evaluated students' improvements in online learning to a larger extent, and whether their team work is better with online learning (e.g., "I have a better exam pass rate when I use online resources" and "My grades are better when I use online resources"). Both instruments are rated on a five point likert scale starting from strongly disagree to strongly agree. High scores indicate higher levels of satisfaction and academic achievement linked to the online environment.

ANALYSES AND RESULTS

Validity and Reliability

The parameters for content validity and internal consistency in terms of Content Validity Index (S-CVI), Cronbach's alpha reliability, composite reliability (CR), and average variance extracted (AVE) were calculated for each scale. Table 2 reports the mean values and standard deviations for each scale and the above-mentioned indexes.

Table 2. Descriptive statistics of the instruments

Dimensions	N. item	Mean (SD)	S-CVI	α values	CR	AVE
Social presence (SP)	9	3.95 (0.79)	0.88	0.93	0.95	0.75
Teaching presence (TP)	13	4.84(0.76)	0.91	0.94	0.95	0.66
Deep processing (DP)	7	3.76 (0.67)	0.83	0.88	0.91	0.67
Shallow processing (ShP)	4	3.18(0.57)	0.80	0.77	0.90	0.81
Academic achievement (AA)	4	4.01(0.67)	0.82	0.88	0.92	0.73
Student satisfaction (SS)	4	3.45 (0.88)	0.89	0.90	0.94	0.84

Cronbach's Alpha values for all the constructs were higher than the suggested 0.7 minimum threshold. Composite reliability which is preferred to Cronbach's Alpha confirmed the reliability of the four instruments with values exceeding the minimum threshold of 0.7. The obtained results are in line with previous findings (Arbaugh et al., 2008; Dihn, 2023; Ejubovic & Puska, 2019; Miller et al., 1996). In addition, the data of the two dimensions of the CoI survey (TP and SP) are in line with previous validated studies among Italian students (Nizzolino et al., 2023). The final criterion for determining internal consistency was the average variance extracted (AVE). According to Hair et al. [67] and Kline [71], the AVE values must be equal to or greater than 0.50. From the table, AVE values ranged from 0.672 to 0.839, satisfying the requirement.

Results

Data from bivariate relationships (Table 3) showed that students' satisfaction was positively linked to academic achievement and unrelated to the other variables; academic achievement was positively linked to deep processing but unrelated with shallow processing; both dimensions of cognitive engagement were significantly related with teaching presence, but unrelated with social presence. Hence, social presence was found to be unrelated with all variables, except the dimension of teaching presence, which belongs to the Community of Inquiry framework.

Hierarchical regression analysis (with stepwise method) was run to explore how academic success (considered as dependent variable in terms of a composite score) was related to the other variables, in order to identify the importance of these variables that account for as much of the variation in the dependent variable as possible. Data showed the overall regression was statistically significant (R^2 = 0.73, $F(4, 443)$ = 23.46, p = < .000); it was found that deep and shallow processing and teaching presence significantly predicted academic success (β = 0.76, p = < .000; β = 0.15, p = < .000; β = 0.68, p = < .000), whereas social presence did not significantly predict academic success (β = 0.60, p = 0.52).

Table 3. Bivariate correlations among the variables

	1	2	3	4	5	6
Social presence	-	0.374**	0.055	0.061	0.042	-0.04
Teaching presence		-	0.513***	0.530***	0.161	0.025
Deep processing			-	0.390**	0.201**	0.161
Shallow processing				-	0.180	0.116
Academic achievement					-	0.631**
Students' satisfaction						-

DISCUSSION

The goal of the current research was to investigate the possible effects of a set of cognitive and social factors on students' academic success and satisfaction in online learning environments. To achieve this purpose, two learning strategies underlying cognitive engagement (deep and shallow processing) and two dimensions operationalising the Community of Inquiry model (social and teaching presence; social support) were taken into account.

The results obtained from correlations supported H1, given the positive association between the two factors of the CoI framework. Although the result is consistent with the empirical data by Arbaugh (2007) and theoretical framework hypothesized by Garrison et al. (2001), the correlation coefficient indicated a moderate association between the two dimensions. In accordance with similar results (Nizzolino et al., 2023; Velazquez et al., 2019) the paramount importance of the dimension of social presence does not seem to be confirmed, thus also confirming some possible adjustments for this dimension which should be more focused on the self in the social context and on the social approach promoted by the teacher, and less on students' emotional perspective.

Findings from patterns of associations partially supported H2 implying significant associations among the two learning strategies, satisfaction and academic achievement. Aligned with the findings by Dinh (2023), the current data indicated that shallow strategy was unrelated with both dimensions of the academic success and that deep processing was significantly associated with academic achievement but unrelated with students' satisfaction. In addition, the observed positive association between the two strategies is not in line with previous research carried out in a traditional learning environment (Greene & Miller, 1996). On the basis of these results, the supposed associations were partially confirmed only for the deep strategy..

With regards H3, significant relationships emerged between teaching presence and both learning strategies, thus partially confirming the supposed associations. Consistently with Dinh's research (2023) such result could be explained by the role adequately played by the teachers when they interacted with the students in the online environments of this study. Indeed, in light of the CoI framework, teacher presence is more precisely shaped when designing online courses (Richardson *et al.*, 2015; Richardson *et al.*, 2016) with reference to design and delivery conditions regarding instructional design, instructor roles and styles, and behaviors and interactions (Richardson *et al.*, 2016). For example, to facilitate learning (e.g., being an active voice in course discourse), teachers should design curricular materials, manage the learning process and environment, and provide a social presence to overcome feelings of isolation among students (e.g., using greetings, names, humor, and self-disclosure; Dennen, Darabi, & Smith, 2007; Richardson *et al.,* 2016). However, the absence of the correlations of social presence with both strategies was not only in line with Dinh (2023) and Shi and colleagues' (2021) studies - even if not aligned with other investigations demonstrating significant relationships with cognitive engagement (Wang, 2022; Zhong et al., 2022) - but also with other researchers, such as Nizzolino et al. (2023) and Velazquez et al. (2019). who affirmed a marginal role played by social presence in synchronous community environments.

A possible explanation could be linked to what Dinh (2023) supposed, that is the lack of relationships of social presence with learner cognitive engagement could be due to the fact that the participants were required to set their cameras on during the real-time and face-to-face interaction with their teacher and peers, and this control over such decisions might have resulted in negative feelings about the synchronous learning online environment.

Finally, the fourth hypothesis, assuming academic success is predicted by the two constructs of the CoI framework, was partially supported, since social presence had no significant effect on academic success.

Conversely, teaching presence and both cognitive processing turned out to be significant predictors of academic success.

If the role played by deep processing and teaching presence in positively affecting academic success were reconfirmed, findings would also demonstrate the positive effect of shallow strategy on academic success. Hence, the current study demonstrated that students characterized by shallow strategy obtained more benefits (higher levels of satisfaction and a better learning performance) from the synchronous online learning context thanks to the teaching roles. To sum up, this investigation pinpointed how synchronous learning context led to reshaping teachers' role in their interaction with students, which in turn resulted in pursuing higher levels of academic success.

CONCLUSION

The ongoing evolution of the education landscape requires ensuring equitable access and high-quality educational experiences for a diverse and expanding population. The preferred approach to surmount this challenge is the integration of digital technologies and blended learning (hybrid synchronous learning), which bridges the gap between on-site and remote education models. Such challenge was also stressed by the pandemic emergency which led teachers to adopt new forms of online teaching in order to maintain student engagement.

The study aims to investigate whether synchronous online environments have an impact on students' academic success within the context of academic education, integrating two theoretical frameworks: the Community of Inquiry model, with reference to its interdependent presences of teaching, cognitive and social, and the cognitive engagement framework focused on student's psychological investments and operationalized as cognitive processes of learning such as the applications of deep or shallow strategies during learning activities. To this end, an online self-report questionnaire was administered to 447 students from universities in southern Italy,.in order to test the best predictors of academic success. In general, the supposed associations were partially confirmed, ranging from moderate correlation between teaching presence and social presence, between deep learning strategies and academic achievement, and between teaching presence and both learning strategies. Moreover, academic success was predicted by teaching presence and both learning strategies. This finding is consistent with the outcomes of a study conducted by Zhang and colleagues (2016), where they emphasize the fundamental role of teaching presence: the teacher organizes and monitors online learning activities to help online students generate learning outcomes not only from the study of learning materials, but also from peer collaboration and interaction. Finally, the study showed no significant role of social presence in online synchronous environments.

The study findings highlight the need to reshape teacher roles, student interactions, materials and course design to best suit the specific learning environment and context, as demonstrated in the synchronous setting observed in this study and according to Karaaslan and colleagues (2018). They also provide insightful suggestions that could be implemented while planning and promoting synchronous online-based learning communities and activities that may enhance students' academic accomplishments from a more collaborative and constructivist standpoint.

It is essential to acknowledge two significant limitations of this study, which should be discussed. Firstly, the participants were recruited from universities situated in Southern Italy, where the synchronous online learning modality was adopted. This was achieved through a convenient sampling method, which in turn affects the generalisability of the findings. Secondly, there was a convergence of students towards course degrees in the Humanistic and Educational areas. This may have constrained the variability in students' digital literacy levels and familiarity with information and communication technologies, which are factors that may influence their learning experiences in general and, consequently, their academic achievements and satisfaction. It is recommended that further studies employ probability sampling methods to enhance the generalisability of the current results. This would enable a more comprehensive comparison of students' learning experiences and outcomes across a wider range of course degrees. Additionally, further studies could be designed to compare students' learning experiences and outcomes in face-to-face and synchronous modalities. Furthermore, it would be beneficial to investigate additional factors that may impact student academic performance in synchronous online learning environments, and the overall educational experience as conceptualised by the CoI framework in terms of teaching presence, cognitive presence and social presence. These factors include the physical learning environment (Dinh, 2023), the use of specific technologies – i.e., augmented reality (AR), virtual reality (VR) simulations, etc. – (Parga et al., 2019), and learners' digital literacy (Getenet et al., 2024).

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BEYOND GENRES:
EXPLORING THE RELATIONSHIP BETWEEN GAMER TYPES AND THE FIVE-FACTOR MODEL OF PERSONALITY

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ABSTRACT

This study explored connections between gamer personalities and motivations by examining relationships between personality traits and player types. A sample of 459 Turkish pre-service teachers completed the Gamification User Types Hexad Scale and the Five Factor Model of Personality questionnaire. Results showed Player, Disruptor, and Socializer types were the most common when considering both single and combined player profiles, indicating strong drives for rewards, boundary-testing, and social connections. Openness emerged as the most prevalent personality trait, reflecting curiosity and creativity among participants. Correlation analyses revealed notable alignments between traits and types, including positive relationships between Openness and Philanthropist/Achiever types; Extraversion and Philanthropist/Achiever types; and Conscientiousness and Achievers. These point to imagination, sociability, and achievement orientation underlying some gaming motivations. Conversely, the negative correlation between Conscientiousness and Free Spirits matches this type's carefree quality. While these relationships confirm connected traits and motivations, more research on causality and application is needed. This study sets the groundwork for personalized gamification approaches and underscores complex interplays between personality differences and player tendencies requiring further examination, particularly regarding impacts on motivation.

Keywords: Gamification, personality traits, gamer typology, individualised learning, pearson correlation.

INTRODUCTION

Games are essential concepts for people's learning processes. The activity of playing games is an innate instinct that enables people to recognize and make sense of their environment from a very early age. This instinctive orientation is the basic cornerstone of human learning. Therefore, it is claimed that games are the most effective and efficient source of learning for humans from an early age to adulthood and beyond.

Games can be played in a natural environment through interactions with the environment or the individual's inner self, or in digital environments as a result of developing technology. In both cases, games provide important learning interactions for the individual.

When games are reviewed in the context of learning, they can basically be categorized as traditional games and digital games. Digital games have emerged as a technological innovation that is now firmly embedded in modern culture, substantially influencing social interaction, education, and entertainment. Current projections estimate 2.7 billion video game players globally in 2020 expanding to 3.24 billion in 2021 (Newzoo, 2020; Statista 2021). This growth trend is expected to persist in 2022 and 2023 as well. The

continued proliferation of the gaming industry speaks to its entrenchment as a mainstream staple that shapes many aspects of the contemporary human experience. These data are generally accepted indicators of how important games have become worldwide. However, the personal characteristics and behaviors of gamers are not the same for all individuals/gamers. Players may differ in terms of their motivations, behaviors, preferences, and the time they spend playing games (Hamari & Tuunanen, 2014). The entire digital gaming market and traditional gaming activities used in education aim to increase their effectiveness by focusing on these individual differences. Today, learners who have grown up with technology are demanding learning processes that are easy to use, enable them to think quickly, and include visual and game features (Annetta, Folta, & Klesath 2010; Sezgin, 2020). Two of the main learning approaches used to design learning processes that meet these demands are game-based learning and gamification.

Game-based learning involves planning the learning process through a game (Sezgin et al., 2018). The learning process is experienced as a result of the game's scenarios and interactions. Gamification, on the other hand, is the use of game design elements in non-game contexts to motivate users, engage them in a learning process, and increase their productivity (Kapp, 2012). The main goal in gamification is not teaching, but adapting learners/players to learning. The main theoretical difference between the two approaches is expressed by Bozkurt (2014) as follows: "In a gamified process, you can feel the game design but you cannot see it. However, in game-based processes, you can feel and see the game idea."

Educational digital games, which have become a part of daily life with the developments in the field of gamification (Ferro et al., 2013), are used in various fields to improve learning (Chen, Shih, & Law, 2020) and affect individuals' socialization, entertainment, and learning experiences in many fields from education to health (Bouzidi et al., 2019). Players have different motivations when playing digital games, such as achieving success in the game or socializing (Graham & Gosling, 2013). This highlights the need to consider many aspects such as players' motivations, learning preferences, and personalities in game design (Ferro, Walz, & Greuter, 2013). Studies in the related field emphasize the importance of considering the player types of learners in the process of preparing learning content (Krath, J., & von Korflesch, 2021).

Table 1. Player Types Formed by Different Researchers (Sezgin, 2020)

Bartle (1996)	Park Associate (2006)	Schuurman et al. (2008)	Fullerton (2008)
Achievers	Power gamers	Fanboys	Competitor
Socializers	Social gamers	Competers	Explorer
Explorers	Leisure gamers	The Escapist	Collector
Killers	Dormant gamers	Time Killers	Achiever
	Incidental gamers		Joker
	Occasional gamers		Artist
			Director
			Storyteller
			Performer

Gotzenbrucker & Kohl (2009)	Drachen et al. (2009)	Nacke et al. (2011)	Xu et al. (2012)
Communicative role-players Anarchists	Veterans	Seeker	Achievers
Steady gamers	Solvers	Survivor	Active buddies
Designers	Pacifists	Daredevil	Social experience seekers Team players
	Runners	Mastermind	Freeloaders
		Conqueror	
		Socialiser	
		Achiever	

Ferro et al. (2013)	Tondello et al.(2016)	Vahlo et al. (2017)	Sezgin (2020)
Dominants	Socializers	Mercenary	Completionists
Inquisitives	Free spirits	Companion	Socializers
Creatives	Achievers	Commander	Suicide Squad-Fiends
Objectivists	Philanthropists	Adventurer,	Pathfinders
Humanist	Players	Patterner	Collectors
	Disruptors	Daredevil	Belligerents
		Explorer	Explorers
			Deep-gamers
			Casual gamers

In this current study, Marczewski's (2015) player types Hexad Scale developed by Tondello et al. (2016) was used to determine the participants' player types. Marczewski (2015) classified players according to their intrinsic or extrinsic motivation and determined player types as achievers, players, socializers, philanthropists, disruptors, and free spirits. Players and disruptors have extrinsic motivation while playing games, while other player types have intrinsic motivation to play games. In-game personas belonging to the player types in Marczewski's (2015) classification of player types are briefly as follows.

Marczewski's (2015) Classification of Player Types

Marczewski's (2015) player types Hexad is a user typology model for thinking about different kinds of game players or users. It was developed by Andrzej Marczewski and consists of six player types:
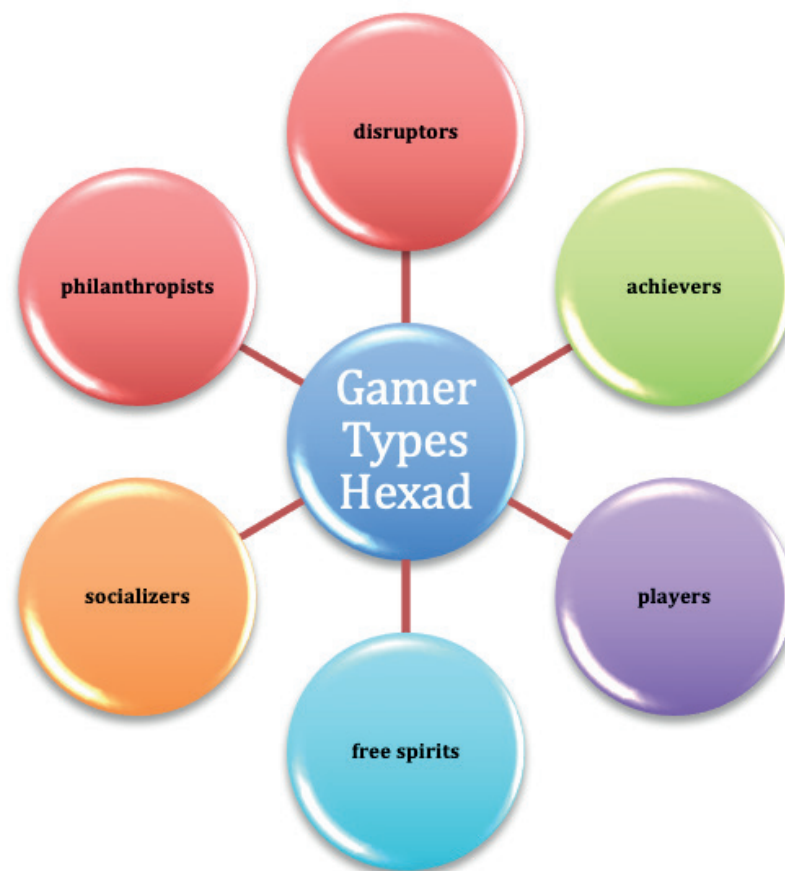
Figure 1. Marczewski's (2015) classification of gamer types

31

To summarise briefly, achievers are focused on winning. They want to acquire knowledge, learn new skills, and improve themselves. They are motivated by mastery. Socializers want to establish social communication with different players and build connections. They are motivated by relatedness. The source of motivation for socializer player types is socializing with other players in a gamified system. Free Spirits want to be independent, explore, and express themselves while playing games. They don't want to be externally controlled in gamified systems; they want to move freely. Philanthropists want to help other players without expecting any reward while playing games. They are motivated by purpose. Disruptors want positive or negative change in the game system by disrupting the system directly or through other players. Players have extrinsic motivation while playing games. They focus on getting rewards and earning badges in the game (Marczewski, 2015; Tondello et al., 2016).

Personality traits are an essential factor that can impact players' motivation to play a game and how they act within the game. Personality refers to distinctive qualities that shape how someone responds across various situations over their lifetime (Haizel et al., 2020). Overall, someone's personality can dictate their motivation for gameplay and their conduct in the game based on stable personality dispositions developed through biological programming or life experiences. This predisposition can also be expressed through cognitive processes caused by genetic or environmental factors. Robert and Mroczek (2008) define personality as relatively permanent traits of thoughts, feelings and behaviors that distinguish individuals from each other. Personality can also be considered as a whole that can change over time.

Personality can be seen as a dynamic construct that transforms over time. Research shows that personality traits are certainly not static, but rather continue to evolve throughout adulthood and later life (Roberts et al., 2017). Given the difficulties of accurately defining personality traits about age, different frameworks have been developed to classify personality traits. As approaches to personality development mature, it becomes imperative that models account for the potential variability of traits across the lifespan rather than relying on fixed assumptions. Describing personality as a holistic system subject to change rather than immutable traits would better reflect the complexity of human individuality. One prominent framework used widely for classifying personality factors is the five-factor model of personality (Costa & McCrae, 1992; Goldberg, 1992). This model suggests that human personality comprises five independent dimensions: openness to experience, neuroticism, agreeableness, extraversion, and conscientiousness. As personality continues to shift in adulthood, the five-factor rubric provides a means for conceptualizing key traits across different life stages.

Traits of the Five-Factor Model of Personality

Openness to Experience

People with high openness to experience as a personality trait are open to new concepts, perspectives, emotions, and encounters (Diener & Lucas, 2019; McCrae & Costa, 1997). Those who exhibit higher levels of openness have a strong curiosity, creativity, originality, and a tendency to defy convention while appreciating diversity. In contrast, individuals with low openness scores are generally less curious, reluctant to break out of their routines, and typically adopt more traditionalist mindsets (Costa & McCrae, 1992; Turhan & Tiftik, 2021). The openness factor indicates one's tendency to seek new horizons rather than remain limited to familiar areas, whether it is physically trying new activities or mentally exploring unfamiliar ideas. Higher levels of openness indicate more innovative thinking and diverse pursuits, while lower levels reveal conformity and narrower forms of behavior.

Neuroticism

Individuals with high levels of the personality trait neuroticism are inclined to more often undergo negative emotions like anxiety, anger, worry, and sadness (Blumer & Doring, 2012 ; McCrae & Costa, 1997). Those exhibiting heightened neuroticism tend to be tense, self-pitying, introverted, pessimistic, and emotionally unstable. Conversely, people on the lower end of neuroticism scores typically present as more composed, relaxed, level-headed, and self-content (Costa & McCrae, 1992; Lounsbury & Gibson, 2009). In essence, neuroticism regulates one's predisposition towards distressing affective states. This factor measures the

likelihood of feeling distressed or unstable rather than calm. Highly neurotic individuals are characterized by sadness, tension, and insecurity, while those with better emotional regulation emerge as calm, cool-headed, and confident.

Agreeableness

Individuals with these personality traits tend to be modest, compliant, friendly, and cooperative (McCrae & Costa, 1997). Agreeable individuals are compassionate, selfless, indulgent, and kind, while individuals with low agreeableness tend to be suspicious, asocial, egocentric, and rude (Blumer & Doring, 2012).

Conscientiousness

People with high levels of conscientiousness exhibit qualities such as organization, discipline, planning, rule adherence, and diligence in their work (Blumer & Doring, 2012; McCrae & Costa, 1997). Individuals scoring lower in conscientiousness are more often disorganized, careless, lacking direction, and acting impulsively on urges rather than considering consequences (Blumer & Doring, 2012; Costa & McCrae, 1992). In essence, this factor captures self-control and responsibility versus sloppiness and reckless spontaneity. While highly conscientious individuals demonstrate orderliness, focus, and hard work ethic, those with less developed conscientiousness tend to lack structured routines, follow-through, or deliberation over their choices.

Extraversion

Extraverted individuals like socializing and talking to others (McCrae & Costa, 1997). People who exhibit more extraversion are generally sociable, energetic, and socially interactive with others. In contrast, those with low extraversion tend to be reserved, quiet, and isolated from others (Blumer & Doring, 2012; Costa & McCrae, 1992). An individual may exhibit primarily one personality type or a mixture of more than one trait dimension. At its core, this factor captures social courage and dynamism as opposed to shyness and apathy. While highly extraverted people seek out the company and lively activities, the less extraverted are withdrawn into solitary spaces and interactions. However, personality consists of gradations across several spectra rather than categorical distinctions, so most exhibit some combination of traits. For example, an individual can be both open to new experiences and extraverted (Ferro et al., 2013).

LITERATURE REVIEW

Previous Research: Studies on Personality Traits, Digital Games and Player Types

In the literature, it is observed that various studies have been conducted on the potential relationship between digital game-playing behaviors and personality traits. These studies include personality traits and gaming behaviors (Graham & Gosling, 2013; Peever, Johson & Gardner, 2012), gaming disorder (Dieris-Hirche, 2020; Muhametjanova et al., 2021), gaming addiction (Muller et al., 2014), motivation and gaming disorder (Carlisle, 2019), online gaming (Charlton & Danforth, 2010; Mentese, 2017), digital game addiction (Kagizmanli, N., 2019; Mehroof & Griffiths, 2010) and game genres (Blocker, Wright & Boot, 2014; Braun et al., 2016; Yildiz, 2019).

Among these studies, Graham and Gosling's (2013) study examined the effect of personality traits on the interactions of those who play the multiplayer online role-playing game World of Warcraft, and concluded that personality traits are significantly effective in those interactions. In Ferro et al.'s study (2013), the findings indicated that behaviors in the virtual world are affected by personality traits.

In another study, Tondello et al. (2016) examined the behaviors of individuals both in the physical and virtual worlds, and according to the findings of the study, it was determined that the personality traits guiding both game behaviors were the same. Again, Haizel et al. (2021) found that the in-game behaviors of gamers who are deeply integrated with the game are likely to stem from their real-life personalities. However, in some studies, it has been stated that individuals, especially in Generation Z, develop a separate personality in the virtual world compared to Generations X and Y, as they grow up intertwined with technology and

spend more time in the virtual world than in the physical world (Dolot, 2018). Similarly, Utar and Yazici Yilmaz (2022) found that Generation Z students have different personality traits in the digital and physical worlds. These studies support the argument that "considering the personality traits of individuals when selecting game elements or designing digital/virtual as well as physical game-centered activities ensures that players are both intrinsically and extrinsically motivated" (Ferro et al., 2013). Because it is thought that game behaviors and personality traits are potentially highly associated.

These studies imply that accounting for players' conduct and personality qualities in digital gaming contexts may constitute a vital learning design consideration for game-based learning and gamification techniques. Numerous investigations with diverse samples have aimed to classify the personality traits and archetypes of video game players (Ferro et al., 2013; Tondello et al., 2016; Utar & Yazici Yilmaz, 2022). Synthesizing key findings across relevant research, certain personality factors and player motivations recur, allowing for generalized frameworks categorizing gamer dispositions and corresponding design tailoring. Essentially, patterns emerge such that understanding user personality and needs enables adaptation of game features to optimize engagement and outcomes. These player-centered insights can meaningfully inform creation of learning games and gamified systems.

Among these studies, Utar and Yazici Yilmaz (2022) examined the relationship between the player types and five-factor personality traits of Generation Z tourism students. These studies reveal connections between player typologies and personality traits. For instance, negative correlations emerged between certain player types and traits among Generation Z students (Utar & Yazici Yilmaz, 2022). Likewise, Ferro et al. (2013) demonstrated associations between personality categories and gamer types. Tondello et al. (2016) validated player classifications while showing five-factor model traits related to user archetypes. In summary, an individual's personality dimensions directly impact their player profile and priorities. Someone dispositionally anxious may favor support roles, while extraverts choose more social designs. These investigations collectively indicate that personality and play styles interrelate, so accounting for user temperament can optimize game-based learning. Matching gaming elements to participant traits may better engage them.

Although there are studies examining the relationship between personality traits and actor types, it is seen that the number of studies in the relevant literature is insufficient. In addition, in the studies conducted in the context of Turkiye, no study deals with player type and personality traits together in the sample of pre-service teachers. For this reason, it is thought that revealing the relationship between players' personality traits and gamification types will contribute to the literature in the contexts of educational game-based learning and gamification of teaching. In this study, it was aimed to examine the relationship between pre-service teachers' player types and five-factor personality traits. Within the scope of this purpose, answers to the following questions were sought:

1. What are the dominant player types of preservice teachers?
2. What are the five factor personality traits of preservice teachers?
3. Is there a significant relationship between preservice teachers' player types and personality traits?

METHODOLOGY

In this study, the dominant gamer/player types and five-factor personality traits of pre-service teachers were investigated. In addition, the relationship between these two variables was examined.

Participants

The sample of this study consists of 459 pre-service teachers studying in various disciplines at a state university in the Mediterranean Region of Turkiye in the Fall 2022 academic term. The study was conducted with pre-service teachers covering all departments to assess measures of personality and player types to assess interrelationships. This university-based sample allows research to be conducted among individuals preparing for future teaching roles. Table 2 summarises the key characteristics of the 459 participants.

Table 2. Characteristics of the Study Group

Gender	Frequency (f)	Percentage (%)
Woman	325	70.8
Man	134	29.2
Sum	459	100

As seen in Table 2, the participants consisted of 325 (70.8%) female and 134 (29.2%) male preservice teachers

Data Collection Tools

A two-part data collection tool was used to collect data online in this study. The first part of the data collection tool includes the Six Gamification Types Scale to determine the player types of preservice teachers. In the second part, the Five Factor Personality Scale was used to determine the personality traits of preservice teachers. Data were obtained from preservice teachers who voluntarily participated in the study during the fall semester of the 2022-2023 academic year.

The Gamification User Types Hexad Scale

"The Gamification User Types Hexad Scale" developed by Marczewski (2015), validated by Tondello et al. (2016), and adapted to Turkish by Akgun and Topal (2018) was used to determine the player types of the participants. The 7-point Likert-type scale consists of 6 factors and 24 items. The factors of the scale are "socializers", "free spirits", "achievers", "philanthropists", "players" and "disruptors". Each factor in the scale consists of 4 items. In their study, Akgun and Topal (2018) calculated Cronbach's Alpha reliability value for the whole scale as 0.89. The reliability coefficient values of the scale factors were found to vary between 0.71 and 0.80

The Five-Factor Model of Personality Test

The Five Factor Model measuring personality includes the dimensions of Openness to Experience, Conscientiousness, Extraversion, Agreeableness, and Neuroticism, abbreviated "OCEAN" (John & Srivasta, 1999). This scale was adapted into Turkish by Unal (2015) and used here to evaluate participant traits. The 44-item tool utilizes a 5-point Likert scale across the five factors representing distinct traits – Extraversion (8 questions), Agreeableness (9 questions), Neuroticism (8 questions), Openness to Experience (10 questions), and Conscientiousness (9 questions). Past analysis by Unal (2015) found sub-dimension Cronbach's alpha reliability scores ranging from 0.62 to 0.87. Mean totals derive from participant responses to corresponding items – Openness to Experience (5, 10, 15, 20, 25, 30, 35R, 40, 41R, 44), Conscientiousness (3, 8R, 13, 18R, 23R, 28, 33, 38, 43R), Extraversion (1, 6R, 11, 16, 21R, 26, 31R, 36), Agreeableness (2R, 7, 12R, 17, 22, 27R, 32, 37R, 42), and Neuroticism (4, 9R, 14, 19, 24R, 29, 34R, 39). Here "R" indicates reverse scoring for scale items.

Data Reliability

To assess the internal consistency of the items measuring the different user types, the Gamification User Types Hexad Scale was subjected to a Cronbach's alpha reliability test. As shown in Table 1, the analysis yielded a Cronbach's alpha coefficient of $\alpha = 0.85$, suggesting a high level of internal consistency among the scale items. In essence, this means that the items within the scale uniformly measure the diversity of user engagement types in gamified systems. In a similar manner, The Five-Factor Model of Personality test was checked for its internal consistency. The computed Cronbach's alpha for this scale was $\alpha = 0.87$, suggesting that the items from the scale measuring the five broad domains of personality have a strong internal consistency, thus validity of the scale in measuring these personality dimensions.

The data were subjected to descriptive statistical analyses and correlation tests. Initial analyses confirmed normal distributions among the variables according to the Kolmogorov-Smirnov test, skewness and kurtosis measures, and stem and leaf plots. Kolmogorov-Smirnov significance levels exceeded 0.05, while skewness and kurtosis remained between -2 and +2, confirming normality for the dataset (n=459). The fulfilment of normality assumptions forms the basis for meaningful parametric tests. Accordingly, the subsequent investigation of the personality and player type measures included correlational methods to show central tendencies that reflect overall trends and relationships between the dimensions.

Descriptive statistics were used to determine the dominant gamification/gamer types and personality traits of the participants. Dominant gamification types were determined to be the trait with the highest score. Participants who received the same score for more than one trait were considered to be equally dominant in these traits. In addition, the frequency of each dominant personality trait was calculated. This was done to determine which personality trait was most common among the participants. Pearson correlation tested connections between personality traits and player types given meeting parametric assumptions. Pearson correlations quantify linear relationships' directionality and magnitude between continuous variables (Tabachnick & Fidell, 2015). Applying this method here reveals pairwise alignments across the five personality dimensions represented on the 44-item scale and user archetypes based on gaming motivations. The resulting correlation matrix indicates any personality factor's positive or negative prediction of a particular player typology using Pearson r values from -1 to +1. Values nearing ±1 denote strong relationships, while values approaching 0 reflect weak or negligible relationships. The correlation coefficients obtained (minus or plus) indicate the direction of the potential relationship, while the absolute value indicates the strength of the relationship.

FINDINGS

This study investigated six different types of gamers (Philanthropist, Socializer, Free Spirit, Achievers, Disruptors, Players), personality traits (Openness to Experience, Conscientiousness, Extraversion, Agreeableness, Neuroticism), and the relationship between these two variables in a sample of pre-service teachers studying at the undergraduate level. In this section, research findings are presented under three headings in line with the research questions.

Findings on Player Types

Within the scope of the first research question, the dominant player/ gamer types of the participants (n=459) were examined. While some participants displayed a clearly defined player type, others exhibited hybrid profiles with multiple motivations. Among those showing one dominant gamer/player type, achievers (n=87), disruptors (n=80), and socializers (n=69) emerged as most prevalent, together comprising almost two-thirds of the sample. These types were followed by achievers, philanthropists and free spirits.

Table 3. Characteristics of the Study Group

Dominant Gamer Types	Count
Player	87
Disruptor	80
Socializer	69
Achiever	49
Philanthropist	47
FreeSpirit	22
Socializer, Achiever	18
Disruptor, Player	13
Philanthropist, Socializer, Free Spirit, Achiever, Disruptor, Player	9
Philanthropist, Socializer	8
Philanthropist, Socializer, Achiever	5
Philanthropist, Achiever	5
FreeSpirit, Achiever	4
Philantropist, Disruptor	4
Socializer, Achiever, Disruptor, Player	4
Socializer, Disruptor, Player	4
Socializer, Achiever, Disruptor	3
Philanthropist, Player	3
Socializer, FreeSpirit, Achiever	3
FreeSpirit, Player	3
Socializer, FreeSpirit	3
FreeSpirit, Disruptor, Player	2
Socializer, Disruptor	2
Philanthropist, Socializer, Achiever, Disruptor	2
Achiever, Disruptor	2
Socializer, Player	2
Philanthropist, FreeSpirit, Achiever, Disruptor	1
Philanthropist, Socializer, Achiever, Disruptor, Player	1
Achiever, Disruptor, Player	1
Socializer, FreeSpirit, Player	1
Socializer, Achiever, Player	1
Philanthropist, Achiever, Player	1

As mentioned above, some players may have more than one dominant player type. When the combined player profiles with more than one player type are examined, it is seen that 18 of the participants have both the "Socializer" and the "Achievers" type. These two types together are more common than others. Some player combinations are very rare. For example, there is only 1 person with the combination "Philanthropist, Socializer, Achievers, Disruptor, Player". The most complex combination of gamer types is "Philanthropist, Socializer, Free Spirited, Achievers, Disruptors, Gamers" which has 6 different types and there are 9 people with this combination. This shows that players can sometimes have more than one motivation, and these motivations can combine to form complex player profiles. Disruptor and Player types are also often seen together. This suggests that more competitive and active gaming styles may coexist. What is noteworthy in this table is that, contrary to expectations (reference), 354 out of 459 participants (77.12%) were of a single dominant player type.

Table 4. **Table 4.** The Most Common Player Types When Considering Combined Player Types

Dominant Gamer Types	Count
Socializer	134
Player	129
Disruptor	126
Achiever	95
Philanthropist	85
FreeSpirit	41

When the combined player types and single dominant player types are examined together, the most common player types identified are socializer, player, and disruptor player types as seen in Table 4. The least observed player type is free spirit. It is also observed that the socializer player type, which ranks 3rd among the dominant player profiles in Table 3, ranks 1st in Table 4 in the overall distribution. When these findings are evaluated together with Table 3, it is evident that the need for socialization is the most influential component of the participants' motivation to play.

Findings on Personality Traits

However, people often display multiple personality traits rather than just one dominant quality, similar to having blended gaming motivations. An individual's "leading" trait simply supersedes other aspects in their profile, which still hold some influence. In other words, even someone high in conscientiousness shows some degree of other attributes, just to a lesser extent. For instance, an exceptionally extraverted person likely possesses some neurotic and agreeable dimensions as well, despite extraversion serving as their defining trait overall. So subjects here exhibit a primary personality orientation amid a composite of qualities integrated in variable degrees. One factor may predominate but secondary traits contribute to multidimensional profiles rather than singular categories.

Table 5. Characteristics of the Study Group

Dominant Trait(s)	Count
Openness	183
Conscientiousness	102
Agreeableness	81
Neuroticism	51
Extraversion	22
Conscientiousness, Agreeableness	7
Openness, Conscientiousness, Extraversion, Agreeableness, Neuroticism	6
Extraversion, Neuroticism	2
Openness, Extraversion	2
Agreeableness, Neuroticism	1
Conscientiousness, Extraversion	1
Openness, Extraversion, Agreeableness	1

These results show that "Openness to experience" is the most common dominant personality trait among the participants. For about one-third of the sample, the Openness to experience personality trait is prominent. This indicates that creative and curious individuals who are open to new experiences and ideas are quite common in the sample. The second most common personality trait in the sample is "conscientiousness". This demonstrates that organized, responsible, and self-disciplined individuals are common among pre-service teachers. On the other hand, "Extraversion" is the least common personality trait. In very few participants (n=6), 5 personality traits were dominant at the same time. This is a very rare and complex personality profile. In general, the prominence of Openness may indicate the creative and curious nature of the sample of this study. Other combined personality traits are rarer and are usually represented by 1 or 2 individuals in the sample.

Table 6. The Most Common Personality Types When Combined Player Types Are Considered

Dominant Gamer Types	Count
Openness	192
Conscientiousness	116
Agreeableness	96
Neuroticism	60
Extraversion	34

When participants who exhibited more than one personality trait were evaluated together with those who exhibited a single trait, "openness to experience" (n=192), "conscientiousness" (n=116), and "agreeableness" (n=96) emerged as the most common personality traits. On the other hand, in both single and multiple-trait groups, "extraversion" stood out as the least common personality trait among the participants. Thus, openness, conscientiousness, and agreeableness are quite dominant in the sample, while extraversion is less common.

The Relationship between Participants' Personality Traits and Player Types

The results of the Pearson correlation analysis to examine the potential relationship between dominant personality traits and dominant player types among the participants (n=459) are presented in Table 7.

Table 7. Pearson Correlation Coefficients Between Participants' Dominant Personality Traits and Dominant Player Types

	Philanthropist	Socializer	Free Spirit	Achiever	Disruptor	Player
Openness	0.534	0.475	0.244	0.481	0.320	0.365
Conscientiousness	0.255	0.248	−0.253	0.338	−0.187	0.089
Extraversion	0.510	0.320	−0.147	0.438	0.060	0.090
Agreeableness	0.101	0.128	0.160	0.105	0.200	0.398
Neuroticism	0.279	0.147	0.166	0.162	0.410	0.304

Correlations significant at 0.01 level of significance

Philanthropist

When the relationship between philanthropist player type and personality traits is examined, it is found that this player type exhibits moderate positive relationships with openness to experience and extraversion and low positive relationships with conscientiousness and neuroticism. The moderate relationship with openness to experience can be explained by the fact that philanthropists are open to innovations and different experiences. The relationship with extraversion is also in line with the social and energetic nature of this player type. The low correlation with the personality trait of agreeableness can be interpreted as individuals of this gamer type are not very committed to certain rules and regulations. The low positive correlation with neuroticism may also reflect their tendency to experience emotional ups and downs. As a result, the personality structure of the philanthropist player type suggests an innovative, social, emotional and more or less rule-less profile.

Socializer

The socializer player type has moderate correlations with the traits of openness, conscientiousness, extraversion, agreeableness, and neuroticism. It has higher correlations especially with openness to experience and extraversion. Since individuals with high openness to experience personality traits are curious, creative, and diversity-seeking, socializers can be expected to exhibit similar characteristics. Likewise, extraverted

individuals who like to be socialized overlap with the socializer player type who values social interaction. The moderate level of agreeableness can also be explained by the socializers' harmonious and friendly nature within the group. The relationship with neuroticism may indicate that this player type may experience emotional ups and downs. The lower correlation with the trait of responsibility may indicate that socializers have a more flexible structure that attaches less importance to rules and discipline. In summary, the personality traits profile of the socializer player type is consistent with their group-oriented, social, emotional, and curious nature.

Free Spirit

Individuals with high openness to experience are curious and diversity-seeking, which coincides with free spirits being in search of discovery and adventure. Also, the extraversion relationship may reflect their sociable side to some extent. However, the negative association with conscientiousness is compatible with the more free and independent nature of free spirits, who do not attach much importance to rules and discipline. The relationship with agreeableness may also indicate the importance they attach to their autonomy. To summarise this information, it can be stated that the personality trait profile of the free-spirited player type reflects a characteristic profile of a free-spirited person who is seeking adventure and discovery and who is free from rules and responsibilities.

Achiever

When the relationship between the achiever player type and different personality traits was analyzed, it was determined that this player type has a high-level relationship with openness to experience and a medium-level relationship with conscientiousness, extraversion, and neuroticism. Individuals with high openness to experience are curious and open to innovations. This coincides with the structure of achiever individuals who seek new challenges and like to explore, and the relationship with conscientiousness personality type matches with their motivated structure towards achieving certain goals. In addition, the extraversion relationship may reflect their ability to interact with the group. Also, the moderate level of correlation between achiever player type and neuroticism personality trait may be a result of the stress they may experience related to their desire to achieve. In general, the personality traits profile of the achiever is consistent with a competitive structure that is open to innovation and exploration and focused on achieving specific goals.

Disruptor

When the relationship between the disruptor player type and the personality traits was analyzed, it was observed that this player type exhibited a low correlation with openness to experience, conscientiousness, and agreeableness, and a medium correlation with neuroticism. The low relationship with openness to experience may indicate that disruptors are only partially open to new experiences and ideas, and the low relationship with conscientiousness may indicate that they do not attach importance to rules and order at a partial level. The weak correlation with the agreeableness personality trait reflects the idea that such players do not tend to make efforts to get along with others. Furthermore, the moderate correlation with neuroticism may reflect the tendency of disruptors to experience negative emotional states such as stress, anxiety and anger. In summary, the personality traits profile of disruptors seems to be consistent with a structure that is indecisive about following rules, may not behave harmoniously, and experiences emotional ups and downs.

Player

A weak correlation was found between the "player" type and the personality trait of openness to experience. This suggests that "players" are generally not very open to new experiences and concepts. The low to moderate correlation with neuroticism and the moderate correlation with conscientiousness suggest that "players" may experience emotional imbalance and at the same time often adhere to structures and schedules. In sum, "players" seem to resist unfamiliar experiences and aim to follow regular schedules, although they may be troubled by emotional mood.

Pearson correlation analysis was performed to examine the relationships between the personality traits of the participants and player types. The results in Table 7 show that there are mostly moderate (0.3-0.5) statistically significant correlations between player types and personality traits at the 0.01 level. The strongest links are between openness to experience and extraversion for philanthropists; openness to experience and extraversion for achievers; and openness to experience and extraversion for achievers player types. This suggests that there are consistent relationships between specific player types and traits. However, correlation analysis only shows the relationship between variables. In other words, a high level of correlation between a player type and a personality trait does not mean that one is the cause of the other; it only indicates a potential relationship.

DISCUSSIONS AND CONCLUSION

Personality Traits

This study aimed to determine the dominant personality traits, dominant player types and personality traits-player types relationships of the participants. When the research findings related to dominant personality traits were analysed, it was found that openness to experience was the most dominant personality trait. This result suggests that the participants consisting of pre-service teachers are open to new experiences and ideas. In addition, it was found that conscientiousness, agreeableness, and neuroticism personality traits followed openness to experience in frequency. However, extraversion personality trait was found to be the least common personality trait among the participants. According to this finding, extraverted personality trait is the least common trait among the pre-service teachers participating in the study. Individuals with high extraverted personality traits are more sociable and interactive than individuals with low extraverted personality traits. However, in this study, this trait was found to be less common among pre-service teachers. This indicates that pre-service teachers are generally more reserved, introverted and prefer to remain silent. From the perspective of teaching profession, this result is remarkable considering that being extraverted is an important characteristic for effective communication with students.

Previous studies on personality traits have revealed different findings. In a study conducted by Erol et al. (2021) on pre-service teachers, it was found that the most common trait was agreeableness, followed by openness, conscientiousness, and extraversion. Neuroticism was found to be the least common personality trait. A separate study conducted by Yigit and Seferoglu (2019) on university students revealed a similar result. Agreeableness was again the most common personality trait, followed by openness, conscientiousness, extraversion and finally neuroticism. Thus, both studies identified agreeableness as the primary trait and neuroticism as the least exhibited trait in their samples. This suggests that there is a consistency in the personality traits of agreeableness and neuroticism, especially among higher education student populations.

In the study conducted by Utar and Yazici Yilmaz (2022), the research sample consisted of tourism faculty students and it was observed that conscientiousness was the most dominant personality trait. Extraversion, agreeableness and neuroticism personality traits were found to follow responsibility personality trait respectively. In addition, it was concluded that openness to experience was the least common personality trait. A separate study conducted by Bolek and Coskun Senturk (2024) on music teacher candidates, it was found that the most common personality trait was openness, followed by agreeableness, conscientiousness, extraversion and neuroticism.

These similarities or differences reflect the potential of different sample groups to influence the research results.

Player/Gamer Types

Analysis of player/gamer types in this sample reveals several prevalent categories. When examining participants with a single dominant gaming style, the Player, Disruptor, and Socializer types emerge as most common. The Player style, exhibited by 87 participants, points to motivation fueled by action, excitement, and reward-seeking. The Disruptor style, seen in 80 participants, indicates a drive for testing boundaries and causing mischief. And the Socializer style, present in 69 participants, shows a priority on connecting with

others. Achievers, Philanthropists, and Freespirits were less common as singular dominant gaming types in this sample. However, when accounting for both single types and combined types, the Socializer, Player, and Disruptor still make up the majority. This demonstrates that rewards, disruption, and social connections shape gaming motivations for much of this population, whether as a primary standalone drive or in tandem with other motivations.

The results of this study offer an interesting perspective when compared to findings from previous research. Firstly, Tondello et al.'s (2019) study among adults and Santos et al.'s (2021) study among almost all age groups starting from 10 years old confirmed that Philanthropist, Free Spirit, and Achiever are the most common gamification user types. In addition to these studies, the study conducted by Lopez and Tucker (2019) on university students revealed that Free Spirit, Philanthropist, and Achiever are the most common user types. Again, Senocak et al. (2019) conducted a study on adult learners in a distance education system and found that Philanthropist, Free Spirit and Achiever user types are the most common user types in the gamification process. In summary, it shows that these three player types are dominant in the general adult learner population and confirms the findings of this study.

On the other hand, there are also studies with different findings. In the study of Utar and Yazici Yilmaz (2022), it was determined that Disruptor, Player, and Free Spirit player types were the most dominant player types among tourism students. In the study conducted by Tondello et al. (2019) among adult learners (>18), it was found that player types varied depending on age and gender variables. These two variables are the only two parameters that can be seen in different samples. Therefore, if player types as individual differences are to be used in an instructional design, the structure of the sample should be evaluated together with previous similar samples. On the other hand, Marczewski (2020) showed that the philanthropist player type was the most common player type. Likewise, this finding is in parallel with the findings of the present study.

The above research shows that similar results on the distribution of gamification user types have been obtained in different studies, while some studies have produced slightly different but parallel results. The reason for these differences can be seen as the nature of the sample (age group, gender, socio-economic level, occupation, etc.). Therefore, it seems important for researchers and designers who want to develop personalized processes in the context of gamification design to conduct further research to better understand the reasons underlying these different results. In particular, in addition to the scales in which users indicate their game behaviors, in-depth analyses such as observation of players' actual behaviors in the game environment can be said to be necessary for the individualization of gamification.

Relationship between Personality Traits and Player/Gamer Types

There are a limited number of studies examining the relationship between personality traits and player types. Firstly, Utar, Yazici, and Yilmaz (2022) examined the relationships between different player types and personality traits. The findings show that there are positive and negative relationships between some player types and certain personality traits. For example, achieving and agreeable personality traits show a positive relationship with certain player types, while extraverted and helpful personality traits show a negative relationship.

In Tondello et al.'s (2016) study, only certain relationships between player types and personality traits were emphasized and some of the relationships were not statistically significant. In particular, no significant relationship was found between player types and extraversion and conscientiousness personality traits. The results from these studies highlight the complex links between game/player types and personality traits and suggest that additional variables (game type, age, gender, or other demographic factors, etc.) may influence these relationships. Therefore, further research is needed to gain a more robust understanding of how these variables interact.

Analyses of correlations between personality traits and player types reveal noteworthy relationships that contribute to explaining motivations and tendencies in this present study. The Pearson correlation analysis revealed several notable relationships between personality traits and player types. Moderate to high positive correlations emerged between Openness and the Philanthropist, Socializer, Free Spirit, Achiever, and Player types, suggesting these types are more common among creative, imaginative people open to experiences.

Additionally, positive correlations were found between Extraversion and the Philanthropist, Achiever, and Disruptor types, indicating these types are associated more with highly sociable, sensation-seeking individuals. Conscientiousness only correlated positively with Achievers, aligning with their achievement drive. Neuroticism correlated with Disruptors and Players, reflecting impulsive tendencies. The strongest correlations were between Openness and Philanthropist; Openness and Achiever, and Extraversion and Achiever, underscoring imagination, curiosity, and sociability as key Achiever motivations.

Furthermore, these correlations shed light on how innate personality differences may shape gaming motivations and styles. For instance, the Player type's association with Agreeableness and Neuroticism points to collaborative and competitive aspects in these players. The relationships between the Philanthropist type and Openness, Conscientiousness, Extraversion, and Neuroticism suggest drives around purpose, meaning and social connections. Overall, personality traits appear to relate to and possibly influence player type formation and gaming approaches. Unpacking these relationships offers insight into the psychological forces underlying different player motivations and preferences. These correlations

This research has shed light on the connections between gamer personalities and motivations by looking at how personality traits relate to player types. It found some of the most common player types are Philanthropists, Achievers, and Free Spirits. However, the prevalence of certain types can shift across different studies. Additionally, complex relationships seem to exist between personality factors and player tendencies. For example, those exhibiting a Philanthropist play style typically display qualities of open-mindedness, organization, sociability, and some anxiety. In contrast, Player-type gamers tend to show traits of cooperation and nervousness. These interplays between personalities and gaming motivations can significantly impact game design elements, user engagement, and marketing plans that tap into gamer psychographics. Also, these relationships could be impactful across areas like game design, user experience, and marketing strategies.

In addition to outlining notable correlations between certain gamer types and personality qualities, suggesting some player profiles relate more broadly to personality factors, this study also highlights a lack of significant correlations for other types. This implies personality may play a less integral role among these gamer types. For instance, the negative association between Free Spirits and Conscientiousness aligns with this player type's carefree nature. However, fully grasping the impact of personality traits in shaping player tendencies requires further investigation. Examining the precise interplays between personality markers, player preferences, and gaming approaches is key for effective gamification design and application. In essence, by uncovering these overlays between personalities and player profiles, this research provides useful insights for customizing game mechanics, experiences, and outreach to resonate better with target groups.

Moreover, emerging research interests involve leveraging player-type models to personalize gamified systems and boost individual motivation and performance. Many current gamified platforms presume users constitute a homogeneous block, responding uniformly to game components. However, studies indicate reactions to gamification differ based on individual differences. Elements motivating one user may not affect another similarly. Due to such limitations of existing platforms, researchers are now exploring how diverse player types perceive and interact with gamified systems. However, consensus persists around the need for more empirical inquiries given the narrow understanding of player-type models and their potential for advancing gamification. Most current studies have focused on correlations between player types and individual perceptions of game features without exposing them to these features in a practical application or analyzing their performance in a platform implementing those elements. In essence, while this research has revealed some initial interplays between personality traits and player profiles, designing truly personalized, optimized gamification systems will require a much deeper investigation into these relationships as well as application in real-world contexts.

However, more work is still required for these relationships to be better understood.

Specific areas needing additional focus include:

- Sample sizes should be assessed for adequacy and representativeness, with studies replicated on larger samples
- More research is required on causality - whether personality determines player type or vice versa remains unknown

- Individual differences in player type combinations and preferences suggest personalized gamification strategies may be impactful
- Interactions between player types, personalities, and gamification experiences warrant additional empirical research to determine impacts on motivation and performance

In a nutshell, this research makes important contributions to gamification studies and lays a foundation for additional research. Increased insight into gamification users' personality traits and player motivations can inform more successful game and user experience design methodologies. However, the complex links between these factors reveal the need for ongoing research to develop a more precise conceptualization of how they are interrelated. While these findings contribute to the emerging understanding of the gamification field, additional research in a variety of contexts will be a complementary element of using this knowledge for better practical application development.

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DEVELOPMENT OF STEAM-BASED E-MODULES ON HUMAN CIRCULATORY TOPICS CONTAINING CRITICAL REASONING AND INDEPENDENT CHARACTERS

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ABSTRACT

This research aims to develop a STEAM-based e-module containing critical and independent reasoning characters. The method used in this study is Research and Development (R&D). The validation of e-modules is assessed based on three aspects, including aspects of content, construction, and language. The experts who validated each aspect consisted of four experts: three lecturers and one fifth-grade teacher. The practicality test was carried out at Supriyadi Elementary School Semarang Indonesia on 15 students and five teachers. The results of Prisma e-module validation based on content aspects were declared "valid" with a V Aiken value of 0.9615, it is declared "valid" with a value of V Aiken 0.9469 in constructed aspect, and the language aspect is declared "valid" with a value of V Aiken 0.9219. Overall, aspects of Prisma's e-module were declared "valid" with an Aiken V value of 0.942. Prisma's e-module received a practicality test score of 86% from students and 96% from educators. It can be concluded that Prisma's e-module is declared "feasible" and "practical" for use in the learning process. Further research can develop e-modules that can be accessed not only in the Android program but also accessible in the iOS program.

INTRODUCTION

Massive technological developments require educational institutions to make updates to stay current with the development of the times (Graesser et al., 2020). The acceleration of technology has also led to a shift in new pedagogical models, methods, and strategies of education(Glaze-Crampes, 2020). The shift was driven by the growing disparity between the instruction provided in schools and the needs and interests of learners (Chen et al., 2019). According to Ozdemir & Hekim (2018), Technology devices are an appropriate resource for educational programs. It implies that educators must innovate (Chang et al., 2014). As a manifestation of this innovation, educators need to overhaul conservative learning tools to digital (Hasanudin et al., 2021).

The development of digital devices for the learning process must be adjusted to the competency needs that students must have in the era of Society 5.0 (Romadhianti et al., 2021). Society 5.0 represents a paradigm shift towards an advanced integration of digital technologies with societal needs (Utaminingsih, Ellianawati, Widiarti, et al., 2023), aiming to harmonize economic progress by resolving social challenges through a human-centric approach (Sa et al., 2021). In the context of education, Society 5.0 necessitates a transformative approach that integrates advanced digital technologies into the learning environment,

promoting personalized to equip individuals with the skills and competencies essential for thriving in an inclusive and sustainable future society (Hikmat, 2021).

In response to the need to be helpful in an ever-increasing world of technology, education researchers are considering integrating technology into classrooms (Matsuura & Nakamura, 2021). One of the ways through STEAM (Science, Technology, Engineering, Art, and Mathematics) is a learning technology approach that leads to excellent types of innovation (Perignat & Katz-Buonincontro, 2019). STEAM is the global interest of academics in the worldwide order (Shih-Yun et al., 2022). Referring to these findings, the development of STEAM-based digital devices is considered a solution to challenges in the era of globalization (Kant et al., 2017).

The development of digital learning tools must be adjusted to actual conditions in the field (Ardianti & Wanabuliandari, 2021). It is so that the innovations carried out are appropriate (Hamid et al., 2020). The results of interviews with teachers and students at Supriyadi Elementary School Semarang found that there has been no significant innovation where teachers have not maximized the use of technology for the learning process. The International Society for Technology in Education (ISTE) calls on educational institutions to adapt to the current technological developments (An, 2020) and support the use of digital devices as a means to promote deeper learning by involving learners in the creation of creative technologies (Quigley et al., 2020). Of course, this indicates a gap between the educational process and the demands of learning in the era of globalization. Another problem found is that fifth-grade students have not fully mastered human circulatory material. Students say the material needs to be more challenging to understand. The teacher said that this material is quite complex; besides, there are many foreign terms, so students have not mastered the material thoroughly. In line with these findings, (Utaminingsih, Raharjo, et al., 2023) said that human circulatory material is challenging material for grade V elementary school students to master because the circulatory process material presented requires abstract abilities to understand it.

Elementary school students are in a concrete stage of development, so cognitively, it is still challenging to translate material that requires abstract ideas (Santrock, 2019). They need devices capable of translating abstract ideas into concrete through learning tools (Lu et al., 2022). STEAM is a technology option that can visualize abstract texts and ideas into concrete/tangible forms (Utaminingsih, Ellianawati, Sumartiningsih, et al., 2023). Factual material for students is presented through videos and digital drawings/sketches in digital learning devices (e-modules) (Herro et al., 2018). The STEAM approach provides an engaging learning experience and increases learners' curiosity to explore science more actively (Bilgiler et al., 2020). Various advantages of STEAM include transforming teaching concepts and models based on new technology (Chung et al., 2022) and playing an essential role in improving students' science and technology levels (Chen et al., 2019).

During the interview, the teacher also mentioned that the student's character, critical reasoning, and independence needed improvement. Critical reasoning and independence are two of the six characters in the Pancasila Student Profile (from now on referred to as the Pancasila student character). Pancasila Student Character is a program the government intensifies to build a better national character (Radja et al., 2022). The character of Pancasila students is designed to answer the competencies that the Indonesian education system wants to produce (Kurniawaty et al., 2022), namely the competence to become a democratic Indonesian citizen and a superior, productive human being (Ministry of Education and Culture and Technology, 2022) and character in the era of the 21st century (Utaminingsih, 2023). Implementing this character does not stand alone but merges with learning by incorporating character values (Ernawati et al., 2018).

Critical reasoning guides students to conduct specific and systematic analyses related to problems objectively (Rumtini et al., 2022), carefully distinguish problems, and identify information to plan problem-solving strategies (Badridduja et al., 2022). Reasoning skills are essential for learners to translate the given learning material (Ellianawati et al., 2021). Critical reasoning skills become crucial to teach, instill, grow, and improve (Slam, 2021) So that students can face various problems that occur around them well, skillfully, and critically (Ernawati & Rahmawati, 2022). However, the character of critical reasoning has yet to be optimally developed in the learning process in elementary school (Kibtiyah, 2022).

Independent character directs students to become learners who can understand themselves and the situation at hand as well as the ability to self-regulate (Utaminingsih & Puspita, 2023), which can regulate

thoughts, feelings (Kahf, 2022), and behaviour to achieve their learning and development goals both in the academic and non-academic fields (Ministry of Education and Culture and Technology, 2022). Through the dimensions in the character of Pancasila learners, students are expected to participate in sustainable global development (Jamaludin et al., 2022) and be resilient in various challenges (Sulistiawati et al., 2023). The hope is that the concept answers the challenges of the Indonesian nation in the 21st century in facing the Industrial Revolution 5.0 (Herro et al., 2018) so that the content in the character of Pancasila students is relevant if integrated with e-modules.

Based on the above problems, the solution to overcome these problems is to develop a STEAM-based e-module with human circulatory material that contains critical and independent reasoning characters. The STEAM approach is the right step to choose because STEAM is a bridge between different disciplines (Milara et al., 2020), which offers opportunities for learners to capture various fields of science by learning through pieces of phenomena incorporated into one discipline (Wu et al., 2022). Thus, the character of critical and independent reasoning can be integrated into the topic of human blood circulation.

RESEARCH QUESTIONS

This research aims to develop a STEAM-based e-module on human blood circulation with character, critical reasoning, and independence. The study provided answers to questions such as:

1. What are the characteristics of STEAM-based e-modules on human blood circulation with critical and independent reasoning characters?
2. What is the feasibility of validating STEAM-based e-modules on human circulatory topics containing critical and independent reasoning characters?
3. What is the level of practicality of STEAM-based e-modules on human circulatory topics containing critical and independent reasoning characters?

LITERATURE REVIEW

STEAM

STEAM is conceptualized as a transdisciplinary learning approach (Bertrand & Namukasa, 2020), which refers to the method in which the problem to be solved arises naturally from the questions asked (Choi & Behm-Morawitz, 2017). As a fundamental component in STEAM education, this approach functions to: 1) motivate students in selecting relevant actual problems to be solved, as explained by How & Hung, 2019), and 2) provide various technology options that enable active participation of students through videos, digital images/sketches, visual tools, and collaboration in the context of developing creative solutions to existing problems (Herro et al., 2018). The implementation of STEAM education in the classroom provides an opportunity for learners to understand the importance of the integration of various disciplines and their applications (Tan & Lee, 2022).

Wu et al. (2022) illustrate three approaches that can be used in STEAM education (Silo, Embedded, and Integration). In an embedded disciplinary approach, domain knowledge from at least one discipline is placed in the context of another (Kant et al., 2017). According to Ozkan & Topsakal (2021), applying the STEAM approach is embedded in subjects by choosing one discipline as the parent of several other disciplines (Jesionkowska et al., 2020). Integration with this research on material about human blood circulation, integrated ICT lessons (technological literacy), mathematics (numeracy literacy), cultural arts lessons (art literacy) (Glaze-Crampes, 2020), and there is a content of Pancasila student character in the dimension of critical reasoning (Utaminingsih, Ihsandi, et al., 2023). Essential elements of reasoning are contained in the material, such as efforts to prevent diseases of the lungs, how the heart works, and how to keep the heart healthy. In addition, it is also contained through the navigation process in using the product to be developed and through the evaluation provided (Al-Mutawah et al., 2021). Independent character will automatically be embedded because STEAM is an approach that trains students to be independent (Lin & Tsai, 2021).

Human Circulatory

Human circulatory material is guided by Basic Competence 3.4, which explains circulatory organs and their functions in humans and how to maintain the health of human circulatory organs, and Basic Competence 4.4, which presents works on circulatory organs in humans. Based on research conducted by Sasmito (2022), learners need help understanding the circulatory organs that are interconnected with each other. This is due to the inability of students to reconstruct circulatory system material involving oxygen, the function of the lungs, the number of blood vessels, and the circulatory cycle (Ulfa et al., 2021). Material with high complexity, many organs involved, and a continuous process causes students to need help understanding the material (Sihaloho et al., 2022). It can trigger obstacles in receiving and integrating student knowledge (Nugraha et al., 2020).

Critically Reasoned Character

The third menu in the comments is the character of critical reasoning. Critical reasoning is one dimension of the character of Pancasila students. Students must have a critical reasoning character to build a better national character (Irawati et al., 2022) and to create superior and quality Human Resources (HR). This is contained in the Regulation of the Minister of Education and Culture (Permendikbud) Number 22 of 2020 to create superior human resources and character by determining 6 (six) character dimensions in the Pancasila Student Profile. Indicators of achieving the critical reasoning dimension are poured into 3 (three) elements of critical reasoning: obtaining and processing information and ideas, analyzing and evaluating reasoning, and reflecting thoughts and thinking processes in decision-making. Students are expected to be able to master every element of the critical reasoning dimension so that they can objectively process information both qualitatively and quantitatively, build relationships between various information, analyze data, and evaluate and conclude it.

Independent Character

Efforts to build a superior and quality national character, in addition to critical reasoning character, can also be realized through independent character. Elements of the independent dimension are self-understanding of self and the situation at hand and self-regulation. Students with excellent self-understanding can set self-development goals to their conditions (Kamal & Rochmiyati, 2022). They know of the situation (Jamaludin et al., 2022) and can choose proper strategies for anticipating challenges and obstacles (Uktolseja et al., 2022).

METHOD

The study employed the Research and Development (R&D) methodology (Schwartz et al., 2016). The study was designed with the development of the design-based ADDIE model as its foundational design framework to address the research objectives systematically. According to Gagne et al. (2005), the ADDIE model, which stands for Analysis, Design, Development, Implementation, and Evaluation, facilitated a structured and iterative approach, ensuring a comprehensive exploration of the subject matter. The ADDIE approach enabled the researchers to thoroughly analyze the needs, design the intervention precisely, develop the prototype with attention to detail, implement it in a controlled environment, and meticulously evaluate the outcomes to derive insightful conclusions (Yu et al., 2021). The flowchart design in the study is presented in Figure 1.
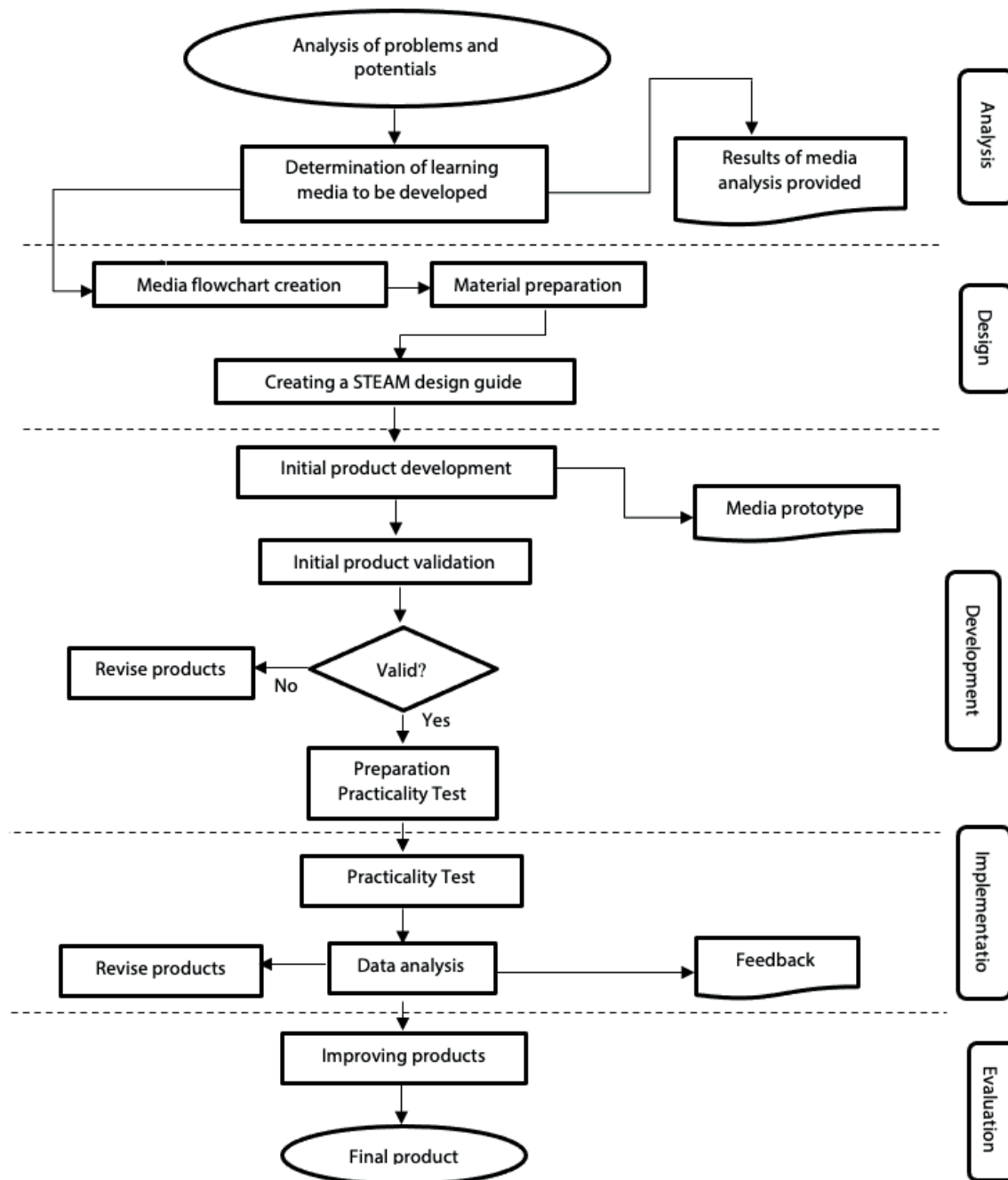
Figure 1. Research Design

ADDIE Research Model

Stage I: Analysis

This stage is an activity to examine or find information related to information sources or data sources and library sources that have relevance to theoretical research. Theoretically, the study is carried out through interviews with educators and students. The information obtained is then summarized and analyzed descriptively to find solutions to get products that suit the needs of students. The interview results found that the material classified as difficult to master by grade V students of Surpiyadi Elementary School Semarang was human circulatory material. Another problem was the character of Pancasila students, the dimension of critical reasoning and independence, still needs to be guided. The next step, a literature review, was carried out to examine solutions that can overcome these problems. Difficulties in the material can be overcome

by visual display, so an e-module that can accommodate visual display was chosen, transforming abstract information into concrete. The development of these e-modules can be inserted with content that can train the science literacy and character of Pancasila students. Through the e-modules that will be developed, the learning process is made as if playing so that it will attract the interest of students and make the learning process feel fun.

Stage II: Design

This stage includes the preparation of the initial design of the practice of STEAM-based e-modules and research procedures for product feasibility tests. Identify the subject matter to be developed by collecting supporting materials and images to obtain a high-quality product draft. Furthermore, the development of e-module products that contain critical and independent reasoning characters. A collection of articles and books relevant to the topic to be developed was obtained from several databases. Material creation begins using PowerPoint software. Furthermore, for the evaluation questions, use the iSpring Suite 10 feature, an additional software for Microsoft PowerPoint. After creating the module, convert the file with presentation format (.ppt) into HTML5 (flash) form using the iSPring Suite ten feature. Furthermore, files can be converted from HTML5 into .apk format or Android applications with Website 2 APK Builder software.

Stage III: Development

The e-module product on the topic of blood circulation containing the character of Pancasila students is made according to the design that has been prepared. Furthermore, expert validation is carried out, including material validation, media validation, and language validation. Material expert validation aims to obtain data in the form of assessments, opinions, criticisms, and suggestions on the accuracy and suitability of material in developing STEAM-based e-modules containing critical and independent reasoning characters so that the scientific truth of the module becomes more reliable. Media validation aims to obtain data from assessments, opinions, criticisms, and suggestions on the appearance and preparation of STEAM-based e-module development. Linguist validation to assess language usage suitability, suitable and excellent language clarity, and e-module readability.

Test the validation using the prepared validation sheet. The first stage of product revision is based on the results of material expert validation tests, including the relevance of teaching materials, consistency, and depth of teaching material substance. The validation test by media experts consists of qualitative data related to presentation structure, graphics, presentation order, module content, how to organize it, display of module activities, involvement in student activities, general appearance, digestibility of the module, attention to the code of ethics, and copyright. Linguist validation tests include data on the suitability of the language used and readability of e-modules. Product design revisions refer to expert advice but still consider field conditions. If the results are invalid, it is an invalid revision, but if it has been continued with trials in small groups.

Stage IV: Implementation

Small group tests were conducted on students and educators as test subjects to collect qualitative data on the readability aspects of STEAM-based e-modules containing science literacy and Pancasila students. The readability test aims to determine the shortcomings in the e-module, such as misprints, typefaces, image layout errors, and others, as well as assess the clarity of the contents of the e-module, ease of understanding the contents of the module, attractive appearance, and readability of the e-module. Small group tests using instruments in the form of questionnaires to determine student responses to the STEAM-based e-modules applied.

Stage V: Evaluation

Analysis of small-scale test results is carried out to improve e-modules to be more suitable for the learning process on large-scale tests. Improvement refers to the effects of teacher and student response questionnaires. After the revision, the product is registered with the Ministry of Law and Human Rights to obtain a copyright.

Participants

This research was held for ten weeks, starting from interviews with teachers and students at Supriyadi 01 Elementary School Semarang, e-module development, content expert validation, construct expert validation, linguist validation, and revision of improvements according to expert advice, to practicality tests and product copyright submissions. The interview was conducted at Supriyadi Elementary School Semarang Indonesia with 2 (two) grade V teachers and 5 (five) grade V elementary schools. The research is implemented in the even semester of the 2022/2023 academic year. Development of e-modules received suggestions and input from supervisors. Each assessment aspect, from content to language, has three experts to validate. Content and construct experts consist of three lecturers and one fifth-grade teacher, and linguists consist of two lecturers and two teachers of fifth grade E-modules after completion are validated and improved according to expert advice, then tested practicality to 15 grade V students at Elementary School Supriyadi Semarang. The 15 learners are homogeneous. In addition, practicality tests were conducted on 5 (five) grade V Supriyadi Elementary School Semarang teachers.

Data Collection Instruments

Data collection instruments for expert validation, each of which includes indicators to be assessed. The scale used in the expert validation instrument consists of five scales, from "very non-conforming," which is given a score of "1," to "very conforming," which is given a score of "5." Media expert validation assessment consists of two aspects: content and presentation feasibility. Further recognizing content expert validation instruments are presented in Table 1.

Table 1. Content Expert Validation Instrument Grid

Number	Feasibility	Indicators
1.	Content Eligibility	Material suitability
		Accuracy of the material
		Material up-to-date
		The character of Pancasila Students
2.	Eligibility of Presentation	Serving technique
		Presentation of Learning

The media expert validation assessment consists of five aspects. The grid of media expert validation instruments is presented in Table 2.

Table 2. Media Expert Validation Instrument Grid

1.	Completeness of E-Modules	Attractive cover and title according to the content
		Complete introduction, table of contents, and instructions for use
		Completeness of videos, supporting links of materials and images
2.	Eligibility of Presentation	Ease of access to e-modules
		How-to page makes it easy to use
		Systematics of presentation
		Easy page search setup
		Easy sharing of e-modules
3.	Software	Ease of operation
		Ease of media management
4.	Consistency	Menu layout consistency
		Consistency of letter shape and size
		Layout consistency

5.	Graphics	Use of font size and type
		Layout
		Page format
		Image clarity
		Video clarity
		Coloring
		Design appears

The assessment aspect of media expert validation consists of 5 (five) elements. More about its aspects and indicators are presented in Table 3.

Table 3. Linguist Validation Instrument Grid

Number	Assessment Aspect	Indicators
1.	Businesslike	Sentence structure accuracy
		Sentence effectiveness
		Standards of terms
2.	Communicative	Facilitate understanding of information
3.	Dialogical and interactive	Motivate students
		Encourage learners to think critically.
4.	Suitability to learner development	Compatibility with intellectual development
		Compatibility with the emotional level
5.	Compliance with language rules	Grammatical accuracy
		Spelling accuracy
6.	Use of terms, symbols, or icons	Proper use of terms
		Proper use of symbols or icons

The e-module practicality data collection instrument is provided to teachers and students. In the teacher practicality instrument, teachers are asked to put a "checklist" mark on the items supplied if the indicators in the questionnaire are by the e-module. The grid of the teacher's practicality instrument is presented in Table 4.

Table 4. Teacher Practicality Test Grid

1.	Cover Page	Attractive cover color
		The image on the cover is transparent.
		The right color combination
		Describe the contents of the module.
2.	Table Clarity / Illustrations / Images	Clear tables/illustrations/drawings
		Tables/illustrations/figures according to the material
		Table/illustration/figure with captions
		Table/illustration/figure with source
3.	Language and Sentences	Language, according to EYD
		Language has a clear intent.
		Communicative sentences
		Effective sentences
4.	Clarity of Writing	Font appropriate
		No typos
		Follow the rules of the EYD.
		The writing can be read clearly.

5.	Color Composition	Attractive colors
		Color composition is not superfluous.
		Vivid and non-opaque colors
		Balanced colors
6.	Use of terms, symbols, or icons	Encouraging material problems-solving
		Practice questions according to the material
		Evaluation test at the end of the module
		Tables and figures are easy to understand
7.	Motivating to Respond to Learning	Fostering an interest in reading
		Encourage students to learn.
		Encourage students to think critically.
		Fostering a sense of enthusiasm for learning

Unlike the teacher practicality questionnaire, the student practicality questionnaire is packaged using language by the language used or easily understood by students. The scale used was only four times, from "strongly disagree" with a score of "1" to "agree" with a score of "4". The grid of instruments of practicality of learners is presented in Table 5.

Table 5. Student Practicality Instrument Grille

1.	Effectiveness	a. Clear study instructions
		b. Clear practice instructions
		c. The e-module is easy to use
2.	Efficiency	a. Material according to the topic of human blood circulation
		b. The material is presented in order
		c. Complete, straightforward and easy-to-understand material
3.	Creativeness	a. Attractive cover color
		b. Clear and sharp images
		c. Interesting background
4.	Readability	a. Font and size are legible
		b. No typos
		c. Language is easy to understand
5.	Interactive	a. Fostering an interest in reading
		b Motivate students to learn
		c. There are tests

Data Analysis

Validity of E-Module Content

Testing the validity of the content is carried out by experts (expert judgment) (Sugiyono, 2015). Specification tables are prepared for context experts to measure their adequacy and compatibility with test items (Zulyusri et al., 2017). The calculation of content validity uses Aiken's V equation to calculate the Content-Validity Coefficient (CVI) based on the results of several validators' assessments of the item. Content validity analysis is carried out by comparing the developed e-module assessment instrument with the instrument grid. Experts

assess material (content), media (construct), and language aspects. Aiken formulated Aiken's V formula for calculating the content-validity coefficient based on an expert panel's assessment of "n" people on an item. The extent to which the item represents the measured construct. The evaluation is carried out by marking a checklist from the category "Not Suitable" with a score of "1" to "Very Conforming" with a score of "5." Aiken's V formula is presented in Eq.1.

$$V = \frac{\Sigma S}{[n(c-1)]} \qquad \text{(Eq. 1)}$$

Information:

S = r – lo

r = number given by the appraiser

lo = lowest validity assessment number

n = number of appraisers

c = highest validity assessment number

According to Aiken (1985), determining the validity of each item assessed can be analyzed by looking at the value of the validity coefficient V contained in the Validity Coefficient Value Table presented in Table 6.

Table 6. Value of Validity Coefficient (Aiken, 1985)

Raters	Number of Twigs Categories							
	2		3		4		5	
	V	P	V	P	V	P	V	P
2							1	0,040
3							1	0,008
3			1,00	0,037	1	0,016	0,92	0,032
4					1	0,004	0,92	0,032
4			1,00	0,012	0,92	0,020	**0,88**	0,024
5			1,00	0,004	0,93	0,006	0,90	0,007
5	1,00	0,031	0,90	0,025	0,87	0,021	0,80	0,040

The study sets the p-value < 0.05, and then the second row sees each number of raters. The number of raters is four experts, and the questionnaire scale used is five scales. Therefore, this study's content validity analysis results are guided by the fourth rater's column with p < 0.05 in the second row and the number of twigs categories (scale) in the fifth column of 0.88. In addition, the level of validity analyzed by Aiken's equation should refer to the Kappa Statistic validity classification category. Kappa statistic or interrater reliability was a measure used to test agreement between two people (raters) on categorical variables. The technique was used by some researchers, such as Wynd et al. (2003), which uses CVI and kappa multi-rater to validate the scale content it develops. Kappa Statistics is an important supplement but not a substitute for CVI. Kappa provides information about the extent of the deal beyond the possibilities (Polit & Beck, 2006). If there are more than two raters, the Kappa multi-rater technique can be used. The statistical measure of interrater reliability is Kappa Cohen, which ranges from 0 to 1.0, where large numbers mean better reliability. Landis & Koch (1977) provides assessment guidelines on the Kappa statistics presented in Table 7.

Table 7. Kappa Statistic Assessment Guidelines (Landis & Koch, 1977)

Kappa	Interpretation
< 0	Poor Agreement
0.00 – 0.20	Slight Agreement
0.21 – 0.40	Fair Agreement
0.41 – 0.60	Moderate Agreement
0.61 - 0.80	Substantial Agreement
0.81 – 1.00	Almost perfect Agreement

E-Module Practicality Test

The e-module practicality test was analyzed by summing the scores of all indicators in each aspect of all respondents so that the final value of each aspect can be known. Further, the absolute value was calculated using the formula presented in Eq. 2.

$$P = \frac{f}{N} \times 100\% \qquad \text{(Eq. 2)}$$

Information:

P = final value

F = Score acquisition

N = maximum score

The category is carried out after the final score is obtained according to the value received. The types of practicality values are presented in Table 8.

Table 8. Practicality Category (Cahyadi, 2019)

Value (%)	Category
80 < x ≤ 100	Very practical
60 < x ≤ 80	Practical
40 < x ≤ 60	Practical Enough
20 < x ≤ 40	Less Practical
0 < x ≤ 20	Not Practical

FINDINGS AND DISCUSSIONS

E-Module Development Results

The development of the Prisma e-module was facilitated by employing diverse software tools, including Microsoft PowerPoint (.ppt), the iSpring Suite 10 functionality within Microsoft PowerPoint (.ppt), and the Website 2 APK Builder application. Microsoft PowerPoint was chosen as the leading software to develop e-modules because Microsoft PowerPoint is a computer program that can be run well on PC/Laptop Based on Windows and also Apple Macintosh, which uses Apple Mac OS. This software is almost available on all educators' PCs/laptops. Microsoft PowerPoint is also easy to operate, so it is an environmentally friendly tool and easy to use in development. The material was developed and compiled in Microsoft PowerPoint. Furthermore, the iSpring Suite 10 feature of Microsoft PowerPoint was used to make evaluations or quizzes. Another use of iSpring Suite 10 was that after the material and examination have been compiled, this feature has a function to convert files with presentation format (.ppt) into HTML5 (flash). Files converted into HTML5 (flash) and then converted into .apk format or Android applications with Website 2 APK Builder software.

E-modules are arranged systematically within two months and designed by the developer to control the content learned because they can adjust to the planned curriculum (Hamid et al., 2020; Komikesari et al., 2020). According to Accraf et al. (2019), e-modules are interactive, allowing easy transitions of learning content because they can accommodate audiovisual media and animations (Andriani et al., 2021). In addition, the e-module is also equipped with practice questions and evaluation questions so that educators can find out the results of learning and increase the competencies and dimensions measured (Ilmi et al., 2021; Rasmussen et al., 2020).

The development of the Prisma e-module was an effort to improve the character of Pancasila students in critical reasoning and independence. Nursalam & Suardi (2022) explained that the e-module is one of the means to enhance the character of Pancasila students in the critical reasoning dimension. It is supported by the findings of Pinontoan et al. (2021) that the learning process supported by e-modules will improve students' reasoning skills. Setiawan et al. (2022) also said that e-modules can improve the critical reasoning ability of elementary school students. Prisma's e-modules was designed to make learners more interested in learning independently. The e-module was intended for students to learn more actively to develop their potential (Dhillon & Murray, 2021) so that learners will increasingly be trained independently to exercise self-control in the learning process so that they can learn and solve problems in their own way (Wasiluk et al., 2022).

E-Module Characteristics

The design of e-modules carefully considers distinctive features to fulfil educational goals. Ideally, the Prisma e-module would be integrated into the instructional process on six occasions. During each session, the pedagogical intent is to cultivate aspects of the Pancasila student persona, specifically fostering critical reasoning and independence. A list of activities for each meeting is presented in Table 9.

Table 9. List of Activities for Each Meeting

I	Circulatory	1. Critical Reasoning
	1. The Role of Blood	Element:
	2. Circulatory System	a. Acquire and process information and ideas.
	3. Great Circulatory	b. Reflect and evaluate his thoughts.
	4. Small Blood Circulation	2. Self-sufficient
	5. Differences between Arteries and Veins	Element:
	6. Video Playback 1 and 2 (Human Circulatory System)	Self-regulation
II	Heart	1. Critical Reasoning
	1. Heart Section	Element:
	2. Heart Size and Location	a. Acquire and process information and ideas.
	3. Heart Function	b. Analyze and evaluate reasoning
	4. Video Playback 3 (Heart) and 4 (Heart and Circulatory)	c. Reflect and evaluate his thoughts.
		2. Self-sufficient
		Element:
		Self-regulation
III	Heart	3. Critical Reasoning
	1. Heart Disease	Element:
	2. How to Keep Your Heart Healthy	a. Acquire and process information and ideas.
	3. Video Playback 4 (How to Maintain Circulatory Organs) and Video 5	b. Analyze and evaluate reasoning
	4. Technology for the heart	c. Reflect and evaluate his thoughts.
		4. Self-sufficient
		Element:
		a. Self-understanding and the situation at hand
		b. Self-regulation

IV	Vein	1. Critical Reasoning Element: a. Acquire and process information and ideas. b. Analyze and evaluate reasoning c. Reflect and evaluate his thoughts. 2. Self-sufficient Element: Self-regulation
V	1. Lung Material and Video Playback 6 2. Creating Mind-Mapping	1. Critical Reasoning Element: a. Acquire and process information and ideas. b. Analyze and evaluate reasoning c. Reflect and evaluate his thoughts. 2. Self-sufficient Element: Self-regulation
VI	Replay of All Videos and Practice Questions	All characters reason critically and independently, and their elements

Quoting from Chaira & Hardeli (2022), an e-module is an Information and Communication Technology (ICT)-based module that contains material and evaluations that are arranged systematically and interestingly, are interactive and independent, and provide feedback through formative tests or quizzes presented. Referring to this statement, the characteristics contained in the Prisma e-module include several components, including 1) Comments (competencies and dimensions); 2) Rambu (study summary for you), which contains the entire material to be taught; 3) Vijar (learning video); 4) Sequizi (a set of core quizzes); and 5) Infi (information about the author and source material). The menu of the Prisma e-module is presented in Figure 2.

Figure 2. Home (Main Menu) of Prisma E-module

"Komen" Menu (Competencies and Dimensions)

The Comments menu in the Prisma application consists of core competencies, essential competencies, and the character of Pancasila students. The Comments menu in the Prisma e-module is presented in Figure 3.

Figure 3. Comments Menu from Prisma E-module

The inclusion of IC and BC on human circulatory material in the menu that has been prepared adapts to the curriculum for the current fifth grade. It is also intended so that students know the competencies that must be achieved to master concepts. In this research, although the goal is not to master the concept, students still have to know the learning objectives that must be achieved. Considering the results of previous interviews both with students and with educators, it was found that the human circulatory material is material that is quite difficult to master, as evidenced by the results of the evaluation of the material, which showed that 17 (seventeen) out of 31 (thirty-one) students had not Complete when evaluating the material. It indicates that more than 50% of students have yet to reach the minimum completeness criteria in the evaluation process, so mastery of concepts about human circulatory material cannot be categorized as being able to be mastered by students.

Rambu (Study Summary for You)

Menu Signs on the e-module is an acronym for learning summary for you. Signs contain all material about human blood circulation, starting from the general circulatory menu, heart and lung organs, and blood vessels. The Signs menu display in the Prisma e-module is presented in Figure 4.
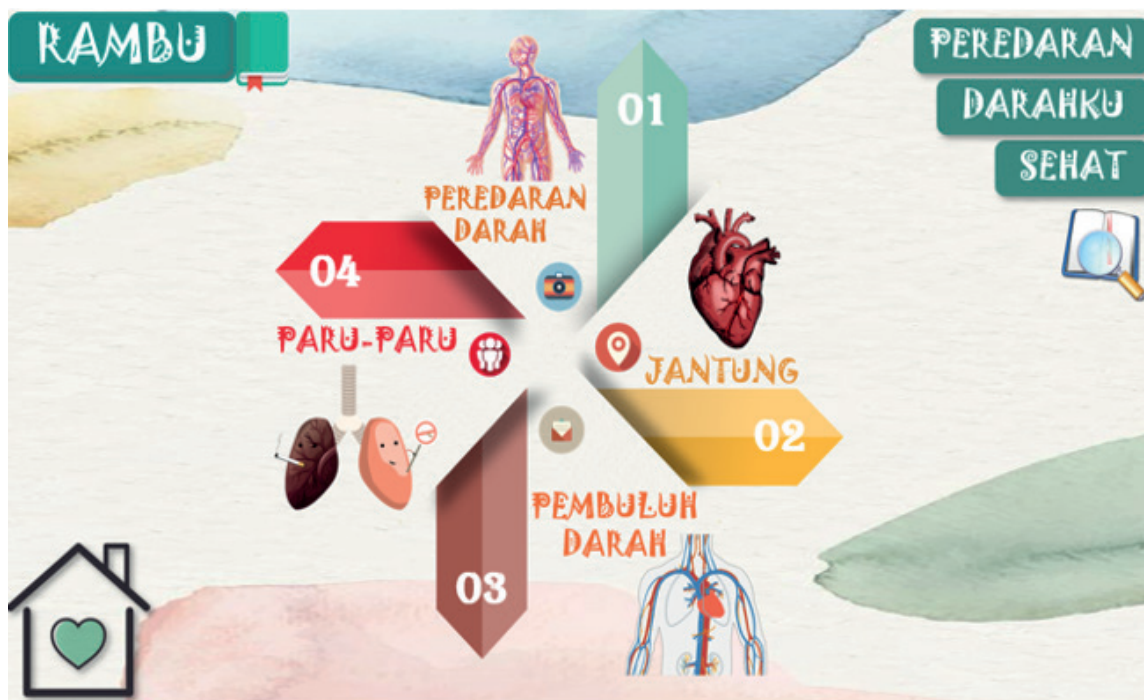
Figure 4. Rambu Menu in Prisma E-Module

The material was adjusted to the measured element. The material was designed to be as attractive as possible to motivate students to learn. The material presented was combined with images, both authentic images and illustrative images. The purpose of using images is to clarify the material presented. It follows the theory developed by Santrock (2019) that children of primary school age are in a concrete stage. The presentation of the material should involve concrete images to capture the explanation given (Meriyati, 2015). Images can lead to understanding abstract ideas by visualizing verbally and symbolically (Saepudin, 2018). Through the pictures presented by students, it is easier to convert the information obtained because explanations accompanied by visual media make explanations easy to absorb and sharpen understanding (Widiastika et al., 2020).

The material in the e-module was not only presented in the form of images but the delivery of information was also presented in the form of tables to group information to make it more concise and easier to understand. Explanations in text form are also given briefly with efficient sentences to make it easier for learners to understand the explanation of the text presented. It aligns with the findings of Irawan et al. (2021) that elementary school-age students are interested in reading short and clear sentences. Referring to these findings, the text in this e-module is presented briefly with efficient and easy-to-understand sentences. In the Rambu menu, in addition to offering explanations in text form, there was also a voice feature that contained descriptions of the material presented on several pages that needed detailed explanations. The feature is helpful as it offers a variety of options and sharpens explanations. Students needing more interest in reading can still get information through the voice features presented.

The STEAM approach to the presentation of concepts was carried out embedded; namely, the material was based on human blood circulation, and then material to sharpen the concept of Pancasila student character was inserted into the material. The material presented is aimed at mastery of concepts, critical reasoning character, and independent character. The material for mastering concepts was adjusted to the material in the textbook used by educators in Supriyadi Elementary School Semarang. However, material from several books and journals was added to sharpen the information provided. The material presented was adjusted to the elements to be measured and accompanied by case examples. The illustrated case examples were connected with everyday life. Students are expected to capture concrete information through the case examples presented and then connect with the surrounding cases. The hope is that through learning the habituation of the case examples given, they have enough provisions and the ability to receive information well, draw conclusions, and solve problems.

Pancasila student character material was presented based on elements following the critical reasoning dimension: obtaining and processing information and ideas, analyzing and evaluating reasoning, and reflecting on thoughts and thought processes in decision-making. The output of the data presented in the Rambu menu, the elements of critical reasoning, can be mastered by students. The primary key to developing learning materials that contain the character of Pancasila students is to attract student involvement in learning and create a pleasant learning atmosphere so that students can learn based on experiences in everyday life that are integrated with the knowledge that has been obtained (Hidayati & Julianto, 2018). Referring to this statement, the material development in this e-module was prepared by including moving images and animations so that students would focus more on the material. It was also conveyed by Nugraha et al. (2020) that moving pictures or animations will help learners focus.

The concept of material development in the Prisma e-module also directs learners to sharpen their understanding of concepts. Furthermore, students can solve various problems in everyday life by drawing conclusions based on scientific evidence. It follows the expected concept of critical reasoning. After exploring the material in the e-module, students can develop an understanding of the material learned in a conceptual scheme. Then, they relate the schema to their general knowledge of procedural skills and use that understanding to solve scientific problems (Azimi et al., 2017).

The elements of the independent dimension consist of awareness of self and the situation at hand as well as self-regulation (Jamaludin et al., 2022). Material about independent character elements was also integrated into healthy circulatory material, such as how to keep the heart healthy, a healthy lifestyle, and knowing the typical number of heartbeats and healthy lung capacity. Independent characters are also automatically integrated into students through Prisma e-modules that run on smartphones. Prisma e-module was designed with many navigation buttons, which direct students to work independently. It aligns with what was conveyed by Mikuteit et al. (2020) and Ilmi et al. (2021) that the development of e-modules that include navigation buttons in menu directions will train the independence of learners. The navigation buttons in the developed e-module also direct students to find, formulate, identify, analyze information, arrive at strategizing, and solve problems. Based on the explanation above, the Prisma e-module guides students to have critical reasoning and independent character.

Vijar (Learning Video)

The Vijar menu in the e-module contains several videos about the human circulatory system, how the heart works, how to maintain the circulatory organs, the dangers of smoking, and the dangers of cholesterol. The menu of learning videos in the Prisma e-module is presented in Figure 5.
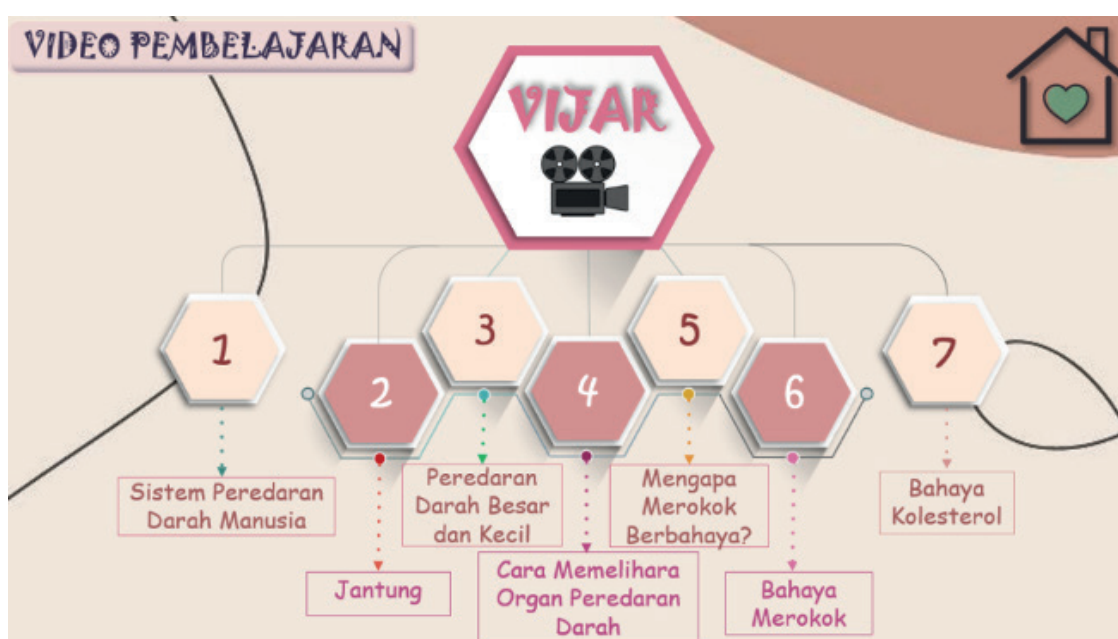
Figure 5. Vijar Menu in Prisma E-Module

Video is an audio-visual media that combines images, text, sound, music, and animated images in one unit (Nugraha et al., 2020). Through learning videos, educators can create a learning atmosphere that is not monotonous (Norma, 2021). Learning videos can help educators teach concepts from the material and explain abstract things in concrete because they present complex information in text, images, and sound (Widiarti et al., 2021). Videos can visualize challenging material to convey through verbal or conventional props (Novita et al., 2019). The purpose of presenting the learning video menu in this e-module is to make transferring information to students easier to convey. Learning videos explain new things to attract students' attention and focus more on learning (Busyaeri et al., 2016; Widiarti et al., 2021). Students also become more motivated to explore information or search for knowledge to explore the material (Wardani & Syofyan, 2018). Referring to this, learning videos can train students' learning independence to support the deepening of the material, and learning objectives can be achieved.

The use of video in learning is an effective way to help students relate the competencies they have mastered to their environment in everyday life (Hapsari & Zulherman, 2021). The video presented directs students to have a critical reasoning character. The information presented in the video can lead learners to process information and ideas, analyze reasoning, and evaluate their thoughts. It is supported by the findings by Suminar (2022) that the application of video in the learning process can improve students' critical reasoning skills. In line with the statement, Windfall et al. (2022) convey that audiovisual media can improve the critical reasoning ability of elementary school students.

Sequizi (Core Quiz Set)

The fourth menu in the e-module, Sequizi, contains quizzes or evaluations. Sequizi is an evaluation stage after the information transfer process through the material presented in the Rambu and Vijar menus. Evaluation of learning outcomes is one of the core (which must be present) of the e-module. The preparation of e-modules needs feedback to measure the level of mastery of the material or the success of students (Asmiyunda et al., 2018). Thus, the evaluation section of the e-module is essential for the independent learning process, which is helpful as a measure of students' learning development (Yanuarti et al., 2022).

The evaluation in the Sequizi menu consists of 3 (three) choices: quiz A, quiz B, and quiz C. Quiz A contains questions about understanding concepts. Quiz B has character training questions, critical reasoning, and independence. Quiz C also contains final evaluation questions for characters with critical and independent reasoning. Quizs B and C look almost identical, but each question item differs. Quiz B can be accessed by disseminating the product to students (initial use). In contrast, quiz C cannot be accessed during the learning process because it was used to measure the character of Pancasila students through pretest and posttest so that quiz C can be accessed when the research process is complete. The Sequizi menu on the Prisma e-module is presented in Figure 6.
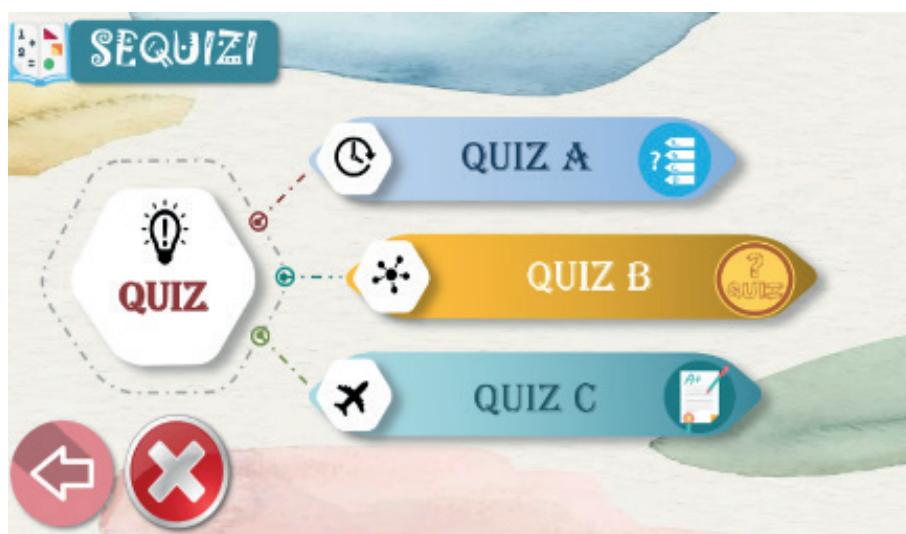
Figure 6. Sequizi Menu in Prisma E-Module

Infi (Information about the Author and Source of the Material)

The fifth menu of the main menu in the Prisma e-module is the Infi menu, an acronym for Information. This menu contains the Prisma e-module developer profile information, application usage instructions (Prisma e-module), reference materials, video and image references, and a glossary. The Infi menu display in the e-module is presented in Figure 7.

Figure 7. Infi Menu in E-Module

The developer profile consists of a researcher profile and a supervisor profile. The developer profile contains a brief curriculum vitae of researchers and supervisors, and there is a developer e-mail address whose function makes it easier for users (educators and students) who want to contact the developer or have questions related to the e-module. The application instructions are intended to make it easier for students to operate the Prisma e-module. There are buttons and instructions and an explanation of the instructions for use. The reference material contains the sources of material used in compiling the Rambu menu. Reference material from books, national journals, and international journals. Citations or references to material were included to appreciate the work of other authors and avoid plagiarism. In addition to material references, video and image references (including navigation button images) were also embedded in the menu so that the video and image sources used in developing the e-module are listed to appreciate the work of video and image creators and avoid plagiarism.

The Glossary menu was intended to make it easier for students to understand words that are difficult to understand or foreign words for students. There was information that explains difficult words/foreign words so that after reading the Glossary, students easily understand words that are considered foreign/words that do not understand their meaning. Students are expected to absorb the material presented more efficiently through the Glossary.

Feasibility of the Prisma E-Module Charged with Critical Reasoning and Independent Characters

The feasibility analysis of the Prisma e-module was obtained through expert validation and practicality test assessments. The feasibility assessment is carried out by expert validation of the Prisma e-module that has been developed. Expert validation consists of lecturers who are competent in their fields and grade V elementary school educators. The assessment of practicality test of the e-module was tested for grade V educators and grade V students of Supriyadi Elementary School Semarang. The design of the Prisma e-module assessment instrument that the supervisor has approved was then submitted for assessment by

expert validation. The expert validation assessment of the Prisma e-module was divided into 3 (three), namely material expert validation (content), media expert validation (construct), and linguist validation. Each expert validation consists of four validators.

Material Expert Validation Results (Content)

Material expert validation consists of 3 (three) lecturers and 1 (one) grade V elementary school teacher. Lecturers who become validators of material (content) are lecturers who have competence in research topics. Content validators have competence in health and education at the same time, as expert lecturers in the field of natural sciences. In contrast, the teacher who became the material validator was a fifth-grade teacher with experience developing teaching materials. As a material expert, the teacher also assesses the limits of human circulatory material for fifth-grade students. The results of Prisma e-module material validation by material expert validation are presented in Table 10.

Table 10. Prisma E-Module Material Expert Validation Results

Item	V value	CVI Aiken	Category Validity Status
1	0,9375	Valid	Almost Perfect
2	0,9375	Valid	Almost Perfect
3	1	Valid	Almost Perfect
4	0,9375	Valid	Almost Perfect
5	0,9375	Valid	Almost Perfect
6	0,9375	Valid	Almost Perfect
7	0,9375	Valid	Almost Perfect
8	1	Valid	Almost Perfect
9	1	Valid	Almost Perfect
10	0,9375	Valid	Almost Perfect
11	0,9375	Valid	Almost Perfect
12	1	Valid	Almost Perfect
13	1	Valid	Almost Perfect
Final V Value	0,9615	Valid	Almost Perfect

Table 10 shows that material expert validation of the Prism e-module obtained a final V value of 0.9615. The results are then reviewed from the value of Aiken's validity coefficient with the number of raters or raters as many as 4 (four) experts and 5 (five) questionnaire scales, with a value of $p < 0.05$. The results of the validity level analysis with Aiken's equation as a whole aspect, the value of V 0.91615, is included in the "valid" category. When reviewed per item, all items are declared "valid" according to the CVI table. Kappa Statistics is another reference used to categorize a product's validity (Polit et al., 2007), and according to assessment guidelines on Kappa Statistics Landis & Koch (1977), Strictly allowed. Based on these results, the Prisma e-module has met the minimum assessment to determine the feasibility of the product from the material aspect (content), according to the Aiken and Kappa Statistical equations. Therefore, the Prisma e-module is declared feasible from material (content).

Media Expert Validation Results

Validation of media experts have competence in graphic design consisting of computer experts and experienced in the world of Education. Media validators are given an assessment grid and validation assessment form to determine the validity of Prisma e-module products from the media aspect, which consists of 3 (three) lecturers and 1 (one) grade V elementary school teacher. Lecturers and teacher who became the Prisma e-module validators had experience in developing learning media for grade V elementary schools. The

validity of the content is quantitatively analyzed using the equations proposed by Aiken. The results of the validation of Prisma e-module material by media expert validation are presented in Table 11.

Table 11. Results of Media Expert Validation Prisma E-Module

Item	V value	CVI Aiken	Category Validity Status
1	0.9375	Valid	Almost Perfect
2	1	Valid	Almost Perfect
3	0.9375	Valid	Almost Perfect
4	0.9375	Valid	Almost Perfect
5	0.9375	Valid	Almost Perfect
6	0.9375	Valid	Almost Perfect
7	1	Valid	Almost Perfect
8	0.9375	Valid	Almost Perfect
9	0.9375	Valid	Almost Perfect
10	0.875	Invalid	Almost Perfect
11	1	Valid	Almost Perfect
12	0.875	Invalid	Almost Perfect
13	0.9375	Valid	Almost Perfect
14	0,875	Invalid	Almost Perfect
15	1	Valid	Almost Perfect
16	0.9375	Valid	Almost Perfect
17	1	Valid	Almost Perfect
18	1	Valid	Almost Perfect
19	0.875	Invalid	Almost Perfect
20	1	Valid	Almost Perfect
Final V Value	0.9469	Valid	Almost Perfect

Table 11 shows the results of media expert validation of the Prisma e-module, which obtained a final V value of 0.9469. When viewed from all aspects, based on the value of Aiken's validity coefficient, with the number of raters 4 (four) raters and 5 (five) questionnaire scales used with $p<0.05$, the results of the validity level analysis with Aiken's equation, show that the Prism e-module from the assessment of media experts is declared "valid." If analyzed per item based on the CVI table, the media expert validation results were four items declared "invalid" with a 0.875 V score. These items are contained in user-friendliness, consistency, and graphics. The item stated invalid according to the CVI table is "The software is easy to access, and the links are easy to share with learners," the following item is "The use of shapes and letters is consistent, simple, attractive, and easy to read," then on the graphic aspect consisting of two items "font size and type according to standards and easy to read" and "the combination of colors used contrasts so that the writing in the e-module can be read." On the other hand, another reference categorizes the V value of 0.875 into the "almost perfect" category, namely the Kappa Statistics reference (Landis & Koch, 1977). The results of the analysis from the authority of CVI Aiken and Kappa Statistic show that the Prisma e-module has met the minimum assessment to be declared feasible from the aspect of media (construct).

Linguist Validation Results

Linguist validation to assess the accuracy of language grammar use, language clarity used, language suitability with the age of the research subject, the efficiency of sentences used, and the overall readability of the e-module. Linguist validation for the feasibility assessment of the language used consists of 4 validators: two Indonesian lecturers and two Indonesian teachers. The validity of the content was quantitatively analyzed using the equation proposed by Aiken. The results of Prisma e-module language validation by linguist validation are presented in Table 12.

Table 12. Prisma E-Module Linguist Validation Results

Item	V value	CVI Aiken	Category
			Validity Status
1	0.9375	Valid	Almost Perfect
2	0.9375	Valid	Almost Perfect
3	0.875	Invalid	Almost Perfect
4	0.875	Invalid	Almost Perfect
5	0.9375	Valid	Almost Perfect
6	0.9375	Valid	Almost Perfect
7	0.9375	Valid	Almost Perfect
8	0.9375	Valid	Almost Perfect
9	0.9375	Valid	Almost Perfect
10	0.9375	Valid	Almost Perfect
11	0.875	Invalid	Almost Perfect
12	0.9375	Valid	Almost Perfect
Final V Value	0.9219	Valid	Almost Perfect

Based on Tabel 12, the result of linguist validation of the Prisma e-module obtained a final V value of 0.9271. By analysis of Aiken's CVI Value with the number of four experts and the questionnaire scale used, there were five scales with $p < 0.005$. Prisma e-module language validation results were declared "valid." If each item is assesed, three items were declared "invalid." It was still permitted by Kappa Statistics referrals (Landis & Koch, 1977), which categorizes 0.875 into the "near-perfect" category, so a V value of 0.875 is still acceptable. Based on the results of these categories, the Prisma e-module has met the minimum assessment for product feasibility from the language aspect.

Validation Results of All Aspects

Based on the results of the content validity analysis test from the validation of material experts, media experts, and linguists, the scores of the three aspects were averaged to determine the final validity value of the Prisma e-module. The results of the validity analysis test on all elements are presented in Table 13.

Table 13. Results of Validation of All Aspects

Validation Team	
Aspects	V value
Material	0,9615
Media	0,9469
Language	0,9219
Average	0,9434
Category	Valid

Table 13 shows that in the analysis of product validity in terms of material validation, media, and language, or all aspects, Prisma e-modules were declared "valid" so that it is suitable for use. These results align with the findings of Amalia et al. (2021) that the e-module developed was declared "valid," with a percentage gain of 92.68%. In detail, thePrisma e-module obtained an aspect score of 94.17% on the language aspect, the content aspect of the student module obtained a score of 91.67%, the criteria were very valid, and the presentation aspect received a 92.59%.

The e-module developed must be declared "valid" by experts with competence in the topic developed and researched so that the product is suitable for use in the learning process, significantly improving the character of critical and independent reasoning. In line with these findings, Rohmaini et al. (2020) state that module development must obtain appropriate criteria from experts before disseminating and using it in the learning process. Rofiyadi & Handayani (2021) added that before e-modules are used in class, e-modules should

be declared "valid" according to improvements from experts so that students would be interested in using the e-module. The e-module are feasible, attractive, and cause curiosity to motivate students to dig deeper into the continuation of the knowledge being learned (UZ et al., 2019). It has implications for achieving learning objectives (Accraf et al., 2019).

Improvements from Expert Validation

Product feasibility assessment assesses material, media, and language expert validation results. According to Bakhtiar (2018), the expert review aims to discover the shortcomings of the developed product and get constructive suggestions for improving the developed product. Annisa & Simbolon (2018) add the expert assessment to identify product deficiencies from the effect development, which is then followed by suggestions for improvement so that the product that has been developed follows learning objectives and is suitable for use in learning.

Improvements from Material Expert Validation

The first assessment was from material expert validation. Based on the validation that material experts on Prisma e-modules have carried out, suggestions were obtained for product improvements so that e-modules become better and more feasible. Suggestions for improving the e-module are to use scientific words in the image captions of the circulatory system and parts of the heart and complete the heart function material. Such improvements are presented in Figure 8.
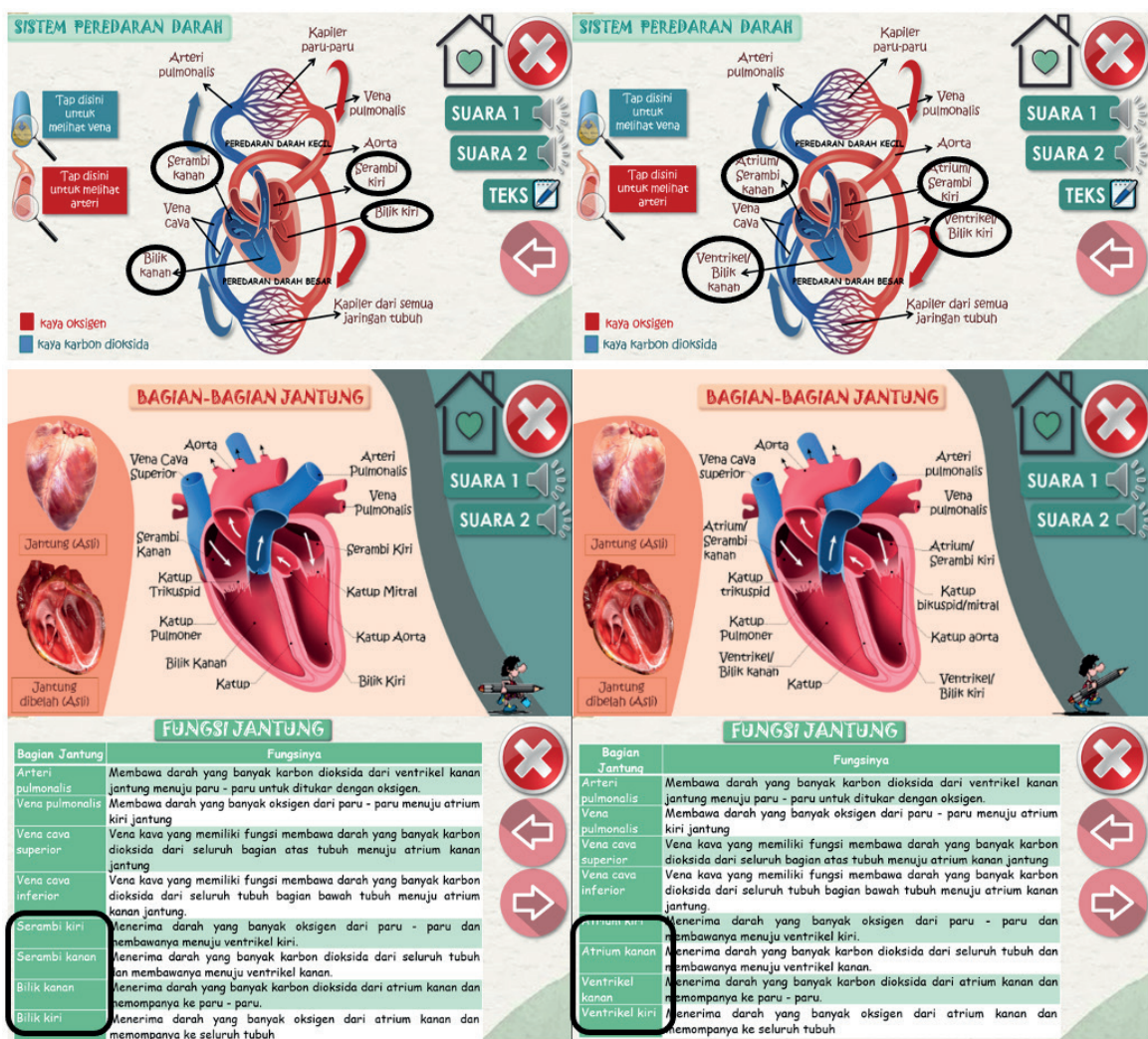
Figure 8. Improved Use of Scientific Words in Image Captions

The left image shows the pages in the e-module before repair, while the right shows the pages after being repaired based on the advice of material experts. Substitute lay language with scientific language or medical terms in e-modules because learners will continue to remember the language/knowledge that was first known until adulthood (Hurlock, 2002). It align with what Piaget said: students will accommodate the knowledge gained (Champion, 2019), then use it in everyday life until it reaches the adult level of knowledge will stick forever (Santrock, 2019).

The use of medical language in e-modules is more appropriate because it follows international standards, besides assuming that if students are introduced to medical terms from an early age, then children will use language accurately in everyday life. This is because elementary school-age children are more accessible to remember, like sponges that readily absorb the material delivered (Solso et al., 2014). The findings support this statement (Wood et al., 2006) that the earlier the topic is given, the easier it will be for students to understand and absorb the material presented. Furthermore, students will use language based on vocabulary mastered in daily communication (Mardison, 2016). The layman's terms in the book remain in the e-module and are not omitted. This is to clarify the difference further and to expand their knowledge.

Further suggestions for adding material about the duration and frequency of exercise, how to calculate an average heart rate when exercising, and the causes of narrowing of blood vessels. Improvements to such suggestions are presented in Figures 9 and 10.

Figure 9. Additional Material Frequency and Intensity of Physical Exercise

Figure 10. Additional Material Causes Narrowing of Blood Vessels

The purpose of adding the material is to provide information so that students know how much time they need to exercise. Through this material, students were also given provisions to calculate their heart rate after exercise so that they will be able to check whether their heart rate is at average frequency. The addition of material about the causes of the narrowing of blood vessels aimed to make students understand the dangers of plaque in blood vessels, especially in the heart, which can eventually cause various diseases in the body. Blockage of blood vessels will cause many diseases such as stroke, coronary heart disease, atherosclerosis, and various other diseases that are one of the causes of death (Kumar et al., 2020; Lina & Saraswati, 2020; Spaziani et al., 2021). Plaque, a trigger factor for heart attack symptoms, is one of the first causes of death in the world (Desky, 2021; Kanna & Eliyas, 2023; Spaziani et al., 2021). After having this knowledge, they will pay more attention to their health and apply a healthy lifestyle. This is supported by the statement by Azzahrah Putri et al. (2021) that students receive the earlier knowledge, the easier they will be to habituate the knowledge acquired.

Improvements from Media Expert Validation

Based on the media experts' (constructs) assessment, several suggestions were obtained for improving the e-module. Improvements are made so that the developed product becomes an interesting learning module and more suitable for use. It align with what was conveyed by Violadini & Mustika (2021) that the modules that have been developed need to be improved to obtain feasibility so that product quality is better and feasible to be delivered to students so that they are more motivated to learn. Suggestions for improvements were made to improve the product so that the product can used as teaching material in supporting the learning process to achieve learning objectives (Sari & Wardani, 2021). The suggestions for improvement from several media validators were to improve the quiz background to make it more contrasting, the selection of fonts that are more attractive for elementary school students, and the font size to be made more prominent. Such improvements are presented in Figures 11 and 12.
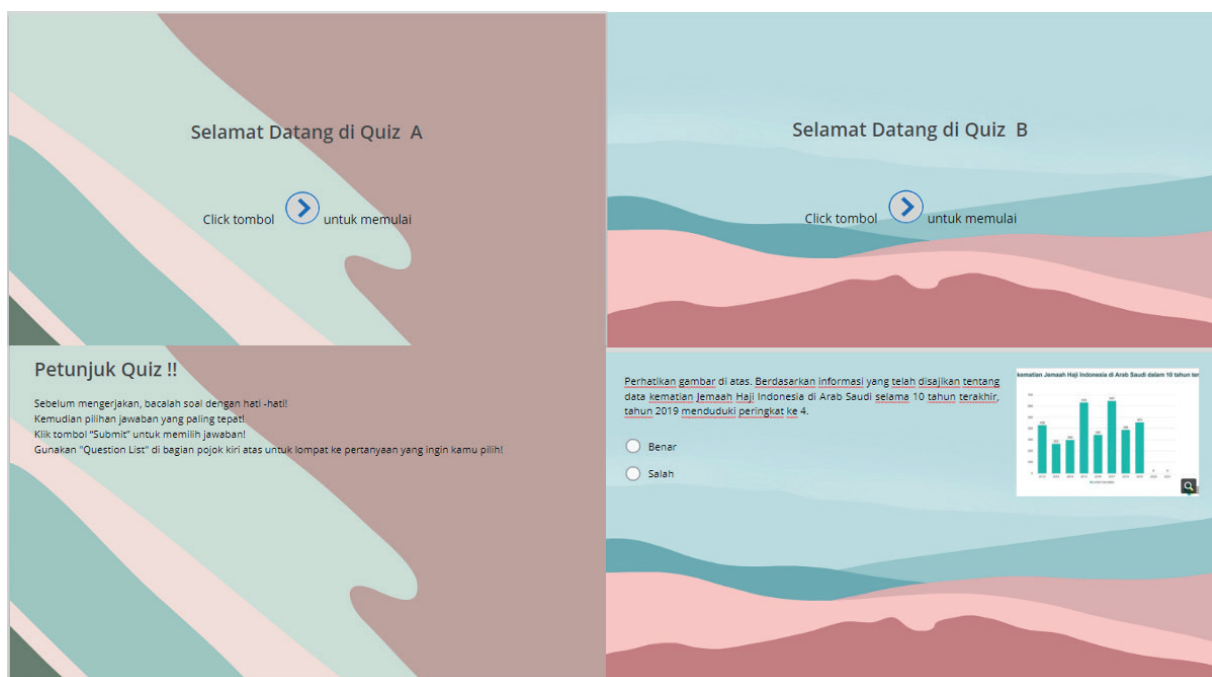
Figure 11. Quiz Display Before Fixing
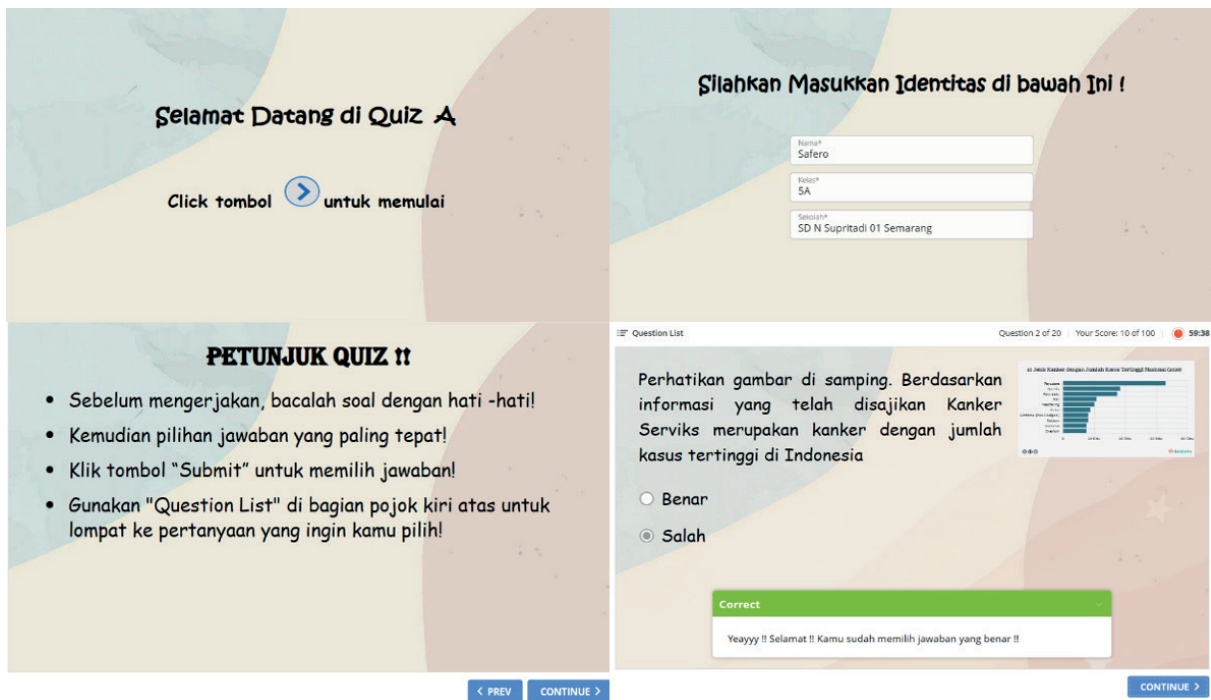
Figure 12. Sequizi (quiz) display after fixing

Improvements to the background display were made more contrasting and aesthetically pleasing so students feel comfortable visually when working on problems. It also contained aesthetic elements that beautified the appearance, making it looked attractive so students felt comfortable working. It was also conveyed by Nadori & Hoyi (2021) that displaying attractive e-modules will foster students' interest in learning. Font fonts were made beautiful so that letters look more attractive and do not seem formal like fonts in books. Font Size was made larger so that the questions are instructions for working on the questions and read more clearly so that students are more comfortable when reading.

Suggestions for further media aspect improvements are on the video reference page to directly link the reference page to the video link address provided. It aimed to students can immediately explore the reference page listed on the website provided. The goal is to appreciate the work of the video creator and avoid plagiarism. The improvements to the video reference page are presented in Figure 13.

Figure 13. Video Reference Page Improvements

Figure 13 shows the fix on the video reference page. The image on the left shows the page before it was repaired. The image on the right shows the link to the video reference. If in "tap," it will directly connect to the video creator's YouTube page. After improvements were made from the media aspect, Prisma e-modules are increasingly suitable for use because of the increasingly attractive appearance and appropriate illustrations representing the material presented. It aligns with what Kurniasari et al. (2018) conveyed: the learning e-module must meet interesting criteria and contain illustrations that captivate users to motivate them to learn (Widiastuti, 2021). Wulansari et al. (2018) said that the images and graphics used in the e-module should represent and explain the learning topic so that learners are readily receptive to the information presented.

Improvements from Linguist Validation

Suggestions from validation linguists to correct the "Preface." The introduction should be intended for students rather than for supervisors. It is because the preface is designed for readers; in this study, the target is students who will use the PrismA e-module. The improvements are presented in Figure 14.
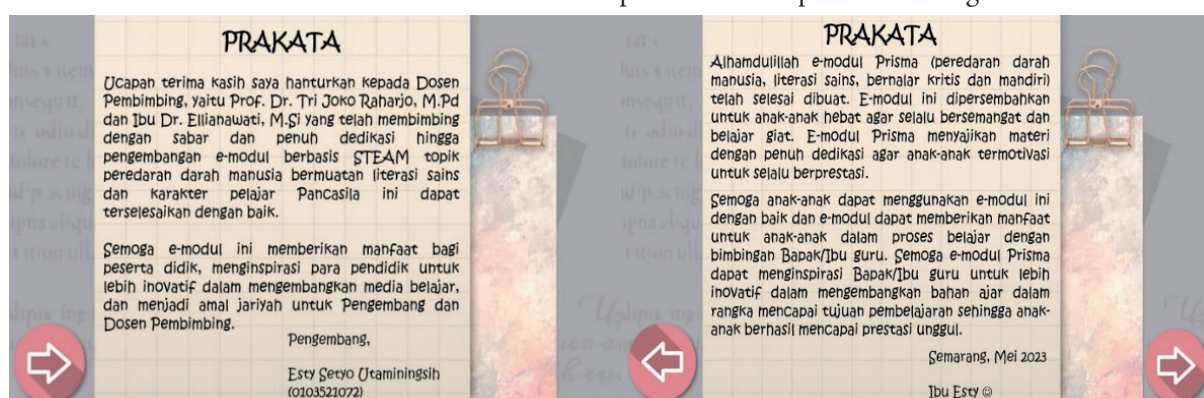
Figure 14. Preface Pages Before and After Fixing

The next suggestion is that "The "Warning" page should use more friendly language, such as call-to-action and not command sentences, so children feel safe when reading them." The improvements to the "Warning" page are presented in Figure 15.

Figure 15. Warning Page Before Fixing

Linguists also suggest removing animations on vein pages because they can interfere with students' focus. It is because the images on the page are full, so animations or moving images can interfere with the focus on the material. Students are feared to be more focused on moving images compared to material images. Improvements to such suggestions are presented in Figure 16.
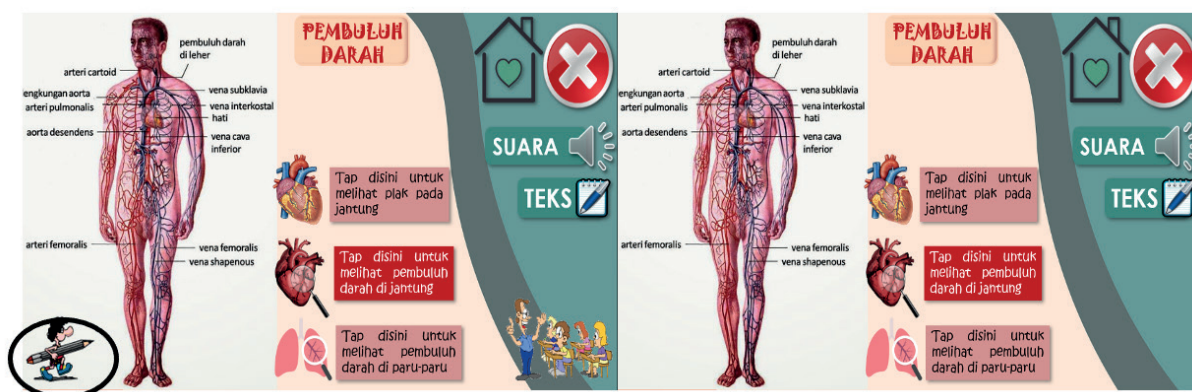
Figure 16. Blood Vessel Page Before and After Repair

Practicality Test Assessment Results

The next step after the product was declared valid and suitable for use in the learning process was to test the practicality of the product. The practicality test of the e-module was tested on grade V educators and grade V students of Supriyadi Elementary School Semarang. Small group tests were generally conducted for students already receiving research topic material. Of course, fifth graders meet these requirements because they have received material about the human circulatory system in semester I. However, they cannot be said to have mastered the concept. A practicality or small-scale test was conducted to see to what extent the Prisma e-module can be used to achieve learning objectives. The results of the practicality test for fifteen students of Supriyadi Elementary School Semarang are presented in Table 14.

Table 14. Results of the Prisma E-Module Practicality Test on Students

Number	Aspects	The Number of Grains	The sum of each aspect's scores
1	Effectiveness	3	163
2	Efficiency	3	157
3	Creativeness	3	143
4	Readability	3	156
5	Interactive	3	159
	Total Amount of Earnings		778
	Maximum Number of Scores		900
	Percentage		86%
	Practicality Level Criteria		Very Practical

Table 14 shows that the practicality test of the e-module is measured in terms of students getting a score of 778 or a percentage of 86%. It can be concluded that Prisma's e-modules are in the "convenient" category. This is in line with the results of the research by Suryati et al. (2022) that the e-modules developed are declared practical with a percentage of 90%, which has the criterion of practicality "outstanding." Based on these results, according to learners, the developed device has an excellent degree of practicality. The finding of Nurhasanah also support the study's results; the e-module designed has a practicality percentage of 90.26%, which is in the "convenient" category. Accraf et al. (2019) Also found something similar: the results of practicality tests on students showed a percentage of 85%, so the products developed were "efficient." E-module developed by Widiastuti (2021) also obtained very high practicality test results with a percentage of 92.6%. Hence, the e-module is interesting for students to used in the learning process.

The practicality assessment of the e-module is obtained from students and carried out to grade V educators of Supriyadi Elementary School Semarang. The results of the practicality test for educators are presented in Table 15.

Table 15. Results of the Prisma E-Module Practicality Test for Educators

Number	Aspects	The Number of Grains	Number of Scores Every Aspect
1	Cover Page	4	20
2	Clarity of Tables/ Illustrations/ Figures	4	20
3	Language and Sentences	4	20
4	Clarity of Writing	4	20
5	Color Composition	4	20
6	Module Content	4	17
7	Motivating to Respond to Learning	4	18
	Total Amount of Earnings		135
	Maximum Number of Scores		140
	Percentage		96%
	Practicality Level Criteria		Very Practical

Based on Table 15 regarding the results of the Prisma e-module practicality test to educators, it can be concluded that the e-module obtained a score of 132 with a percentage of 96% and was in the level of practicality "very practical." Similar findings are also contained in the results of the study by Raharjo et al. (2017) that the e-module practicality test developed from the educator's assessment is practical with a percentage of 90%. This is also supported by the results of research by Accraf et al. (2019) that the practicality test of educators on the developed product has the criterion of "very practical."

In a practical assessment by educators, there are several suggestions for improvement, namely, on some audio so that the sound is louder, and the audio has been improved. The following request is to add pictures and explanations on the Sphygmomanometer page. Improvements to such suggestions are presented in Figure 17.

Figure 17. Sphygmomanometer Page Before and After Repair

Figure 17 shows the page of the Sphygmomanometer before and after repair. In addition to the above improvements, educators also provide input related to technical use. According to educators, using e-modules should be accompanied by control and direction from developers (teachers) during the learning process, so that learning can continue by the learning implementation plan and objectives. It means that educators must monitor the use of e-modules in elementary schools because students still need guidance in the learning process with new things. Advice from educators can make it easier for students to use Prisma e-modules. In addition, it expected to have promising implications for learning outcomes. It align with this statement, Aini (2019) conveys that educators have an essential role in the learning process, namely improving student learning outcomes. Based the practicality test day in Table 14 and Table 15, both aspects of the practicality assessment of students and educators are in the "very practical" criteria. It can be concluded that the developed product can be continued to the large-scale test stage. The e-module is suitable for use in the learning process to deliver human circulatory material.

CONCLUSION

The developed e-modules train critical reasoning characters and independent characters. The Rambu menu (learning summary for you) and the Vijar menu (learning videos) guide and teach all elements of critical reasoning and independent character by the provisions of the Pancasila Student Profile to shape the nation's character because the content is more detailed and equipped with a microscopic description of the process flow. The Sequizi menu, a comprehensive collection of core quizzes, is employed to engage students and gather feedback on their learning outcomes, thereby facilitating the assessment and enhancement of students' Pancasila character development. Prisma E-Modules have been feasibility-tested by experts based on content, construction, and language aspects. Judging from the aspect of Prisma e-module content, it is declared "valid" with a value of V Aiken 0.9615. When viewed from the constructed aspect, it is stated "valid" with a value of V Aiken 0.9469, and the Language aspect is declared "valid" with a value of V Aiken 0.9219. Overall, aspects of Prisma's e-module were declared "valid" with an Aiken V value of 0.942. Prisma's e-module received a practicality test score of 86% from students and 96% from educators. Suggestions for further research can develop applications that can be accessed by devices with Android and iOS programming bases so that all students can install applications developed on their respective devices. This research aims to improve the character of Pancasila students in the dimensions of critical and independent reasoning; further research can develop e-modules containing six dimensions of Pancasila student character.

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THE INTENTION OF GENERATION Z TO USE MOBILE LEARNING: THE ROLE OF SELF-EFFICACY AND ENJOYMENT

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ABSTRACT

The Technology Acceptance Model (TAM) is a concise and efficient predictive model used to explain the acceptance of m-learning technology. However, several studies have shown that TAM cannot fully explain the acceptance of m-learning among Generation Z. This study aims to formulate TAM as a model of m-learning acceptance for Generation Z. TAM developed based on self-efficacy and enjoyment is expected to explain the behavior of Generation Z in accepting m-learning. This study uses a survey approach, utilizing PLS-SEM as an analysis tool and primary data collected through questionnaires. Participants in this study were 563 students who used m-learning (on class application) at the Muhammadiyah University of Purwokerto, Indonesia. The results contribute to the formulation of a successful m-learning implementation model for Generation Z. These results provide empirical support indicating that self-efficacy and perceived enjoyment cause them to use m-learning now and in the future. Generation Z, who grew up in the digital era, has a high level of proficiency in using technology. Self-efficacy increases user optimism. They are confident in their ability to complete tasks and solve problems when using m-learning. Enjoyment can increase the belief that m-learning is user-friendly and useful. The results of this study support the theory of self-efficacy which states that user beliefs serve as the best predictors of their behavior in using technology in mobile learning.

Keywords: Technology acceptance model, mobile learning, Generation Z, self-efficacy, enjoyment, intention to use.

INTRODUCTION

The inclusion of ICT in educational institutions and the use of mobile learning (m-learning) are crucial in the era of the Industrial Revolution 4.0 and Society 5.0 (Weeden & Cornwell, 2020). The term ICT (Information and Communication Technology) is a synonym for digital technology, or all forms of technology used to store, display, process, transmit, share, or exchange information via electronic means (Nikolopoulou, 2022). IR 4.0 is a stage of technological development that develops vital interactions between humans and machines. IR 4.0 has changed the landscape of educational innovation, driven by artificial intelligence and digital physical frameworks that make human-machine interfaces more universal (Shahroom & Hussin, 2018). Meanwhile, Society 5.0 is a societal structure built to realize a prosperous, human-centered society, where economic development and solving social challenges can be achieved, and people can enjoy a high quality of life actively and comfortably (Fukuyama, 2018).

Mobile learning (m-learning) is an educational and learning activity through mobile technology that includes wireless networks, the Internet, mobile devices, and e-learning applications so that learning can be done anywhere and anytime (Danish & Hmelo-Silver, 2019; Alowayr & Al-Azawei, 2021). M-learning used effectively, will encourage autonomous learning (Cheung et al., 2021). This is also an efficient learning strategy that allows students to utilize their academic abilities related to the learning process (Zimmerman, 2013). M-learning can meet students' needs, speed up search and access to information, mobility of the learning environment, faster and more timely interactions, develop learning motivation, and make it easier for students to learn. M-learning has become an important learning activity, because it is easily accessible (available), low-cost, easy to use, and interactive (Kumar et al., 2019; Aljawarneh, 2020). It creates self-directed learning, which will be used in the future (Al-Emran et al., 2020). Its use requires readiness, optimism, and self-directed learning from lecturers and students (Lin et al., 2016).

The successful implementation of m-learning relies on user willingness and acceptance (Almaiah & Alismaiel, 2019). Both lecturers and students, as well as education providers, need to adapt to this technology to ensure high-quality learning experiences (Herliandry et al., 2020; Fadli et al., 2020). Failure to utilize m-learning can hinder the realization of its advantages and benefits (Almaiah & Al-Khasawneh, 2020). Therefore, it is important to resolve any issues so that its use is effective (Saade & Kira, 2007).

Several studies examine the failure of m-learning implementations (Teo et al., 2020; Almaiah & Al-Khasawneh, 2020; Al-araibi et al., 2019). In developing countries, it has been reported that 45% of projects have failed, 40% have partially failed, and only 15% have succeeded. The primary cause of failure is often the discomfort and lack of confidence experienced by users when using m-learning (Al-Araibi et al., 2019). This failure represents a loss for educational institutions.

The Technology Acceptance Model (TAM) is commonly used to study the success of m-learning. TAM explores user intentions and actual usage (Mailizar et al., 2021; Ritter, 2017). TAM has been used as an effective and concise model to explain the acceptance of m-learning technology. This model has been empirically validated and replicated in various studies (Teo et al., 2019; Mohammadi, 2015). TAM focuses on user intentions and actual usage behavior, providing insight into factors that influence technology adoption. However, several studies have questioned the ability of TAM to explain the acceptance of m-learning, especially for Generation Z (Li et al., 2021; Sukendro et al., 2020). This study argues that additional factors should be included in the TAM framework.

This research proposes a model of m-learning success. This research uses a sample of mostly m-learning users from Generation Z. According to Gupta & Pathania (2021), Generation Z is known to be adaptable and skilled in using technology. This generation has a high interest in new technology and often utilizes digital technology. They often access information via the internet using their smartphones. This generation also has high self-efficacy and enjoyment when using m-learning (Lai et al., 2021; Ching-ter et al., 2017). This research develops a technology acceptance model (Davis, 1989) using self-efficacy and enjoyment as variables that influence m-learning acceptance. This model can be used for different technology acceptance and age ranges. However, because they have different characteristics, other results are possible (IBIII et al., 2023).

Many studies have investigated factors influencing the successful adoption of m-learning and have identified enjoyment as a significant determinant (Wang et al., 2020; Wang et al., 2019; Ching-ter et al., 2017; Jiang et al., 2021; Al-Gahtani, 2016). Enjoyment refers to the intrinsic motivation and pleasure derived from using m-learning which positively influences the willingness to accept and utilize it (Wang et al., 2019; Ching-ter et al., 2017). When users enjoy the experience, they tend to tend to perceive the technology as more usable and convenient.

However, there are research findings on the impact of enjoyment on m-learning usage that have been inconsistent. Some studies support the notion that enjoyment influences m-learning usage positively, while others have found no significant effect (Wang et al., 2020; Jiang et al., 2021; Al-Gahtani, 2016). It is important to consider these differing perspectives and further investigate the relationship between enjoyment and m-learning adoption to gain a comprehensive understanding of the factors influencing its success.

Indeed, self-efficacy is another key factor that influences the success of m-learning (Thongsri et al., 2020). Self-efficacy refers to users' belief in their capabilities to effectively use the system. Higher levels of self-efficacy have been found to positively affect user satisfaction (Hammouri & Abu-Shanab, 2018). However, some studies have reported no significant impact of self-efficacy on the success of m-learning (Kosycheva & Tikhonova, 2021). Further research is needed to explore and reconcile these divergent findings regarding the relationship between self-efficacy and m-learning adoption. The results of this study are expected to be a reference for developing a successful model of m-learning implementation, especially for Generation Z.

METHOD

Research Design

The research design used is a survey that uses quantitative measurements. Component-based Structural Equation Modeling (SEM) using Partial Least Square (PLS) is the analytical approach adopted in this research. PLS-SEM is used to explain the relationships between latent variables in complex models. SEM was used to evaluate the proposed research model. The PLS-SEM model consists of two submodels: a measurement model (outer) and a structural model (inner).

Participants

The population of this study has used students as m-learning users at the Muhammadiyah University of Purwokerto (UMP). UMP is one of the universities in Indonesia, which uses offline and online methods. The m-learning application "onclass" has been implemented at UMP since 2020. Other populations can be studied in further research.

Participants are undergraduate and postgraduate students of UMP. Their ages range from 20 - 35 years. Participants are generally Generation Z who are the internet generation or digital natives. They are considered very potential in utilizing technology, especially for the implementation of m-learning.

Data Collection

Determination of the minimum sample size using power analysis (Hair et al., 2022). Sampling using the random sampling method. Students filled out the questionnaire using a Google form. Data was collected for 1 month (February 2024), so the number of participants collected was 563 students. The time of data collection varies, the study used a non-response bias test to prevent sample bias. The test uses the common method bias (Podsakoff et al., 2003), using the highest full collinearity variance inflation factor (FCVIF) test (Kock, 2015). Based on the test results, it is known that the highest FCVIF in the research model is less than 3.3. This shows that the bias that occurs is not a significant problem.

This research uses latent variables, namely perceived enjoyment, self-efficacy, usefulness, ease of use, and m-learning usage. Table 1 presents the questionnaire statements that are indicators for measuring the variables. The data collected is primary data, and the instrument used for data collection is a questionnaire, using a 1-5 Likert scale (from strongly disagree to strongly agree). The average indicator score is categorized into five levels from 1 to 5 which indicates very low to very high levels. This research also used a questionnaire with open questions for respondents.

Based on Table 1., there are 17 items from 5 constructs in the conceptual research model (self-efficacy, enjoyment, perceived usefulness, ease of use, and m-learning usage). Five items are used to measure self-efficacy. This indicator refers to Hammouri & Abu-Shanab (2018) and Mutahar et al. (2018). Enjoyment

is calculated using three indicators referring to Al-Gahtani (2016) and Ching-ter et al. (2017). Perceived usefulness, ease of use, and m-learning usage are measured using three indicators each referring to Davis (1989) and Al-Fraihat et al. (2020).

Table 1. Operational definition and measurement of variables

Variables	Indicators
Self-efficacy (Hammouri & Abu-Shanab, 2018); (Mutahar et al., 2018)	Confidence can use m-learning through the user guide
	Confidence can solve problems using m-learning
	Confidence can use m-learning even though it has never been used before
	Confidence can use m-learning because there is a tutorial.
	Confidence can use m-learning with learning in a short time
Enjoyment (Al-Gahtani, 2016)"ISSN":"22108327","abstract":"E-learning has become progressively more vital for academia and corporate training and has potentially become one of the most significant developments and applications in Information Technologies (ITs; (Ching-ter et al., 2017)	Using m-learning is comfortable
	Enjoyment of using m-learning
	Using m-learning happily
Perceived Usefulness (Al-Fraihat et al., 2020); (Davis, 1989)	The use of m-learning causes learning to be more effective and efficient
	The use of m-learning causes increased activity in learning.
	The use of m-learning facilitates the achievement of learning objectives
Perceived ease of use (Al-Fraihat et al., 2020); (Davis, 1989)	Ease of learning m-learning
	Ease of operating m-learning
	Ease of becoming proficient with m-learning
M-learning Usage (Al-Fraihat et al., 2020); (Davis, 1989)	Frequency of using m-learning
	Regular use of m-learning
	Dependence on the use of m-learning in studies

Validity and Reliability

The measurement model in the PLS-SEM model is tested to assess the quality of the indicators. Evaluation is used to test the validity and reliability of indicators of research variables. Significance criteria for factor loading tests, average variance extracted (AVE), composite reliability (CR), and Fornell-Larcker criteria (Hair et al., 2022).

Data Analysis

The model developed in this study, as in Figure 1, has seven hypotheses. The hypothesis is formulated that partially perceived usefulness and ease of use have a positive effect on m-learning usage. Another hypothesis is that self-efficacy and enjoyment have a positive effect on perceived usefulness and ease of use.

The analysis technique used is component or variant-based Structural Equation Modeling (SEM) using Partial Least Square (PLS). PLS-SEM is used to explain the relationship between latent variables. We are using PLS-SEM to estimate variable relationships with complex models (Hair et al., 2022).

The PLS-SEM model constructed comprises two sub-models: the structural (inner) model and the measurement (outer) model. The structural model illustrates the relationship between latent variables whether they are exogenous or endogenous. According to Hair et al. (2022), structural model evaluation is used to test the coefficient of determination (R^2), effect size (f^2), and the significance of the path coefficient. Hypothesis testing uses the significance of the path coefficient (p-value less than 0.05).
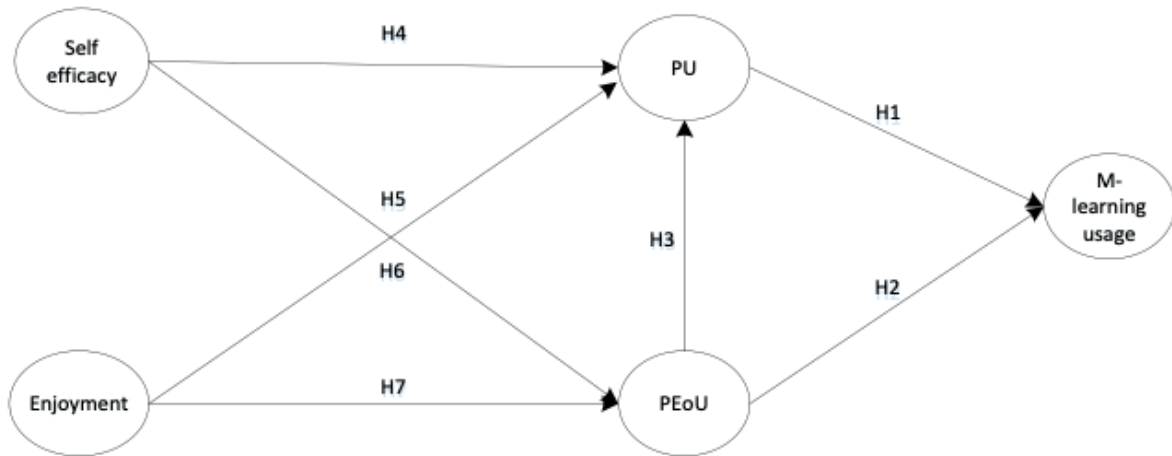
Figure 1. M-learning success model

Based on the phenomena and review of previous research results, a model was proposed as in Figure 1. The hypotheses formulated in this research are:

H_1: Perceived usefulness has a positive effect on m-learning usage.

H_2: Perceived ease of use has a positive effect on m-learning usage.

H_3: Perceived ease of use has a positive effect on perceived usefulness.

H_4: Self-efficacy has a positive effect on perceived usefulness.

H_5: Self-efficacy has a positive effect on perceived ease of use.

H_6: Enjoyment has a positive effect on perceived usefulness.

H_7: Enjoyment has a positive effect on perceived ease of use.

FINDINGS

Demographic Profile and Characteristics of Participants

The demographic profile and characteristics of the participants are presented in Table 2.

Table 2. Demographics of participants' profiles

Characteristics	%
Gender	
Female	69.02
Male	30.98
Age	
<30 years old	92.45
≥30 years old	7.35
Times to use m-learning	
≤ 3 years	81.18
> 3 years	18.82

Table 2 shows that there were 69.02% females and 30.98% males among the 563 participants. Most participants have used m-learning for less than 3 years (81.18%), while those who have used it for more than 3 years are 18.82%. Participants are undergraduate and postgraduate students of UMP. Their ages range from 20 - 35 years. They are Generation Z (92.45%), with users under 30 years old (born in 1995 or later). This generation is known to have a high interest in new technology and often utilizes digital technology. They are the first digital generation, use a lot of communication technology, and are always connected to the world. They are often and familiarly interacting with the web, internet, smartphones, laptops, and digital media, so they are more adaptable and skilled in using m-learning (Gupta & Pathania, 2021; Szymkowiak et al., 2021). Generation Z has diverse learning styles. They also have a lot of knowledge and experience in using information technology and information systems. They are very participative, proactive, and productive in the use of IS (Szymkowiak et al., 2021).

Validity and Reliability

Validity and reliability testing using measurement model test. The measurement model test uses outer loading, CR, AVE, and Fornell-Larcker values. The results of validity and reliability testing are presented in Tables 3 and 4.

Table 3. The validity and reliability (AVE, CR, and outer loading)

Variables	AVE	CR	Indicators	Outer Loading	
				Original	p-value
Self-efficacy	0.57	0.87	SE1	0.72	0.00
			SE2	0.71	0.00
			SE3	0.75	0.00
			SE4	0.86	0.00
			SE5	0.71	0.00
Enjoyment	0.81	0.93	E1	0.93	0.00
			E2	0.89	0.00
			E3	0.87	0.00
PU	0.70	0.88	PUI	0.83	0.00
			PU2	0.86	0.00
			PU3	0.78	0.00
PEoU	0.68	0.87	PEoU1	0.83	0.00
			PEoU2	0.86	0.00
			PEoU3	0.78	0.00
M-learning usage	0.46	0.52	Usg1	0.83	0.00
			Usg2	0.84	0.00
			USg3	0.81	0.00

Table 4. The discriminant validity (Fornell-Larcker criterion)

Variables	M-Learning usage	Enjoyment	PEoU	PU	Self-efficacy
M-Learning usage	0.83				
Enjoyment	0.52	0.89			
PEoU	0.51	0.48	0.83		
PU	0.49	0.52	0.59	0.94	
Self-efficacy	0.46	0.52	0.52	0.37	0.75

The measurement model test results show the outer loading value above 0.7, p-value below 0.05, CR above 0.7, and AVE above 0.5 (Table 3). The Fornell-Larcker value for each variable is higher than the other variables (Table 4). Based on these findings, it can be concluded that the measurement model meets the criteria for validity and reliability. Thus, all indicators used in this research reflect latent variables.

Data Analysis

Descriptive statistics are used to describe the characteristics of research variables. Table 5 provides a summary of participants' responses regarding self-efficacy, enjoyment, perceived usefulness, ease of use, and actual use of m-learning.

Based on Table 5, self-efficacy, enjoyment, perceived usefulness, ease of use and actual use of m-learning obtained an average score for all indicators ranging from 3.41 – 4.20, including in the high category. Users show high self-efficacy in utilizing m-learning. They quickly adapt to m-learning systems with the help of user guides, training, or tutorials, even when they have no previous experience. They also have the confidence to solve any problems encountered while using it.

Users feel happiness and comfort when using m-learning, which influences perceived usefulness and ease of use. Users consider m-learning to be a valuable tool that increases the effectiveness and efficiency of online learning. It functions as an alternative learning media that users need. Overall, users feel that using this application facilitates the learning process because m-learning is easy to learn and operate. As a result, they believe it is easy to become proficient in using m-learning.

Table 5. Recapitulation of participants' responses

Variables	Indicators	Scores	Average
Self-efficacy	SE1	4.03	
	SE2	3.98	
	SE3	4.11	4.02
	SE4	4.09	
	SE5	3.87	
Enjoyment	E1	3.97	
	E2	4.09	3.98
	E3	3.89	
Perceived Usefulness	PU1	3.38	
	PU2	4.31	3.93
	PU3	4.11	
Perceived Ease of Use	PEoU1	4.24	
	PEoU2	4.24	4.21
	PEoU3	4.16	
M-learning usage	Usg1	3.96	
	Usg2	4.12	4.01
	Usg3	3.95	

The average score for actual use of m-learning is also in the high category. Both students and lecturers consistently use the application during m-learning. They rely on the application to fulfill all their learning-related tasks and assignments. The application seamlessly integrates their tasks and work processes.

The structural model illustrates the relationship between latent variables whether they are exogenous or endogenous. The evaluation of the structural model encompasses tests for the significance of path coefficients, the coefficient of determination (R^2), and the effect size (f^2). Detailed results of the evaluation are presented in Tables 6 and 7.

Table 6. Path coefficient, statistic-t, p-value

Hypothesis	Path coefficient	t-statistic	p-value	Result
H_1	0.29	4.24	0.00	Supported
H_2	0.34	4.82	0.00	Supported
H_3	0.47	7.99	0.00	Supported
H_4	0.04	0.62	0.43	Not Supported
H_5	0.37	8.95	0.00	Supported
H_6	0.31	5.12	0.00	Supported
H_7	0.29	8.12	0.00	Supported

Table 7. The coefficient of determination (R^2) and the effect size (f^2)

Variables	R^2	f^2
Self-efficacy		0.15
Enjoyment		0.11
Perceived usefulness	0.63	0.08
Perceived ease of use	0.53	0.11
M-learning usage	0.52	

The strength and direction of influence between latent variables can be observed from the path coefficient values. According to Table 6, at the significance level α = 5%, enjoyment has a positive effect on perceived usefulness while self-efficacy does not show any effect. Both self-efficacy and enjoyment, however, do have an impact on perceived ease of use. Perceived usefulness and ease of use, in turn, affect the usage of m-learning. Additionally, perceived ease of use influences perceived usefulness.

The standard f^2 values of 0.02, 0.15, and 0.35 are used to indicate small, medium, and large effects of exogenous variables on endogenous variables (Hair et al., 2022). Referring to Table 7, it is observed that self-efficacy and enjoyment variables have a medium effect on m-learning usage, while the perceived usefulness variable has a small effect. Additionally, perceived ease of use has a medium effect on m-learning usage.

The R^2 value demonstrates the proportion of variability in perceived usefulness that can be explained by changes in the variables of self-efficacy, enjoyment, and perceived ease of use, amounting to 0.63 or 63%. It implies that variables outside the study account for 37% of the variability. Similarly, the R^2 value for perceived ease of use is 0.53, indicating that self-efficacy and enjoyment influence 53% of the variability in perceived ease of use. Furthermore, the R^2 value for m-learning usage suggests that perceived usefulness and ease of use contribute to a change in the variability of m-learning usage by 52%.

DISCUSSIONS AND CONCLUSION

The Effect of Perceived Usefulness and Ease of Use on M-learning Usage

Based on Table 6, perceived usefulness and ease of use have a positive effect on the use of m-learning. This means that when users find m-learning useful and easy to use, they are more likely to use it frequently. This research defines perceived usefulness as the potential of m-learning to facilitate learning for users. Perceived ease of use is reflected in users who are easy to operate and proficient in using m-learning. This perception is a motivating factor to continue using m-learning. This research states that users who have a high perception of the usefulness and ease of use of m-learning applications tend to use them more often.

Usability and ease of use play an important role in influencing the acceptance and implementation of m-learning. Users feel that m-learning can be used anywhere and anytime. So, the learning becomes more efficient. They can save time and money by studying offline. The m-learning application used at UMP has also been designed to meet the needs and be user-friendly so that they feel comfortable using it. This causes them to use it regularly and will continue to use it in the future.

User-friendly and easy-to-implement m-learning design increases users' ability to learn how to use it and increases their willingness to adopt it. When users find m-learning easy to use, this positively influences their willingness to utilize it. Simple and accessible m-learning design with interactive functions contributes to user comfort and dependability on the system, thereby leading to continued use.

M-learning that is easy to use will increase the user's proficiency in using it. Perceived ease of use directly influences perceived usefulness. The easier it is to use m-learning technology, the more users will experience its benefits in supporting their learning. In addition, when users find m-learning easy to use and useful, this will encourage them to continue using it. These findings are consistent with Li et al. (2021); Ang et al. (2021); and Baber (2021) that explained if m-learning is too complicated and users have negative experiences, they may avoid or refuse its use.

This study found that students' perceptions that m-learning causes learning to be more effective and efficient had an average value of 3.38, which is quite sufficient. The average perceived usefulness score was high, but they felt that the use of m-learning applications was not optimal for improving their understanding and skills. They understand learning materials better when using offline learning methods. This is possible because the technological devices (such as laptops, smartphones, or other gadget specifications and internet speed) they use are inadequate (Asghar et al., 2023; Asgari et al., 2021). Lecturers and students who use m-learning have the perception that m-learning and offline learning are the same except for the media. It is different. In offline classes, lecturers find it easier to understand student behavior. As for m-learning, lecturers must design learning tools that motivate and encourage active participation from students (Bao, 2020; Abduljawad & Ahmad, 2023).

Nikolopoulou (2022) stated that offline and mobile learning have different characteristics. Offline learning makes it easier to create closeness and interaction with lecturers, as well as active student participation. However, the problem that occurs is limited time and place. The benefits of using m-learning include flexibility in time and place, as well as familiarity with digital technology. Meanwhile, m-learning problems are related to more complex technical usage and a lack of social interaction between lecturers and students.

Currently, the role of m-learning cannot completely replace offline learning. This learning method is still in its early stages of development and there are still many problems that need to be resolved. Many higher education institutions have failed to achieve the expected benefits of this system (Kumar & Chand, 2018; Almaiah et al., 2020). Some studies even report a decline in acceptance rates among students (Alrawashdeh et al., 2020; Almaiah & Al Mulhem, 2018). Hybrid or blended learning is an alternative learning that combines offline and m-learning (Lee et al., 2022; Li, 2022).

The Effect of Self-efficacy on Perceived Usefulness and Ease of Use

Table 6 shows that self-efficacy affects perceived ease of use but not usefulness. The path coefficient shows a positive relationship (p-value = 0.00) indicating that the higher the self-efficacy, the greater the perceived ease of use. Since the Covid-19 pandemic occurred, in 2020, Universitas Muhammadiyah Purwokerto (UMP)

has implemented m-learning as an alternative learning solution that can be done anywhere and anytime. The success of its implementation depends on the willingness and self-efficacy of the user. Self-efficacy acts as a predictor that influences the ease of use of m-learning. Self-efficacy refers to users' beliefs about their ability to use m-learning effectively. As seen in Table 3, m-learning users show high self-efficacy. This belief makes users optimistic and confident in their ability to complete tasks and solve learning problems. Users with high self-efficacy increase their confidence in their abilities and predictions, thus opening their minds to relevant actions. Based on Table 2, it is known that the respondents are dominated by Generation Z. They have high motivation and curiosity in using technology. These conditions play an important role in increasing self-efficacy. Motivated students will spend more time studying. This will increase their self-confidence in using m-learning. Users with high self-efficacy feel their ability to use m-learning effectively. Users get guidance and tutorials on using m-learning. This will increase their self-confidence and self-efficacy in operating it. Users who have previous experience with m-learning can also increase their self-confidence in using it. Generation Z has high self-confidence in their knowledge and skills in interacting with m-learning technology and tends to have a more positive attitude towards its use. Increasing self-efficacy can also be achieved through technical trials of using m-learning.

However, there are often problems related to the technological infrastructure used, be it hardware, software, facilities, or network capabilities. Common problems that occur when using m-learning are inadequate hardware such as laptops, smartphones, or other devices, as well as unstable internet speeds. Lack of integration between hardware and software can also cause problems in its implementation. With high self-efficacy, they try to solve these problems. This is in line with Asgari et al. (2021) and Hammouri & Abu-Shanab (2018) that people who have higher levels of self-efficacy have a positive impact on user satisfaction.

This study found that self-efficacy did not affect the perceived usefulness of m-learning. The research findings show that users have high self-efficacy and perceived usefulness towards m-learning, but perceived usefulness is not influenced by self-efficacy. Users are aware of the benefits provided by m-learning. At UMP, the implementation of m-learning has been going on for six semesters. Users have realized the benefits of flexibility because they can access m-learning from anywhere and anytime. The findings of this study are in line with Thongsri et al. (2020) and Hammouri & Abu-Shanab (2018), that self-efficacy is one of the factors that influence the success of m-learning for Generation Z.

This study also found that the effectiveness of m-learning depends on the behavior of lecturers and students. Lecturers should act as facilitators, not just provide materials through m-learning applications. Unfortunately, lecturers do not provide the right instruments to use in m-learning. Learning only relies on the delivery of materials and direct online interactions between lecturers and students. Therefore, instruments are needed that can improve students' understanding and skills independently. M-learning utilizes technology to increase the accessibility and effectiveness of learning. M-learning is also expected to create an interactive environment that encourages effective and positive learning experiences. Lecturers need to have a positive influence in building students' mindsets and behaviors towards independent learning and understanding of content through m-learning. In addition, lecturers can encourage positive attitudes towards the use of m-learning. In utilizing m-learning, lecturers must design various learning methods and tools to improve students' understanding and skills. Creative, innovative, and practical learning methods and tools are created to encourage student involvement. These instruments should encourage focus, provide feedback, and trigger student autonomy in the learning process.

Students are also expected to be more responsible in their learning. With self-awareness, they should use all the instruments and features available in the application to improve their understanding and skills. During online meetings, they and the lecturer can discuss and find solutions to problems according to the subject matter studied. These ideal conditions have not yet occurred in the implementation of m-learning at UMP. They have felt the usefulness and ease of use of m-learning as a flexible learning method, but students and lecturers do not report that the use of m-learning can improve the expected understanding and skills.

Mumford & Miller (2018) emphasize how the use of m-learning can influence users' access to feedback. M-learning has characteristics that facilitate student feedback and engagement, which should be carefully monitored. Blended learning between offline and mobile learning can help reduce potential problems. In offline learning, lecturers have better control over student behavior, allowing for more effective management.

The Effect of Enjoyment on Perceived Usefulness and Ease of Use

Table 6 shows that enjoyment has a positive effect on perceived ease of use and usability. Users who feel comfortable will feel that m-learning provides usability and ease of use. Based on Table 2, users feel high enjoyment, usefulness, and ease of use. Users who are comfortable using m-learning will find it easy to operate and useful. Enjoyment contributes to the ease and higher usability of m-learning applications. These are extrinsic motivators that can be incorporated into TAM.

The use of m-learning has been implemented for six semesters. Before using m-learning, users have received a lot of information and experience through video tutorials to familiarize themselves with its functions. Students acquire the skills necessary to use m-learning effectively. So, students have found m-learning user-friendly, useful, and beneficial.

M-learning should be designed to be visually appealing and user-friendly. This will further strengthen users' perceptions that the application is easy to use and can facilitate their learning tasks more efficiently. The user-friendly approach makes them feel enjoyment and contributes to its use. Furthermore, the findings of this study indicate that perceived enjoyment plays an important role in users' intention to use m-learning. Ease of use and perceived usefulness will increase users' intentions to adopt and continue to use m-learning now and in the future.

M-learning becomes effective if lecturers and students have the responsibility to support its success. The comfortable and attractive m-learning design makes it easy for users to adapt to various m-learning applications and platforms. This design provides a higher-quality learning experience.

This research found that self-efficacy and enjoyment influence perceptions of usefulness and ease of use, and impact actual use of m-learning. Future research is expected to develop m-learning success models by incorporating other characteristics of Generation Z. This generation is more adaptable and skilled in using technology. Thus, the m-learning model was found to be successful and appropriate for Generation Z.

This research has expanded the m-learning success model using TAM by adding self-efficacy and enjoyment variables. The success of m-learning of Generation Z can be measured through reflective indicators: including perceived usefulness, ease of use, and m-learning usage. Indicators that reflect self-efficacy include the belief that users can utilize m-learning effectively through guides and tutorials, even without previous experience and limited time. Enjoyment is reflected through feelings of joy, enthusiasm, and comfort when using it.

These findings have indicated that enjoyment is an external variable that influences perceptions of usefulness and ease of use. Generation Z has demonstrated a high level of proficiency in using technology from an early age. The existence of guides and tutorials further enriches their experience and increases their confidence in using it.

Additional findings suggest that enjoyment has a positive effect on perceived ease of use and usefulness. Enjoyment makes individuals believe that m-learning is user-friendly and offers benefits. This is an extrinsic factor that influences acceptance of technology. Motivation also plays an important role in m-learning adoption.

Even though students and lecturers have realized the usefulness and ease of use of m-learning as a flexible learning method, they have not experienced an increase in understanding of learning. Based on the results of the questionnaire, it is known that technically learning becomes more efficient when using m-learning. However, the effectiveness of using m-learning to improve learning objectives has a lower score. Lecturers and students have not reported an increase in students' understanding and skills when using m-learning. They feel that m-learning has made learning techniques easier. Lecturers should not only provide material and interact with students online but should also motivate students to learn autonomously.

M-learning is proposed to use diverse learning tools to improve students' understanding and skills. Apart from that, lecturers should prepare creative, innovative, and practical learning materials to foster student learning independence. Lecturers should develop learning tools that support students to be actively involved in learning and problem-solving discussions. M-learning must also be interactive to create an effective and meaningful learning environment. The implementation of M-learning at UMP through onclass applications has only been three years. This causes the implementation to not obtain optimal results. In this research, it is proposed that optimal learning outcomes can be done by combining it with face-to-face learning.

In further research, it is proposed to test the effectiveness of using m-learning in improving student understanding and skills. Future research can also be expanded by including additional variables, dimensions, and indicators to strengthen confidence and general acceptance of the research conducted. In addition, it is necessary to examine the key factors for the success of information systems, both internal and external, which are useful for further research.

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TEACHING SELF-REGULATED LEARNING STRATEGIES ON EFL STUDENTS IN MOOCS: A CASE STUDY IN VIETNAM

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ABSTRACT

Self-regulated learning (SRL) has been extensively explored in psychological research, particularly for its influential role in online education systems. Despite its importance, little is understood about how SRL-focused training impacts students' academic experiences. This study seeks to address this gap by examining SRL interventions within Massive Open Online Courses (MOOCs). Using a quasi-experimental design, the research involves both control and experimental groups. SRL strategy questionnaires and learner self-evaluations for speaking skills were administered before and after the training. Learning diaries were used to analyze students' application of SRL strategies in the MOOC environment, and pre- and post-tests measured the intervention's impact on speaking proficiency. Additionally, descriptive statistical analysis was conducted on the questionnaire results, complemented by thematic analysis of students' reflective journals. The findings revealed a strong positive correlation between EFL students' SRL strategy usage and their speaking course outcomes. Reflective journal analysis indicated that students tailored SRL strategies to their learning processes within MOOC contexts. The study provides practical insights for incorporating SRL training into MOOC-based learning and offers a theoretical foundation for promoting SRL across diverse educational systems.

Keywords: Teaching self-regulated learning strategies, synchronous online learning, MOOCs, higher education, Vietnam.

INTRODUCTION

Since its initial conceptualization in the 1970s, SRL has been regarded as a mechanism for self-control and self-instruction across various fields of study (Schunk & Greene, 2018). Numerous theoretical frameworks have since emerged to explore how SRL enhances the learning process. Defined broadly, SRL encompasses cognitive, metacognitive, motivational, behavioral, and emotional aspects (Panadero, 2017). Zimmerman (2000) described it as a cyclical process involving personal, behavioral, and environmental elements during learning and performance phases. This process occurs in three stages: forethought, performance, and self-reflection. Pintrich (2000) characterized SRL as students actively setting goals and employing cognitive, metacognitive, and resource management strategies to achieve those goals. This research adopts Pintrich's definition due to its applicability to MOOCs

Studies highlight the critical role of instructor support in fostering SRL, especially in promoting interactions among students and educators in online platforms (Cho & Kim, 2013; Gopez & Gopez, 2024). Meta-analyses have shown that SRL training programs significantly improve academic performance and enhance

cognitive and motivational strategies (Theobald, 2021). These programs also boost self-efficacy, directly influencing academic outcomes. However, details such as duration, resources, and delivery modes of these programs are often unclear, limiting their practical application

Within ESL/EFL education, SRL strategies have been shown to enhance language competence. For example, these strategies have positively impacted students' writing and speaking skills (Teng et al., 2020; Wijaya, 2021). Experimental studies have demonstrated that lower-proficiency students benefit more from SRL training than their higher-proficiency peers, underscoring the need for tailored approaches (Apridayani, 2022). While some argue that SRL is rooted in Western educational values, studies show that Asian students, including Vietnamese learners, can develop strong SRL capabilities with adequate opportunities (Lâp, 2008; Li et al., 2018; Tran & Tran, 2021).

In Vietnam, the Ministry of Education and Taining (2017) has emphasized the importance of self-directed learning to prepare students for the evolving demands of the workforce in the 4th Industrial Revolution in the context of the current graduates; in this regard, Vietnamese students would become self-directed by learning through open sources, such as Open Education Resources - OERs - and Open Course Ware – OCW. While research on SRL in Vietnamese higher education is growing, studies predominantly focus on specific skills. These studies focused on the impacts of SRL strategies on a specific skill, such as on writing (Mai, 2021), listening (Lem, 2019), the relationship between self-regulated English learning and self-efficacy (Ha, 2021), English major's perceived effects of SRL strategies on their learning (Tran & Nguyen, 2020), relationship between university students' self-efficacy and their English proficiency (Ngoc Truong & Wang, 2019), or SRL strategies and depression among medical students (Van Nguyen et al., 2015). This leaves a gap in understanding SRL's broader impacts. This study aims to fill this gap by exploring SRL strategies in MOOCs and their influence on EFL students' speaking performance.

Teaching students strategies for self-regulated learning is vital as it fosters their ability to manage their own learning processes (Parveen & Jan, 2023). These strategies encompass a self-guided approach through which learners apply their mental abilities to develop task-specific skills across different contexts (Nurjanah, 2023). By adopting such methods, students can minimize distractions from digital tools and enhance both their academic performance and overall learning outcomes (Wang et al., 2022). Furthermore, in the current digital era, essential skills like active learning, strategic learning methods, and critical thinking are increasingly indispensable (World Economic Forum, 2018, 2020). This underscores the necessity for students to not only gain knowledge but also master the methods for acquiring it.

An experimental study conducted by Hsu (2021) investigated the impact of self-regulated learning user interfaces (SRLUI), which support activities such as setting goals, planning tasks, self-assessment, and creating reminders, on the academic results of students enrolled in MOOCs. Findings indicated that employing SRL tools could benefit certain learners, helping them achieve improved grades. However, the research did not examine other influential factors such as prior knowledge, instructor involvement, or the quality of the course materials. Additionally, the study relied solely on self-reported pre-course questionnaires to measure self-regulated learning, a method prone to bias and inaccuracies.

This study comes into existence to meet this very purpose. Finally, the heightened emphasis on self-regulated learning at the university level presents a considerable challenge, particularly for students transitioning from high school to higher education (Vosniadou, 2020). Consequently, implementing a training program on SRL would greatly benefit these learners (Theobald, 2021). This study aims to fulfill that objective. The research questions are framed as follows:

1. To what extent do students' SRL strategies differ after being taught in MOOC-based learning environment?

2. What is the relationship between the EFL students' SRL strategies and their speaking final-course grades?

3. How do EFL students employ the taught SRL strategies in their learning in a MOOC-based learning environment?

LITERATURE REVIEW

Self-regulated Learning under the View of Social Cognitive Theory

Bandura's Social Cognitive Theory (1986) provides a framework for understanding self-regulated learning (SRL) as the result of interactions among personal, behavioral, and environmental factors. According to Schunk and DiBenedetto (2020), personal aspects encompass thoughts, beliefs, perceptions, and emotions, while behavioral elements include choices of activities, persistence, effort, performance, and the ability to adapt to surroundings. Environmental factors involve social influences, such as role models, guidance, feedback, standards, incentives, and opportunities for self-assessment.

Bandura's Social Cognitive Theory places significant emphasis on learning through observation (observational learning) and confidence in one's capabilities (self-efficacy) as essential components of SRL. Core self-regulation strategies, including setting goals, monitoring progress, and reflecting on actions, are pivotal. Similarly, Zimmerman's research (2000) complements Bandura's theory, highlighting the critical role of social environments, such as feedback and encouragement from educators, peers, and family, in fostering SRL. Collectively, these viewpoints illustrate that SRL is shaped by the dynamic interaction of mental processes, social influences, and external environments.

Zimmerman's Cyclical Phases Model of SRL

Stemming from the aforementioned social-cognitive view of SRL, Zimmerman and Moylan (2009) proposed a cylindrical model of SRL including three main phases: forethought, performance, and self-reflection. In the forethought phase, students are involved in task analysis which comprises of goal setting and strategic planning, and self-motivation beliefs, such as self-efficacy, task interest or value, and outcome expectations. The performance phase or Phase 2 involves self-control and self-observation processes, in which students will utilize cognitive, metacognitive, resource management, and motivation strategies to remain engagement in tasks and motivate themselves to complete the tasks. The third phase to the self-reflection phase includes self-performance and makes causal attributions about their academic outcomes (Zimmerman, 2000). These three phases occur in a cyclical manner (Zimmerman, 2000, 2013).

Building on the social-cognitive perspective of self-regulated learning (SRL), Zimmerman and Moylan (2009) introduced a three-phase cyclical model of SRL: forethought, performance, and self-reflection. The forethought phase involves analyzing tasks, which includes setting goals and planning strategies, as well as fostering motivational beliefs such as self-efficacy, task interest, value, and expectations for outcomes. During the performance phase, students focus on processes like self-control and self-monitoring, employing strategies for cognition, metacognition, resource management, and motivation to sustain their engagement and drive task completion. The final phase, self-reflection, involves evaluating performance and attributing outcomes to specific causes (Zimmerman, 2000). These phases function cyclically, with insights from one phase informing the next (Zimmerman, 2000, 2013).

This model offers a detailed framework for understanding SRL sub-processes and highlights essential strategies, such as cognitive, metacognitive, and resource management techniques, that are particularly valuable in online learning contexts (Lehmann et al., 2014). Notably, this model has been widely adopted in virtual learning environments, including massive open online courses (MOOCs) (Min & Nasir, 2020).
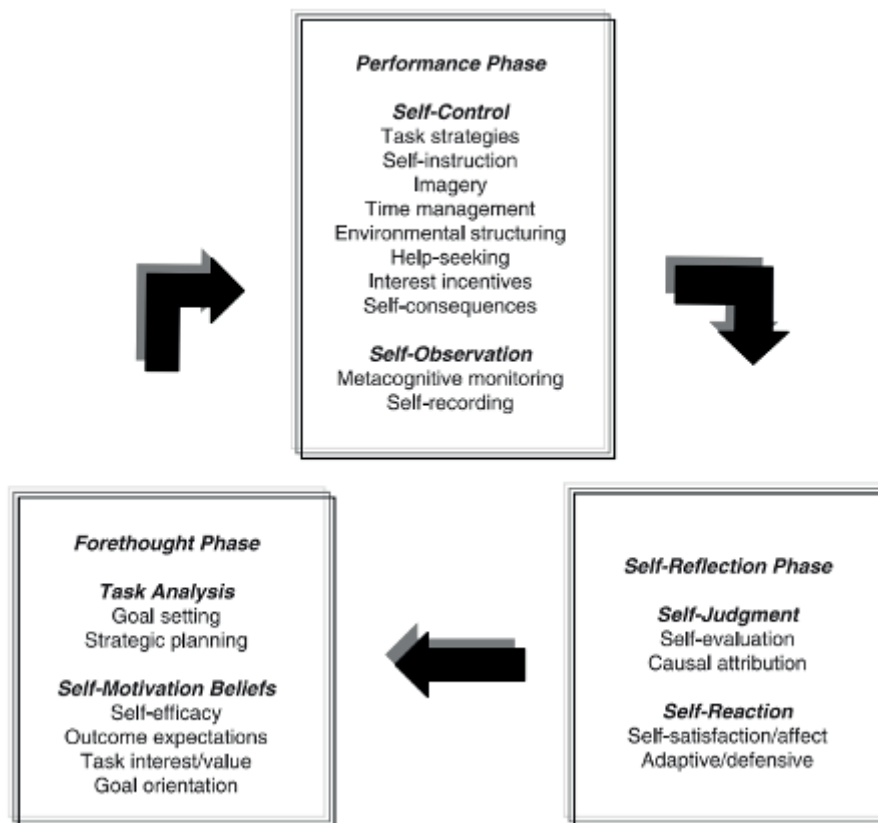
Figure 1. Cyclical phases model. Adapted from Zimmerman and Moylan (Zimmerman & Moylan, 2009)

SRL Strategies on Students' Academic Achievement in HEs

Numerous studies have examined the factors affecting academic success in higher education (HE), including peer learning (e.g., Lim et al., 2020), the use of learning platforms (e.g., Han & Shin, 2016), and self-regulated learning (SRL) strategies (e.g., Broadbent & Poon, 2015). This section emphasizes the role of SRL strategies in shaping academic outcomes in HE, which forms the core of this research.

Schneider and Preckel (2017) conducted a meta-analysis that revealed a significant link between SRL strategies and academic achievement. Among the motivational and engagement-related elements, resource management strategies—such as managing time, seeking help, and engaging in peer learning—exhibited a moderate yet meaningful relationship with performance. Effort regulation also showed a strong positive correlation. These findings align with Lim et al. (2020), who highlighted peer learning's contributions to academic success. Cognitive and metacognitive strategies were also positively linked to performance, though the association was moderate. Similarly, Honicke and Broadbent (2016) noted a medium-strength connection between self-efficacy, an essential SRL component, and academic performance.

Despite this, some research has produced mixed outcomes. For instance, Lim et al. (2020) and Cho and Heron (2015) found that certain SRL strategies did not always correlate positively with performance, indicating the influence of context and the multifaceted nature of SRL's effects.

In online education, SRL strategies are generally linked to better academic results (Broadbent & Poon, 2015; Kizilcec et al., 2017; Turan & Demirel, 2010), though supporting evidence remains limited (Goradia & Bugarcic, 2017).. Kizilcec et al. (2017) refined the Online Self-Regulated Learning Questionnaire (OSLQ) initially developed by Barnard et al. (2008) and updated by Littlejohn and Milligan (2015). Administering the questionnaire to over 4,800 participants, they found that actively setting goals and planning strategies strongly contributed to meeting course objectives. Interestingly, help-seeking behaviors were sometimes found to impede goal achievement.

In a later study (2020), Kizilcec and colleagues explored the impact of plan-making and "value relevance" interventions on course completion rates. Their results revealed no notable differences between the

interventions, suggesting that SRL initiatives may require additional context-aware support to improve their effectiveness (Kizilcec et al., 2020).

Turan and Demirel (2010) explored the relationship between self-regulated learning skills and achievement, concluding that developing SRL abilities enhances overall knowledge and transforms learners' self-efficacy. However, Mahmoodi et al. (2014) did not observe a positive relationship between SRL strategies and English achievement. Similarly, Kim et al. (2014) found only a weak relationship between cognitive strategies, metacognitive self-regulation, and student achievement in an online mathematics course. Although SRL strategies and students' perceived learning outcomes were positively related, Wei et al. (Wei et al., 2023) recommended conducting experimental studies to establish causality.

Turan and Demirel (2010) examined the relationship between SRL skills and academic achievement, concluding that improving SRL abilities boosts self-efficacy and knowledge. However, Mahmoodi et al. (2014) found no clear link between SRL strategies and English language performance, and Kim et al. (2014) reported only a weak relationship between cognitive and metacognitive strategies and success in an online mathematics course. Although SRL strategies were positively associated with perceived learning outcomes, Wei et al. (Wei et al., 2023) emphasized the need for experimental studies to confirm causal links.

Overall, SRL strategies appear integral to enhancing academic performance, as evidenced by improvements in grades, though some studies report inconclusive results. Zimmerman (1989) highlighted the context-sensitive nature of self-regulation, calling for further research into its applications across diverse disciplines and educational environments. Additionally, the causal relationships between SRL strategies and academic performance remain insufficiently explored, particularly within MOOCs and higher education settings.

Self-regulated Learning and Speaking Ability

While self-regulated learning (SRL) is considered well-established in educational psychology, its potential applications in English Language Teaching (ELT) remain underexplored (Teng, 2022). Despite the limited research, existing studies highlight its benefits. SRL has been shown to enhance academic performance (Teng, 2022), improve foreign language proficiency in flipped classrooms (Ozturk & Cakiroglu, 2021), and support better speaking outcomes in traditional learning contexts (Aregu, 2013; Uztosun, 2020).

Aregu investigated the influence of SRL strategies on speaking abilities by involving 97 students from a "Spoken and Written Communication" course at Bahir Dar University's College of Business and Economics. His study utilized surveys, tests, and reflective diaries. Meanwhile, Uztosun observed that self-regulated learners often sought opportunities to practice speaking beyond classroom settings. Ozturk and Cakiroglu examined SRL's role in flipped classrooms by comparing test outcomes between experimental and control groups, finding that the experimental group excelled in reading, writing, speaking, and grammar.

Additionally, incorporating SRL techniques with smartphone-assisted activities has been shown to significantly enhance speaking skills (Alotumi, 2021; Menggo et al., 2022). These findings are consistent with other studies that emphasize SRL's positive impact on language acquisition (Almekhlafy, 2020; Godwin-Jones, 2017).

These studies demonstrate that SRL methods can effectively improve speaking skills in both physical and online learning environments. However, many assume participants already understand or accept the value of SRL strategies for enhancing their speaking abilities. Research on training students in SRL techniques to develop speaking skills in digital settings remains scarce. This study aims to fill this gap by addressing the role of SRL training in online speaking skill development.

METHOD

Materials

The materials used for the treatment of the study are granted permission from the two authors of Self-regulation intervention (Siegle & Reis, n.d.) of the University of Connecticut. This intervention program has been validated and experimented from 1990-2013 with the participation of the University of Connecticut (1990-2013), University of Virginia (1990-2013), Yale University (1990-2006), the University of Georgia (1990-1995), Stanford University (1996-2000), City University of New York (1996-2000). For this reason,

the materials of this intervention program are adapted in the current study. Based on these materials, detailed SRL strategies lesson plans, based on Archer and Hughes' (2011) guidelines, are made to teach the experimental group.

Design

We employed an experimental design with a control group and an experimental group, lasting 5 weeks during the time students learning a MOOC in Coursera within 3 months. We evaluated the effectiveness of the treatment with pre- and post-questionnaire survey collected from both control and experimental groups, and assessed students' use of self-regulated learning strategies by having them write reflectional journals with eight suggesting questions after each time they finished learning in MOOCs.

Participants

The participants of this study, as illustrated in Table 1, include fulltime undergraduate English major students from two intact classes in a priavate university in Mekong Delta. These students meet the described criteria, such as majoring in English, having completed English preparation courses prior to their discipline and a MOOC completion (Advanced English grammar-ENG302c). More importantly, their English proficiency (based on their completed English courses scores on previous semesters) difference prior to the treatment has been proved statistically insignificant (Sig._Levene's test = 0.55, Sig.t-test = 0.136 > 0.05). In other words, the control group and the experimental group are not different in terms of their English proficiency based on their academic scores before their taking the MOOC SSC302c (Advanced Presentation Skills) in Coursera.

Table 1. Research participants

Category	Class1	Class2
Advanced Presentation Skills (SSC302c)	SRL	
(Control group)	SRL	
(Experimental Group)		
Advanced English grammar (ENG302c)	Completed	Completed
English preparation courses	Completed	Completed
Gender	Female:Male	
20:10	Female:Male	
23:8		
Age	19-20	19-20

Although random assignment of the participants to the control and experimental groups are difficult in real EFL classes, there should be, to some extent, random assignment of the group to the experimental condition or another (Gass, 2010). The current study setting happened to have two intact classes that share almost similar features, which made the use of a control and an experimental group possible in this study. Ten out of 31 participants of the experimental group were willing to write reflective journals, including two males and eight females.

Teaching SRL Strategies

The studies in the MOOC context by Kizilcec et al. (2017) and Littlejohn et al. (2016) identified seven effective approaches to SRL: goal setting, time management, self-assessment, plan, methods to approach a task, elaboration, and help-seeking intention. However, using the tool developed from these previous studies, Jansen et al. (2017) identified that two persistence and environmental structuring were also effective in assessing the SRL strategies of students in MOOCs. As a result, SRL strategies used in this study would be the integration of all these findings.

The teaching of nine Self-regulated learning strategies was conducted on the experimental group who has been experiencing learning in two MOOCs in a private university in the Mekong Delta, Vietnam. All lessons were conducted online via Google Meet. The instructor, also the researcher of the present study, followed the guidelines for explicit instruction developed by Archer and Hughes (2011). To them, the structure of a typical explicit lesson includes three parts: opening, body, and closing. In particular, the opening section should get students ready to learn new skills or contents; the body of the lesson includes three steps, namely modelling, prompted or guided practice, and unprompted practice. The closing section should be a summary of key points of the lesson in an interactive way, such as posing questions related to the lesson contents for students to answer.

Research Instruments

Closed-ended questionnaires and reflective journals were used for data collection. The questionnaire-surveys comprise two sections. Section 1 includes the participants' demographic information, and Section 2 includes 47 items related to SRL strategies adapted from previous studies. In particular, the items related to goal setting, environment structuring, time management, help-seeking, and self-evaluation were adapted from (Barnard et al., 2009), items involved in task strategies, strategic planning, and elaboration were adapted from (Kizilcec et al., 2017), and those relevant to students' persistence strategies and academic achievement were adapted from Jansen et al. (2017) and Ejubovic and Puska (2019).

In order to examine if the students' academic scores increase or not after the treatment, two of my colleagues, who have been working as English teachers for almost ten years in universities and have experienced in grading oral exams since 2017, were invited to be the examiners for a pre-test which was performed by the experimental group. The reliability of their grading was tested using Paired Samples Test. The results are presented below:

Table 2. Inter-rater reliability of Pre-test speaking scores of the experimental group

| | | Paired Differences | | | | | | | |
| | | | | 95% Confidence Interval of the Difference | | | | | |
		Mean	Std. Deviation	Std.Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Exp. group	Examiner1a Examiner1b	-.10032	.46787	.08403	-.27194	.07129	-1.194	30	.242

The sig. = 0.242 > 0.05 means that the mean grading scores of EL1705 by the two examiners were not different. This means that the students' pre-test scores can be used to compare with their end-course (or post-test) scores.

The reflective journals suggested eight open-ended questions, such as "What SRL strategies did you apply in your learning in MOOCs for the subject SSC302c?", "What worked well? Please explain.", "What did not work well? Please explain.", or "What will you change or improve for the next time learning in MOOCs?"

Data Collection and Analysis

Piloting Phase

Prior to the official data collection phase, the questionnaire was administered to thirty-one students who have studied at least one MOOC at the same university with the research participants for the purpose of piloting phase. The Cronbach's Alpha of the variables ranged from 0.714 – 0.921, indicating that the instrument was reliable for further data collection and analysis.

Table 3. Reliability Statistics of piloting phase

Variables	Cronbach's Alpha	N of Items
Time management	.896	3
Self-evaluation	.824	4
Task Strategies	.857	6
Goal Setting	.919	5
Elaboration	.889	3
Environment Structuring	.814	4
Help Seeking	.714	5
Strategic planning	.919	4
Persistence	.921	5

The Actual Research Data Collection Procedures

The questionnaires were surveyed via Google Form. Five-point Likert scale was used, starting from Strongly disagree to Strongly agree, to investigate the participants' perspectives on the issue under investigation. The pre-questionnaire survey was conducted before the teaching of SRL strategies, while the post-survey was performed after the participants sat the end-course exam. The students were also asked to write reflective journals after each time they study in MOOCs to reflect on how they have applied the taught SRL strategies to their learning in MOOCs.

A correlation analysis approach in SPSS 25 was utilized for the questionnaires, and thematic analysis was employed to interpret data from students' reflective journals. This study would employ a process of six steps to analyze data, generate codes, and create themes recommended by Braun and Clarke (2006, pp. 87–93), namely familiarizing with data, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and producing the report.

ANALYSIS AND FINDINGS

Instrument Reliability: Pre-survey and Post-survey

Table 4. Measurement Model Parameter Estimation

Dimensions	Pre-survey	Post-survey
Goal-setting	0.735	.826
Environmental structuring	.818	.793
Task strategies	.846	.856
Time management	.869	.852
Help-seeking	.822	.724
Self-evaluation	.738	.742
Elaboration	.858	.824
Strategic planning	.832	.795
Persistence	.910	.862
Academic performance	.724	.779

Table 4 indicated the internal consistency reliabilities of the pre-survey and post-survey were ensured (Cronbach's Alpha > 0.7, Hair Jr, et al., 2021).

Research question 1: To What Extent do their SRL Strategies Differ after being Taught in MOOC-based Learning Environment?

This result of the Test of Normality (Table 5) of the survey data indicates that the scores of SRL strategies were not consistent, i.e., while P-values of goal setting, help-seeking, and self-evaluation were parametric or with a normal distribution (P = 0.58–0.147 > 0.05), P-values of environmental structuring, task strategies, time management, elaboration, strategic planning, and persistence ranged from 0.03–0.10, which was smaller than 0.05, indicating that the scores of these strategies did not follow a normal distribution. For this reason, Mann-Whitney can be used for mixed data distributions, including both normal and non-normal distributions (Vickers, 2005).

Table 5. Distribution of SRL strategy scores

	Tests of Normality					
	Kolmogorov-Smirnova			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
GS	.100	61	.200*	.970	61	.147
ES	.117	61	.037	.947	61	.010
TS	.119	61	.031	.943	61	.007
TM	.131	61	.010	.956	61	.028
HS	.147	61	.002	.963	61	.065
SE	.138	61	.006	.962	61	.058
EL	.142	61	.004	.946	61	.009
SP	.182	61	.000	.934	61	.003
PE	.146	61	.002	.942	61	.006

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Differences in SRL scores of the pre-survey between the control and experimental groups are demonstrated as follows:

Table 6. Pre-survey results of SRL strategies perceived by the control and experimental groups

	GS	ES	TS	TM	HS	SE	EL	SP	PE	AA
Mann-Whitney U	377.50	389.50	428.00	287.50	402.50	456.00	438.50	460.00	437.00	456.50
Wilcoxon W	842.50	885.50	893.00	752.50	898.50	921.00	934.50	956.00	902.00	952.50
Z	-1.269	-1.096	-.536	-2.597	-.910	-.131	-.387	-.073	-.408	-.124
Asymp. Sig. (2-tailed)	.204	.273	.592	.009	.363	.896	.699	.942	.683	.902

a. Grouping Variable: Group

Table 6 indicated that there is no difference in students' perceived values of SRL strategies in their learning in MOOCs, except for time management strategy (p = 0.009 < 0.005). In particular, the students of the experimental group had higher perceived values of time management than the control group (Mean rank = 36.73 vs. 25.08).

Table 7. Perceived values of time management between two groups (Mann-Whitney Test)

SRL strategy	Group	N	Mean Rank	Sum of Ranks
Time management	Experimental group	31	36.73	1138.50
	Control group	30	25.08	752.50
	Total	61		

However, their perceived values of SRL strategies have changed after the teaching of SRL strategies to the experimental group were conducted. Differences in SRL scores of the post-survey between the control and experimental groups were signposted below:

Table 8. Post-survey results of SRL strategies perceived by the control and experimental groups

	GS	ES	TS	TM	HS	SE	EL	SP	PE	AA
Mann-Whitney U	184.50	306.00	463.00	250.00	425.50	409.00	370.00	378.50	460.00	394.50
Wilcoxon W	649.50	771.00	928.00	715.00	890.50	874.00	835.00	843.50	956.00	890.50
Z	-4.066	-2.320	-.029	-3.137	-.574	-.813	-1.389	-1.256	-.072	-1.024
Asymp. Sig. (2-tailed)	.000	.020	.977	.002	.566	.416	.165	.209	.942	.306

a. Grouping Variable: Group

Table 8 showed changes in students' perceptions of the values of SRL strategies to their leaning in MOOCs. Particularly goal-setting strategy, environmental structuring, and time management have differed among the control and the experimental group.

Table 9. Changes in perceived values SRL strategies between two groups (Mann-Whitney Test)

SRL strategy	Group	N	Mean Rank	Sum of Ranks
Goal-setting	Experimental group	31	40.05	1241.50
	Control group	30	21.65	649.50
	Total	61		
Environmental structuring	Experimental group	31	36.13	1120.00
	Control group	30	25.70	771.00
	Total	61		
Time management	Experimental group	31	37.94	1176.00
	Control group	30	23.83	715.00
	Total	61		

a. Grouping Variable: Group

Table 9 indicated that the participants of the experimental group valued the roles of goal-setting, environmental structuring, and time management strategies in their learning in MOOCs than those from their counterparts from the control group.

The study also investigated how the control group perceived the values of SRL strategies after their three months of learning in MOOCs without being taught these strategies. Differences in SRL scores of the pre-survey and post-survey of the control group were measured as follows:

Table 10. Pre-survey and post-survey results of SRL strategies perceived by the control

	GS	ES	TS	TM	HS	SE	EL	SP	PE	AA
Mann-Whitney U	447.00	437.00	426.00	410.00	416.00	444.00	417.50	438.50	423.00	438.00
Wilcoxon W	912.00	902.00	891.00	875.00	881.00	909.00	882.50	903.50	888.00	903.00
Z	-.045	-.194	-.357	-.599	-.505	-.089	-.486	-.172	-.401	-.179
Asymp. Sig. (2-tailed)	.964	.846	.721	.549	.614	.929	.627	.864	.689	.858

a. Grouping Variable: Group

Table 10 indicated that their perceptions of SRL strategies have not changed over time.

Differences in SRL perceived scores of the pre-survey and post-survey of the experimental group were measured as follows:

Table 11. Pre-survey and post-survey results of SRL strategies perceived by the experimental group

	GS	ES	TS	TM	HS	SE	EL	SP	PE	AA
Mann-Whitney U	288.50	274.00	472.00	347.50	436.50	431.00	389.50	415.50	475.50	430.50
Wilcoxon W	784.50	770.00	968.00	843.50	932.50	927.00	885.50	911.50	971.50	926.50
Z	-2.718	-2.940	-.120	-1.902	-.624	-.702	-1.299	-.923	-.071	-.709
Asymp. Sig. (2-tailed)	**.007**	**.003**	.904	.057	.533	.483	.194	.356	.943	.478

a. Grouping Variable: Group

Table 11 showed that their perceptions of the values of SRL strategies (goal-setting and environmental structuring) in their learning in MOOCs have changed. In particular, they valued the roles of these two strategies more after being taught these strategies and experienced them in their learning in MOOCs in three months (Table 12 indicated the higher perceived values of these strategies).

Table 12. Changes in perceived values SRL strategies of the experimental group (Mann-Whitney Test)

SRL strategy	Group	N	Mean Rank	Sum of Ranks
Goal-setting	Ex.Group_pre-survey	31	25.31	784.50
	Ex.Group_post-survey	31	37.69	1168.50
	Total	62		
Environmental structuring	Ex.Group_Pre-survey	31	24.84	770.00
	Ex.Group_post-survey	31	38.16	1183.00
	Total	62		

From the results and analysis above, it can be concluded that the intervention program of SRL strategies to students of English major have brought positive changes in their perceptions of the roles of SRL strategies in their learning in MOOCs, especially three SRL strategies such as goal-setting, environmental structuring, and time management.

Research Question 2: What is the Relationship between the EFL Students' SRL Strategies and their Speaking Final-course Grades?

In order to evaluate if there are any changes in the grades of the participants before and after the treatment, a comparison of the scores of the pre-test and the post-test (i.e., their end-course exam) was performed, in which the pre-test was carried out prior to the participants' commencement of their learning in MOOCs,

and a post-test was taken from their grades of the end-course exam. However, to ensure the inter-rater reliability of the two examiners, the Wincoxon Ranks Test was performed due to the skewed distribution of the students' grades.

Table 13. Inter-rater reliability of the end-course scores by two examiners

	Examiner1b - Examiner1a
Z	-1.263b
Asymp. Sig. (2-tailed)	**.207**

a. Wilcoxon Signed Ranks Test

Since Sig. = .207 > 0.05, there are no differences in grading of the two examiners.

Table 14. Differences in grades of pre-test and post-test

	Pre-test - Post-test
Z	-3.509b
Asymp. Sig. (2-tailed)	**.000**

a. Wilcoxon Signed Ranks Test

Since Sig. = .000 < 0.05, there are statistically significant differences in grades of the pre-test and post-test of the participants.

Table 15. Pre-test & Post-test results of the experimental group

Student ID	Examiner1a	Examiner1b	Pre-test	Examiner2a	Examiner2b	Post-test
Student 1	4	3.6	3.8	6.5	7	6.8
Student 2	5.5	5.7	5.6	7.3	7.5	7.4
Student 3	6.25	6.5	6.4	5	5.5	5.3
Student 4	7.5	7.5	7.5	8.75	9	8.9
Student 5	6	5.5	5.8	5.5	5	5.3
Student 6	3.75	4	3.9	6	5.5	5.8
Student 7	8	7.6	7.8	7.3	7.5	7.4
Student 8	3	2.9	3	5	5	5
Student 9	7	7.4	7.2	6.3	6.5	6.4
Student 10	5	5	5	5.5	5.5	5.5
Student 11	5.5	5.9	5.7	6	5.75	5.9
Student 12	6	6.2	6.1	6.5	6	6.3
Student 13	6	6.4	6.2	7	7.5	7.3
Student 14	6.75	6.5	6.6	7	7	7
Student 15	5.5	5.4	5.5	6.2	6	6.1
Student 16	4	4.6	4.3	6	6.3	6.2
Student 17	6	6.8	6.4	7	7.25	7.1
Student 18	5	5	5	6	6.2	6.1
Student 19	5	4.2	4.6	6.5	6.5	6.5
Student 20	3.75	3.8	3.8	6.3	6.5	6.4
Student 21	5	5.2	5.1	9	8.5	8.8
Student 22	5.5	6	5.8	6	6	6
Student 23	3.75	3.75	3.8	8.5	9	8.8

Student 24	7.25	7.6	7.4	8	8.3	8.2
Student 25	5	4.4	4.7	5.5	5.3	5.4
Student 26	3	3.5	3.3	5	5	5
Student 27	4.25	4.2	4.2	6.5	6.3	6.4
Student 28	6.25	6.8	6.5	6.5	7	6.8
Student 29	6.5	5.46	6	6.5	7	6.8
Student 30	5.5	6.5	6	7	7.5	7.3
Student 31	7	7.7	7.4	5	5.25	5.1
Average			**5.50**			**6.56**

Since the end-course speaking grades are not normally distributed (Table 16), Spearman's rank correlation was run to examine the relationships between students' end-course speaking grades and SRL strategy scores (Table 12). Details were presented below:

Table 16. Tests of Normality

	Kolmogorov-Smirnova			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
End-course Speaking grades	.106	31	.200*	.939	31	.076

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Table 17. Correlations of SRL strategies and end-course speaking grades

			GS	ES	TS	TM	HS	SE	EL	SP	PE
Spearman's rho	End-course Grades	Correlation Coefficient	.090	.242	.334	-.166	.330	.498**	.452*	.508**	.427*
		Sig. (2-tailed)	.630	.190	.067	.371	.070	**.004**	**.011**	**.003**	**.017**
		N	31	31	31	31	31	31	31	31	31

Table 17 indicated that there was a positive correlation between students' end-course speaking grades and Self-evaluation, Elaboration, Strategic Planning, and Persistence (rs=.50, n=31, p=.004 < .05, rs =.45, n=31, p=.011 < .05, rs =.51, n=31, p=.003< .05, rs =.43, n=31, p=.017 < .05 respectively).

Research Question 3: How do EFL Students Employ the Taught SRL Strategies in Their Learning in a MOOC-based Learning Environment?

The participants reported on various aspects of their learning process in MOOCs for the subject SSC302c, including their study times, study environments, whether they studied alone or with peers, and the specific SRL strategies they applied. They also reflected on what worked well, what did not work well, which SRL strategies were most useful for them when learning MOOCs, and how they planned to improve their learning in virtual environments in the future. Over time, the participants showed an evolving comprehension and application of SRL strategies such as goal setting, time management, environmental structuring, help-seeking, elaboration, self-evaluation, persistence, and task strategies. They adapted their study habits, learned from their experiences, and made adjustments to improve their learning outcomes. The reflections reveal a journey of personal growth, as they became more self-aware learners, identified strategies that worked best for them, and recognized areas for further improvement.

Based on the thematic analysis approach by Braun and Clarke (2006), we have coded the data from the participants' reflective journals, which were written in two months, and developed the following five themes:

Theme 1: Strategies for effective learning

This theme encompasses the various strategies students have employed to manage their learning in MOOCs effectively, such as goal setting, time management, and strategic planning. Students prioritized their tasks and scheduled study sessions, set specific academic goals, and employed various learning methods like mnemonic devices or summarization to enhance comprehension and retention. This theme highlights the structured approach students take towards managing their workload and achieving academic success. The following excerpts illustrate this point.

> *In this week, I had a noticeable change during my studies. In particular, I tried to apply new strategies to my learning process and diversified my problem-solving skills during my studies. For example, I learned how to prioritize important presentations in other subjects and then spend my free time studying on Coursera (Student 3)*

> *For this week, I applied the Time management strategy to organize my schedule and complete the MOOCs within the specified time as well as balance the time to meet the deadlines between SSC302c and other courses. (Student 5).*

Theme 2: Motivation and engagement

It includes students' use of elaboration and persistence strategies to maintain engagement with the material and persist through challenges.

Elaboration Strategy: students make connections between existing knowledge and new information to learn new knowledge

> *Student 8: Linking new concepts to real-life examples or to knowledge I already possess has greatly enhanced my learning process.*

> *For the task strategy, I had some methods to do well that was when I studied MOOCs, I usually summarized my knowledge and took notes on what I have learned and understood (Student 4).*

Persistence: refers to students' efforts to maintain focus and remain studying despite challenges or lack of interest.

> *The thing that I haven't done well myself is persistence. I often end up in the middle because the test is too difficult, or I don't do well on the quiz (Student 1).*

> *Student 9: Even when topics are challenging or interest wanes, I push myself to continue studying and engage with the material.*

Theme 3: Reflective and adaptive learning

This theme reflects students' capacity for self-reflection, and their willingness to adjust strategies based on effectiveness. It showcases the critical role of self-evaluation and openness to change in students' continuous improvement and learning optimization. The following excerpts demonstrate this theme:

> *Besides, after each week of study, I usually check all my knowledge and evaluate myself what I have learned after this week (Student 3).*

> *In the future, I plan to continue refining my time management skills and explore additional strategies to optimize my learning experience in MOOCs. (Student 10)*

Theme 4: Collaborative and independent learning

This theme reflects on students' approaches to learning styles, ranging from independent to collaborative study by seeking help from peers. This theme, arising from peer collaboration and feedback seeking, emphasizes the role of social interaction in the learning process. It highlights how students collaborate with

peers on assignments, and actively seek feedback from instructors and peers, underscoring the value of shared learning experiences and resource utilization in enhancing understanding and academic performance.

> Only when I have a problem with tasks, I seek help [from course mates], and we will study together (Student 6).

> As for help-seeking strategy, I sent messages to my classmates to ask for help when I did not fully understand the lesson. Sometimes, I sought clarification from my instructor as well (Student 10).

> Lately, I usually study in Coursera alone. Because I want a quiet space, and when I work or study alone, I feel it has a faster intensity than usual (Student 7).

> Usually, I go to a quiet cafe to be able to complete all the MOOCs set out. Strategy 8 is to use other sources to apply to learning, one of the most used sources I used is Google in addition to ask friends (Student 4)

Theme 5: Adaptive learning environments

Students expressed their preferences for specific study environments that support their learning habits and needs. This theme highlights the importance of a conducive learning space that varies from person to person.

> I have applied SRL strategies to learning, namely environmental structuring... For example, I often find comfortable places with less noise so that I can concentrate more (Student 1)

> Student 3: Choosing a quiet room away from distractions has significantly improved my concentration and efficiency in studying.

These themes provide an insightful picture of the participants' self-regulated learning experiences in MOOCs at tertiary level, highlighting the strategies they find most effective, the challenges they encounter, and how they adapt their learning approaches to overcome these challenges after being taught SRL strategies.

DISCUSSION

This study aims at investigating students' perceptions of the value of SRL strategies to their learning in MOOCs, and to their speaking ability in particular after being instructed in SRL strategies and exploring how the students employ these strategies by self-reporting their experiences after each time learning in MOOCs. In response to a call for an experimental study to further investigate the causal relationship between SRL strategies and learning outcomes (Wei et al., 2023), this study confirms a positive correlation between SRL strategies and students' English speaking performance, which is unsupportive of a study by (Mahmoodi et al., 2014). In Mahmoodi et al.'s study, students were surveyed about their perceived impact of SRL strategies on their English achievement. The study did not review if the students had been taught the SRL strategies before or not; hence, it is possible that their true experience in these strategies might be questionable.

Yet, this study is supported by previous studies which indicated positively significant roles of time management, peer learning, goal setting, and strategic planning in students' academic performance (Broadbent & Poon, 2015; Kizilcec et al., 2017; Lim et al., 2020; Schneider & Preckel, 2017; Turan & Demirel, 2010). In addition, the result also showed an increase in the experimental group's end-course grades after the intervention. This result is consistent with the previous research by Almekhlafy (2020), Alotumi (2021), Godwin-Jones (2017), and Menggo et al. (2022), who contend that the assistance of SRL strategies enhances students' speaking abilities.

Although the study's focus was not on motivation, the themes emerged from the Findings section, namely Motivation and Engagement and Adaptive Learning Environments, also reflect on the role of intrinsic and extrinsic motivation in students' self-regulated learning processes in MOOCs. These themes reflect on what drives students to study (i.e., persistence in learning) and how they create conducive learning environments. Whether motivated by personal ambition or external rewards (i.e., a bonus grade for early completion of the course), students find ways to minimize distractions by organizing their study spaces, manifesting the interplay between an internal drive and an external impetus in fostering effective learning habits.

The study once again emphasizes that teaching SRL strategies to university students is essential (Vosniadou, 2020), and that observational learning or modelling facilitates students' SRL (Bandura, 1986). Findings

from the research students' reflective journals also resembled the cyclical process of SRL portrayed by Zimmerman's Cyclical phases model (Zimmerman & Moylan, 2009), in which the Performance phase of Zimmerman's Cyclical model was categorized into two subphases in this study, namely "Development and Refinement of strateegies" and "Overcoming challenges and enhancing SRL". Students' SRL processes in MOOCs in this study were outlined and depicted in Figure 2 as follows:

- *Initial Phase (equivalent to the Forethought phase as in Zimmerman's model):* Students start by establishing goals, prioritizing tasks, the strategies to be used to achieve their goals, and creating environments conducive to learning, such as choosing quiet places and setting specific study times.

- *Development and Refinement of Strategies:* Over time, students refine their strategies for better time management, environmental structuring, and task strategies. They become more adept at employing sophisticated approaches like elaboration, setting clearer and more feasible goals, self-evaluation, actively seeking feedback, using additional resources like Google, and consulting peers to enhance learning efficiency.

- *Overcoming Challenges and Enhancing SRL:* Students face various challenges in MOOCs, such as maintaining motivation, persistence, dealing with distractions, adjusting study habits based on the effectiveness of the applied strategies, and trying new strategies to diversify their problem-solving skills and learn to prioritize tasks more effectively. Some recognized that passive reading and video watching were insufficient for effective information retention. In response, they made changes to their approach, such as implementing specific time slots for studying and creating a study schedule to avoid procrastination, stayed on track with the course schedule, and shifted from time management to task strategies when the former became less effective in certain contexts.

- *Relentless Improvement and Reflection (equivalent to the Self-reflection phase as in Zimmerman's model):* Through self-evaluation and self-reflection, students continuously contemplate their learning process, identifying what works well and what needs improvement. They express intentions to apply learned strategies more effectively in the future, indicating a cycle of ongoing self-regulation and enhancement of their learning experience.

These processes are illustrated in the figure below:

Figure 2. Students' SRL processes in MOOCs

This progression underscores the dynamic nature of SRL, highlighting how students actively engage with, adapt, and refine strategies to optimize their learning in MOOCs.

CONCLUSION AND LIMITATIONS

To the best knowledge of the author, this study is the first one using a randomized experimental design to examine the effects of teaching SRL strategies to EFL university students learning in MOOCs on their speaking performance. The results confirm the impact of SRL strategies, namely goal-setting, time management, environment structuring, help-seeking, self-evaluation, task strategies, strategic planning, and elaboration, on their speaking achievement and underscore the importance of teaching these SRL skills to students.

The findings of the current study add a theoretical contribution, confirming the demand for training SRL skills for students regardless of on-site or off-site learning formats. Regarding practical contribution, this study visualizes the implementation of teaching SRL strategies so that universities, educators, and instructors could consider online hands-on SRL activities and pedagogical support for students in online courses.

The current study acknowledges its limitations in terms of its incapability of unveiling students' on-the-spot activities in MOOCs and a single experimental group. Hence, the study calls for further investigation of this issue with more control and experimental groups and with a design that can capture students' SRL activities in MOOCs. This could help uncover their detailed engagement and more explanatory behaviours. Thus, appropriate scaffolding could be made upon an individual basis. Another limitation is the teacher effect because the researcher took on both roles as the researcher and teacher for the class. However, this limitation was curbed by the way that the findings and interpretations were backed with "reasoned argument" and "adequate evidence" (Denzin & Lincoln, 2018).

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INTENTION TO ADOPT INNOVATION CULTURE AMONG EMPLOYEES IN ONLINE DISTANCE LEARNING HIGHER EDUCATION INSTITUTIONS

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ABSTRACT

The objective of the study is to evaluate both direct and indirect relationships among organizational culture, attitude, intention, and adoption of the innovation culture in Malaysian ODL higher education institutions. The findings of this study are crucial for ODL institutions to maximize employee performance by adopting an innovation culture for their survival and sustainability. The research framework includes two independent variables: organizational culture and attitude, intention as a mediator, and adoption as a dependent variable. Primary data was collected through the survey questionnaire and distributed via e-mail. The study utilized non-probability purposive sampling. This study analyzed 316 questionnaires, representing an 86.5% response rate. The results support the proposed hypotheses, confirming the significant influence of organizational culture and attitude on intention. The findings show that attitude and intention significantly influence adoption. However, organizational culture does not significantly influence adoption. The intention was a critical mediator between independent and dependent variables. This study's model demonstrates high prediction relevance based on statistical analysis with PLS prediction and a validated predictability test (CVPAT). Only one direct relationship hypothesis was rejected, while the four direct and two indirect relationship hypotheses were supported. Overall, this study provides valuable insights into maximizing the adoption of an innovation culture in ODL higher education institutions.

INTRODUCTION

According to Osman (2018), higher education institutions in Malaysia that provide online distance learning (ODL) services to students face intense competition. Hence, improving student services' effectiveness, efficiency, and cost-effectiveness is needed to ensure their survival (Osman et al., 2020). The ever-changing technological landscape necessitates innovation for higher education institutions, particularly those that rely heavily on technology, such as Open and Distance Learning (ODL) institutions. Innovative activities in Open and Distance Learning (ODL) institutions can assist organizations in meeting their objectives. This necessitates innovative approaches from the leadership of ODL institutions to effect positive change and increase their market competitiveness, ultimately attracting more students to study online. Thus, Online Distance Learning (ODL) institutions must actively promote innovation to remain competitive in higher education. This may involve adapting current practices to online learners' needs, integrating new technologies or methods, or exploring new services or programs to meet their changing needs. By being innovative, ODL

institutions can succeed and provide an excellent education to a growing number of online students. In conclusion, establishing and fostering an innovative culture in ODL organizations is crucial. Despite the extensive research on innovation culture within the management discipline, educational institutions have a shortage (Fuad, Musa, & Hashim, 2022), especially in studies focusing on higher education, specifically Open and Distance Learning (ODL) institutions.

The definition of innovation is the creation of something new or a change in practice or perception (Singh & Aggarwal, 2022) where ideas, attitudes, knowledge, skills, products, or services can all be considered (Roffeei, Kamarulzaman Yusop, 2017; Roffeei, Yusop, Kamarulzaman, 2018). While the precise definition of innovation culture is ambiguous (Jucevicius, 2007), it is widely recognized as an essential component of organizational culture and management theories. Culture includes values, norms, beliefs, and assumptions, shaping individual attitudes in Distance Learning (ODL) higher education institutions. Introducing a culture of innovation at ODL is challenging because it can disrupt traditional working methods. Leaders need to prioritize communication and collaboration over hierarchical structures. Support through training and learning opportunities should be tailored to individual expertise to foster an innovative environment. Organizations that emphasize creativity in ODL recognize the importance of long-term investment. Fostering a culture of innovation in ODL institutions can sustain competitiveness, increase student enrollment, and provide exceptional educational experiences. Ensuring staff have adequate resources to stimulate creativity in ODL is vital. Incentives such as rewards for valuable ideas are needed to encourage a culture of innovation among employees. Although innovation is necessary, the culture of innovation in Malaysian ODL institutions needs improvement (Osman, Mohamad, & Mohamad, 2021). The findings of this study benefit various stakeholders, including policymakers, especially the Malaysian Ministry of Higher Education, in formulating policies for Open and Distance Education (ODL) institutions in this country. This study also helps ODL institutions in Malaysia plan strategies to increase the adoption of innovation culture, leading to an improvement in organizational culture.

PURPOSE OF THE STUDY

Despite the extensive research on innovation culture within the management discipline, educational institutions are lacking (Fuad, Musa, & Hashim, 2022), especially in studies focusing on higher education, specifically Open and Distance Learning (ODL) institutions. Although innovation is crucial for the success of higher education institutions, the culture of innovation in Malaysia's ODL institutions is not yet at the desired level, and there is a need for improvement (Osman, Mohamad, & Mohamad, 2021). Hence, this study aims to assess direct and indirect relationships between organizational culture, attitude, intention, and adoption of the innovation culture in Malaysian ODL higher education institutions.

LITERATURE REVIEW

Organizational Culture

Organizational culture is regarded as one of the most essential factors in stimulating innovative behavior among employees. A strong organizational culture will be more crisis-resistant (Scaliza et al., 2022). According to Qi and Chau (2018), organizational culture is a critical indicator for assessing an organization's overall innovation culture. The organizational factors that promote innovation are the organizational strategy, structures, and working culture (Spannari, Juntunen, Pessi & Ståhle, 2023). According to M. Hazem and Zehou (2019), organizational culture determinants that foster innovation and creativity are support mechanisms, strategy, structure, and behavior. In recent years, organizational culture has remained a critical factor in adopting an innovation culture. Recent research has demonstrated the importance of fostering innovation adoption through a positive and supportive culture. Shahzad, Xiu, and Shahbaz (2017) discovered a statistically significant positive relationship between organizational culture and innovation adoption. According to a survey conducted in the United States, perceived organizational innovativeness and cohesiveness influenced physician adoption of electronic health records and increased individual adoption (Heinze & Heinze, 2020). As a result, it is possible to conclude that organizational culture positively influences the adoption of an innovation culture (Schuldt & Gomes, 2020).

Attitude

According to previous studies, attitude and intention are significant predictors of adopting an innovation culture. Recent studies show that organizations must foster a positive attitude towards innovation to encourage people to embrace a culture of innovation. Positive attitudes will influence the decision to adopt an innovation culture. It will promote creative thinking and practices. According to the literature, for employees to come up with new ideas, they should be creative, well-prepared, leaders, and willing to take risks. It has also been determined that managers who supported and guided their employees were more innovative. Hence, manager support is critical in developing an innovation culture (Ayvaz, Akyol, & Demiral, 2019). In addition, a study of consumer attitudes and behavioral intentions in the United States, France, and China found that positive attitudes toward mobile marketing are related to positive behavioral intentions to use mobile marketing (Wells, Kleshinski, & Lau, 2012).

Intention

In creating an organization's innovation culture, intention is very important. The word "intention" refers to a person's mental and emotional attitude towards a particular behavior and how ready they are to participate. Research findings indicate a significant positive correlation between intent and innovation culture adoption. The intention to use electronic health records (EHRs) has been discovered to be one of the most important factors influencing physicians' adoption patterns (Iqbal et al., 2013). According to a study by Nassar, Othman, and Nizah (2019) on the Palestinian MoHE staff, they highly intend to incorporate ICT into their daily work and are willing to accept change. It demonstrates that behavioral intention positively mediates the effect of social influence on ICT adoption. The results of recent studies indicate that individuals who are more inclined to embrace an innovation culture are more inclined to implement such a culture within their respective organizations. In summary, intention significantly influences the adoption of an innovation culture within organizational contexts. Hence, organizations should develop a positive attitude toward innovation and foster a culture that encouraging employees to adopt new and creative ideas and practices.

RESEARCH MODEL

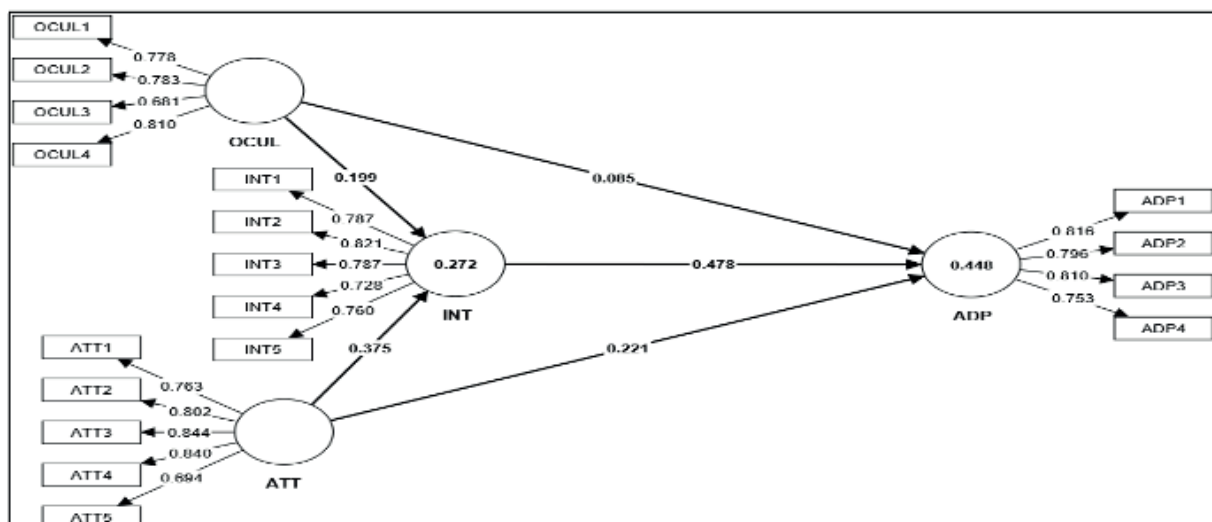Figure 1 includes the exlanation of research model.

Figure 1. Research Model

METHODOLOGY

This study examined employees in Malaysian higher education who were online distance learning employees. Primary data were collected using a survey instrument designed after a comprehensive analysis of previous studies. The survey questionnaire contained measurement items that were frequently employed and had strong reliability and validity. The selected respondents were e-mailed the survey questionnaires. This study had 18 observed variables, including independent and dependent variable measurement items. Four constructs were measured in the study, including organizational culture with four measurement items, attitude with five measurement items, intention with five measurement items, and adoption with four measurement items. The organizational culture construct comprised four measurement items, while the attitude and intention constructs consisted of five measurement items each. The adoption constructs also had five measurement items. The measurement of all constructs in this study was conducted with a 5-point Likert scale that ranged from strongly disagree to strongly agree.

Respondents

The respondents for this study were the employees in online distance learning higher education institutions Due to a lack of a sample frame, purposeful sampling, a non-probability sampling technique was used to collect the data. In this study, 59% of respondents identified as male, compared to 41% as female. Regarding age, the largest age group, comprising 42% of respondents, was 31-40 years old, followed by 41-50 years old at 35%. According to the distribution of respondents by job category, 69% of respondents were classified as academics, while 31% were classified as non-academics. The distribution of years of service revealed that 30% of respondents fell within the 11-15 years range, followed by 27% in the 6-10 years range. The highest percentage of respondents with a doctorate was 31%, followed by those with a master's degree at 26%. 86% of respondents responded positively when asked about their recommendation, while 14% responded negatively.

Data Collection and Analysis

385 questionnaires were disseminated, of which 333 were successfully collected, with a response rate of 86.5%. The response rate obtained in this study is deemed adequate for data analysis using SEM, the structural equation modelling technique. After data screening and removing outliers, 316 questionnaires were considered suitable for analysis. In this study, PLS-SEM was used to test the relationship of the proposed model, while in a pathway model, it assesses the extent to which a construct influences the target construct (Hair, Hult, Ringle, & Sarstedt, 2022). This method supports explanatory and predictive goals while assisting in developing existing and new theories (Richter, Cepeda, Roldan, & Ringle, 2016). PLS-SEM is a versatile method for estimating complex structural and measurement models (Hair, Risher, Sarsted, & Ringle, 2019). It can handle complex models with many variables and includes modelling of latent variables and their relationships in various fields and scope of studies such as information systems (Chin et al., 2020), higher education (Ghasemy, Teeroovengadum, Becker, & Ringle (2020), human resource management (Ringle, Sarstedt, & Gudergan (2020) and marketing (Liu, Yu, & Damberg, 2022), have used PLS-SEM method. Finally, as Ringle, Wende, and Becker (2022) suggested, SmartPLS4 is used in this study to estimate and model the evaluation results.

Common Method Bias

A common challenge in management research is the presence of measurement method bias, which occurs when observed variability in data is attributed to the measurement method rather than the underlying construct. This study addressed this issue by employing Harman's single-factor test to detect the presence of such bias. According to the test results, the main factor only explained 37.4% of the variance, indicating that method bias did not play a significant role in this study. As a result, the potential impact of method bias in this study can be minimal, supporting Podsakoff and Organ (1986) view that bias is not significant when the principal component explains less than 50% of the variance.

Measurement Model

This study evaluated the constructs' validity and reliability using the PLS-SEM algorithm (Hair, Hult & Ringle, 2017). The model was evaluated to establish the reliability and validity of the outer loadings. Table 1 demonstrates that all constructs exceeded the minimum threshold of 0.5 for average variance extracted (AVE), with the lowest AVE being 0.584 and the highest AVE being 0.631. This indicated that convergent validity for all constructs was established. Additionally, the composite reliability values for the constructs ranged from 0.848 to 0.893, exceeding the threshold of 0.7 recommended by Hair, Hult & Ringle (2017).

Moreover, Cronbach's alpha coefficients for all constructs ranged from 0.761 to 0.836, confirming the measures' reliability. In evaluating discriminant validity, it is crucial to analyze if the indicators of a specific construct demonstrate more significant loadings on their respective construct when compared to other constructs. The diagonal elements in Table 2 represent the loadings of indicators on their corresponding constructs. Overall, based on the cross-loadings observed in Table 2, it can be concluded that discriminant validity has been established. Key indicators show strong loadings on their constructs compared to other constructs, show clarity and can be distinguished from each other. Table 3 uses the Hetrotrait-Monotrait ratio (HTMT) to assess discriminant identifiability. This ratio compares the correlation between different constructs (heterotrait) with the correlation within the same construct (monotrait). The HTMT ratio below 0.9 indicates discriminant identifiability, indicating that the constructs can be distinguished. Examining the value of the HTMT ratio in Table 3 shows all values below 0.9. Therefore, discriminant identifiability is achieved between the constructs of ADP (Usage), ATT (Attitude), and INT (Intention), in line with the findings suggested by Henseler, Ringle, and Sarstedt (2015).

Table 1. Construct Reliability and Validity

	CA	CR	AVE
ADP	0.806 (0.765, 0.840)	0.872 (0.849, 0.892)	0.631 (0.585, 0.674)
ATT	0.850 (0.815, 0.880)	0.893 (0.870, 0.912)	0.625 (0.574, 0.675)
INT	0.836 (0.799, 0.866)	0.884 (0.861, 0.903)	0.604 (0.554, 0.651)
OCUL	0.761 (0.705, 0.805)	0.848 (0.818, 0.873)	0.584 (0.529, 0.633)

Notes: CA=Cronbach Alpha   CR=Composite Reliability   AVE=Average Variance Extracted

Table 2. Cross Loadings

	ADP	ATT	INT	OCUL
ADP1	**0.816**	0.481	0.568	0.406
ADP2	**0.796**	0.412	0.447	0.340
ADP3	**0.810**	0.425	0.480	0.350
ADP4	**0.753**	0.281	0.476	0.237
ATT1	0.302	**0.763**	0.318	0.476
ATT2	0.406	**0.802**	0.376	0.417
ATT3	0.506	**0.844**	0.507	0.596
ATT4	0.420	**0.840**	0.400	0.465
ATT5	0.340	**0.694**	0.318	0.459
INT1	0.553	0.433	**0.787**	0.390
INT2	0.494	0.403	**0.821**	0.352
INT3	0.442	0.325	**0.787**	0.318
INT4	0.469	0.362	**0.728**	0.289
INT5	0.453	0.397	**0.760**	0.306
OCUL1	0.335	0.442	0.331	**0.778**
OCUL2	0.315	0.381	0.254	**0.783**
OCUL3	0.294	0.475	0.356	**0.681**
OCUL4	0.354	0.561	0.357	**0.810**

Table 3. Hetrotrait-Monotrait (HTMT) Ratio

	ADP	ATT	INT
ATT	0.593 (0.484, 0.692)		
INT	0.751 (0.653, 0.827)	0.572 (0.450, 0.672)	
OCUL	0.534 (0.388, 0.662)	0.750 (0.651, 0.835)	0.529 (0.394, 0.647)

Note: A two-tailed percentile bootstrap test was performed using 5,000 subsamples, with a confidence interval of 5% (ranging from 2.5% to 97.5%).

FINDINGS

Structural Model

The structural model was evaluated using a methodology inspired by Hair, Hult, and Ringle (2017), which included a simultaneous analysis of pathway coefficients () and coefficients of determination (R2). The analysis employed the partial least squares (PLS) method and 5000 subsamples to determine the significance level of the path coefficients. The results of the confidence interval hypothesis tests are summarized in Table 4, including the path coefficients (beta), t-statistics, p-values, and interpretations. Hypothesis 1 (OCUL -> INT) exhibits a beta coefficient of 0.199, a t statistic of 3.181, and a p-value of 0.001. The findings support the hypothesis by demonstrating a significant positive relationship between organizational culture (OCUL) and intention (INT). Hypothesis 2 (ATT -> INT) has a beta coefficient of 0.375, a t statistic of 6.180, and a p-value of 0.000. This signifies a significant positive relationship between attitudes (ATT) and intention (INT), supporting the hypothesis. Hypothesis 3 (OCUL -> ADP) has a beta coefficient of 0.085, a t statistic of 1.388, and a p-value of 0.165. The findings indicate no significant relationship between organizational culture (OCUL) and adoption (ADP); thus, the hypothesis is not supported. Hypothesis 4 (ATT -> ADP) displays a beta coefficient of 0.221, a t statistic of 3.674, and a p-value of 0.000. The findings of this study demonstrate a significant positive relationship between attitudes (ATT) and adoption (ADP), thereby supporting the proposed hypothesis. Hypothesis 5 (INT -> ADP) exhibits a beta coefficient of 0.478, a t statistic of 9.123, and a p-value of 0.000. The findings demonstrate a significant positive relationship between intention (INT) and adoption (ADP), supporting the hypothesis. Hypothesis 6 (OCUL -> INT -> ADP) has a beta coefficient of 0.095, a t statistic of 2.977, and a p-value of 0.003. This shows that organizational culture (OCUL), intention (INT), and adoption (ADP) have a significant positive mediating relationship, which supports the hypothesis. The beta coefficient for Hypothesis 7 (ATT->INT->ADP) is 0.179, the t statistic is 4.845, and the p-value is 0.000. This supports the hypothesis by showing a significant positive mediating relationship between attitudes (ATT), intention (INT), and adoption (ADP). According to the analysis, Hypotheses 1, 2, 4, 5, 6, and 7 are supported, proving meaningful relationships between the various variables. Although there is no conclusive evidence linking organizational culture and adoption, hypothesis 3 is not supported.

Table 4 summarizes the findings of the hypothesis testing, including information on effect sizes. Regardless of the sample size, the effect size is a measurement that captures the magnitude of an effect. This study used Cohen's criteria (1992), which categorizes effect sizes as small (ranging from 0.020 to 0.150), medium (ranging from 0.150 to 0.350), or large (greater than or equal to 0.350), to evaluate the effect sizes. This study's observed effect sizes ranged from small (0.008) to large (0.120). The inflation rate of intrinsic value (VIF) values, as shown in Table 5, were all below the less strict threshold of 5. The highest VIF value recorded was 1.801. This level of collinearity enables meaningful comparisons of sizes and facilitates the interpretation of coefficients in the structural model. The recruitment process resulted in significant explained variance for the endogenous construct, as evidenced by an R2 value of 0.448 (see Figure 1). As indicated by an R2 value of 0.272, the model explained approximately 27.2% of the variance in the structure in terms of the mediator.

The assessment of the model's capacity to draw inferences and offer management suggestions was of particular significance and was conducted using out-of-sample predictive analysis. For this purpose, the PLSpredict method was utilized (Shmueli, Ray, Velasquez & Chatla, 2016; Shmueli et al., 2019). As displayed in Table 6, Q2 predictions exceeding 0 indicated that the predictions made by PLS-SEM outperformed the standard naive mean predictions. Furthermore, the PLS-SEM predictions' root means square error (RMSE) values

were lower across all nine cases than the linear model (LM) prediction benchmark. This outcome indicates that the proposed model possesses predictive capability (refer to Table 6). In addition, Liengaard et al., 2021 conducted a Cross-Validated Predictive Ability Test (CVPAT) and PLS prediction analysis to evaluate and validate their model's predictive capabilities. CVPAT uses an out-of-sample approach to average loss values and evaluate model prediction errors. This value is compared with two indicators: the average loss value of the forecast with the average indicator as a smart indicator and the average loss value of the linear model as a cautious indicator. Expected lower PLS-SEM mean loss values indicate superior predictability compared to markers, resulting in negative heterogeneity. CVPAT determines the difference in average loss value between PLS-SEM and significant markers. A negative difference indicates superior predictability. Table 7 shows the CVPAT results, which show that the average loss value of PLS-SEM was lower than the benchmarks, as evidenced by the negative discrepancy in the average loss values.

Hair, Hult, Ringle and Sarstedt (2016) and Hair, Hult and Ringle (2017) suggest utilizing Importance Performance Analysis (IPMA) to evaluate the significance and effectiveness of latent variables in explaining acceptance. The outcomes of this analysis are presented in Table 7. Regarding overall impact, intention had the most decisive influence on adoption, with a value of 0.478, followed by attitude (0.400) and organizational culture (0.180). These values represent the relative significance of each latent variable within the context of recruitment. On a scale from 0 to 100, organizational culture received the highest performance score of 66.569, while intention received the lowest score of 60.650. This indicates that social norms performed relatively well, whereas intention had the lowest value of achievement.

Consequently, despite being the most important factor in recruitment, intention demonstrated the lowest level of performance. These findings suggest that top management in ODL higher education institutions prioritize and emphasize activities to enhance employees' intentions. Concentrating on enhancing intent makes it possible to boost overall performance.

Table 4. Hypotheses Testing Results & f2

	Beta	T statistics	P values	f2	2.50%	97.50%	Decision
H1: OCUL -> INT	0.199	3.181	0.001	0.034	0.069	0.317	Supported
H2: ATT -> INT	0.375	6.180	0.000	0.120	0.249	0.488	Supported
H3: OCUL -> ADP	0.085	1.388	0.165	0.008	-0.039	0.200	Not Supported
H4: ATT -> ADP	0.221	3.674	0.000	0.049	0.101	0.337	Supported
H5: INT -> ADP	0.478	9.123	0.000	0.301	0.373	0.578	Supported
H6: OCUL -> INT -> ADP	0.095	2.977	0.003		0.034	0.158	Supported
H7: ATT -> INT -> ADP	0.179	4.845	0.000		0.111	0.256	Supported

Table 5. Hetrotrait-Monotrait (HTMT) Ratio Collinearity Statistics – Inner VIF

	ADP	INT
ATT	1.801	1.608
INT	1.373	
OCUL	1.662	1.608

Table 6. Collinearity Statistics – Inner VIF

	Q²predict	PLS-SEM_RMSE	LM_RMSE	PLS-LM
ADP1	0.237	0.637	0.643	-0.006
ADP2	0.172	0.634	0.645	-0.011
ADP3	0.184	0.692	0.692	0.000
ADP4	0.063	0.757	0.762	-0.005
INT1	0.200	0.632	0.636	-0.004
INT2	0.171	0.639	0.647	-0.008
INT3	0.112	0.681	0.688	-0.007
INT4	0.128	0.696	0.708	-0.012
INT5	0.152	0.631	0.636	-0.005

Table 7. VIF Cross-Validated Predictive Ability Test (CVPAT)

	Average loss difference	t value	p-value
ADP	-0.089	4.467	0.000
INT	-0.077	3.904	0.000
Overall	-0.082	4.789	0.000

Table 8. Importance-Performance Map Analysis (IPMA)

	Total Effect	Performance
ATT	0.400	66.491
INT	0.478	60.650
OCUL	0.180	66.569

DISCUSSIONS

This study assessed both direct and indirect relationship associations among organizational culture, attitude, intention, and the adoption of innovation culture in Malaysian Online Distance Learning (ODL) higher education institutions. The finding indicates that a strong organizational culture significantly influences employees' intention to adopt an innovation culture. ODL-HEIs should focus on cultivating a positive and innovative organizational culture by promoting collaboration, openness to change, and a shared commitment to continuous improvement. This finding is consistent with the study done by Spannari, Juntunen, Pessi, and Ståhle (2023) and Scaliza et al. (2022). Leadership should actively communicate and reinforce the institution's values and vision, emphasizing the importance of innovation in online education. The finding of hypothesis 2 underscores the pivotal role of attitude in shaping employees' intentions. The result is well supported by Ayvaz, Akyol, and Demiral (2019) findings. ODL-HEIs should implement strategies to foster positive attitudes toward innovation among Faculty and staff. This may involve providing training programs, creating awareness campaigns, and recognizing and rewarding innovative practices. Leadership should communicate the benefits of embracing innovation and create an environment encouraging risk-taking and creative thinking. The finding from this study indicates that organizational culture might not directly impact adoption; ODL-HEIs should not overlook the importance of aligning organizational culture with the goals of innovation adoption and emphasize the role of intention as a mediator.

With the presence of intention as a mediator, organizational culture has a positive and significant indirect impact on the adoption. This finding concurred with the study by Nassar, Othman, and Nizah (2019). Strategies to bridge this gap may involve refining organizational processes, communication channels, and incentives to ensure the innovation culture is embedded in daily practices. The findings of this study also suggest that intention serves as a mediator between organizational culture/attitude and adoption. This is proven to be accurate based on the findings from the study by Schuldt and Gomes (2020) and Heinze and Heinze (2020). ODL-HEIs should focus on nurturing employees' intention to innovate by providing training programs that enhance skills and confidence. Communication channels should allow for a continuous feedback loop, reinforcing the connection between intention and the organizational culture or attitude.

IMPLICATION

The implication of this study is to provide meaningful findings about the factors that influence intentions in online distance learning institutions to foster an innovation culture. The findings emphasize the importance of organizational culture and attitudes towards innovation culture. The findings contribute significantly to current knowledge and provide valuable insights and recommendations for institutions seeking to foster a culture of innovation in online learning institutions and build an environment that fosters innovation in line with changing educational needs.

RECOMMENDATION FOR FUTURE STUDY

Future comparative studies can be conducted to explore the similarities and differences in promoting a culture of innovation between online distance learning institutions and conventional institutions, providing valuable insights into the main obstacles and opportunities that online distance learning institutions face. It can be used to examine the strategies and interventions that are most effective in increasing adoption to foster the innovation culture in online distance learning institutions. In addition, future studies may also involve experimental studies or the implementation of intervention programs to assess the impact of different approaches on individuals in adopting innovative practices. The study will help to assess the impact and sustainability of the culture of innovation, including its influence on student achievement. Thus, it will improve our understanding of the most effective strategies for fostering and sustaining a culture of innovation in higher education institutions that provide online learning.

CONCLUSION

Within the context of Malaysian online and distance learning (ODL) higher education institutions, this study investigates the relationship between organizational culture, attitude, intention, and acceptance of innovation culture. Based on the study's findings, it can be concluded that organizational culture and attitude significantly impact intention. Although attitudes and intentions have a significant impact on acceptance, organizational culture does not influence acceptance in a significant way. On the other hand, it was discovered that intention is a significant mediator. These findings significantly contribute to the body of knowledge and offer direction to online learning institutions, allowing them to cultivate a culture of innovation to meet the requirements of ever-changing educational challenges.

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MODELING THE NEXUS BETWEEN STUDENTS' INTERACTION, SATISFACTION, AND ACCEPTANCE OF ONLINE LEARNING

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ABSTRACT

The proliferation of communication technologies in recent years has significantly contributed to the swift transformation of education. The outbreak of the COVID-19 pandemic at the beginning of 2020 caused further drastic changes in education, making digital transformation one of its most apparent attributes. This evolution has necessitated a call for more studies delving into students' learning experiences in a fully online learning environment, especially in nations where online education is still in its nascent stage. By adopting the structural equation modeling approach, this study was intended to examine the effects of various types of interaction on student satisfaction and the impact of student satisfaction on their behavioral acceptance of online learning. The study also aimed to examine the mediating role of student satisfaction in the relationship between interaction and perceived acceptance. The participants comprised 336 students across multiple academic disciplines from a private university in the Mekong Delta of Vietnam. A questionnaire was used for data collection. The results showed that student-teacher interaction and student-student interaction were significant determinants of student satisfaction, whereas student-content interaction and student-interface interaction yielded opposite outcomes. In addition, of the four types of interaction, satisfaction only mediated the relationships of student-teacher interaction and student-student interaction with perceived acceptance. These results emphasize the importance of fostering meaningful interaction activities between teachers and students, as well as among students themselves, in enhancing student satisfaction and further boosting the prospects of online education in today's digital world.

Keywords: Online learning, relationship, student interaction, satisfaction, acceptance.

INTRODUCTION

The integration of digital platforms in the education landscape has witnessed a remarkable surge in recent times, driven by advancements in information and communication technologies (Hockly & Dudeney, 2018; Yunus, 2018). Aware of the vast potential afforded by digital media, numerous educational institutions have availed themselves of its resources to provide students with various Internet-based educational modalities, including but not limited to distance learning and blended learning. Such a propensity is particularly pertinent, given the diverse educational needs of individuals in the current epoch of life-long learning. It can be posited that the advent of technological applications has engendered a profound metamorphosis in the education milieu, thereby affording students various avenues to acquire knowledge. This transformative paradigm has not only extended the purview of learning beyond the confines of conventional educational settings but has also facilitated the dissemination of outreach education programs to home learning

environments. By harnessing the capabilities of technology-based innovations in education, many institutions have incorporated digital platforms, such as video meetings and online chatrooms, into their training curricula. This development yields enhanced convenience in educational delivery (Suvorova et al., 2021) while concurrently fostering students' learning experiences. Furthermore, the prevalence of online learning is poised to provide evidence of its myriad benefits, such as serving as a potential alternative for transcending spatial and temporal boundaries while also offering the advantages of flexibility and accessibility of quality education where it is most needed (Aydin, 2013; Wu et al., 2023). Nevertheless, the salient facets of online instruction are commensurate with its challenges, one of which pertains to optimizing student interaction in the learning process as it may affect the effectiveness of online education (Sun & Rueda, 2012).

In Vietnam, although online learning was initiated a long time ago (Tran & Nguyen, 2022), it was not until the outbreak of the COVID-19 pandemic worldwide that such a mode of education became widely adopted in response to the continuous learning needs of students during the contemporary suspension of face-to-face classes. This paradigm shift to online learning has sparked a growing interest in exploring student satisfaction with this form of education (Nguyen et al., 2022) as it serves as a barometer for gauging how students perceive their learning experiences and assessing the caliber of the course instruction (Hew et al., 2020). However, in the field of online education, Teng (2023) underpins the lack of in-depth exploration into the factors that impact student satisfaction, especially in institutions where online learning is newly executed. This work, therefore, endeavored to contribute toward expanding the existing literature investigating the determinants of satisfaction based on a comprehensive analysis of an interaction model. Besides, even though preliminary research shows that interaction has a significant role in shaping student satisfaction, there remains a dearth of works examining the relationship between students' satisfaction and their behavioral intention to accept online learning, especially in the post-pandemic "new normal." Overall, the current inquiry was undertaken to scrutinize the intricate interplay between students' interaction, satisfaction, and acceptance of online learning through the lens of tertiary students' perspectives using a structural equation modelling approach (SEM). Also, the study was intended to fill the existing gap in the relevant body of knowledge by exploring whether students' satisfaction with online learning mediates the impact of interaction on their perceived acceptance of online education. The findings of the present study are hoped to assist educators, instructional designers, and policy-makers in optimizing the design and delivery of virtual learning courses, consequently amplifying the optimal learning conditions for online students.

LITERATURE REVIEW

Student Satisfaction

Student satisfaction is widely recognized as a multifaced construct comprising various dimensions that collectively contribute to students' reflection on their educational experiences (Amoush & Mizher, 2023; Wong & Chapman, 2022). In a parallel vein, Elliot and Healy (2001) postulate that learning satisfaction is a multidimensional concept, which is delineated by the manifestation of students' emotions and attitudes toward the learning process. Furthermore, it is contingent upon the extent to which students' learning needs and expectations are fulfilled or exceeded based on their learning encounters (Elliot & Healy, 2001; Palmer & Holt, 2009). That is, when students perceive that they have successfully attained their educational goals and procured the desired reservoir of knowledge and competencies, they are probably satisfied with their learning activities. Puzziferro and Shelton (2008) suppose that students who find online learning satisfying are more likely to succeed in their studies, whereas dissatisfied learners may encounter difficulties in their learning process (Dharmadjaja & Tiatri, 2021). Within digital education, it has been empirically established that satisfaction serves as a noteworthy determinant of academic performance and the efficacy of the execution of online learning systems (Ke & Kwak, 2013; Kuo et al., 2013; Meyer, 2014). Student satisfaction with online learning has been conceptualized as a convoluted and multifaceted concept encompassing varied factors. These include, for instance, efficient communication, participation in online discussions, flexibility, workload, technological support, instructors' teaching expertise, and feedback (Wei & Chou, 2020). Furthermore, Geary et al. (2023) underscore the significance of teachers fostering a sense

of learning community and social connection to ensure student satisfaction in virtual classes. In this study, satisfaction is characterized by the manner in which students evaluate their online learning encounters in virtual educational settings. Understanding the intricate nature of student satisfaction is, therefore, crucial for educators and institutions in enhancing the learning experiences and facilitating the academic outcomes of their students.

Interaction

Moore's (1989) Model of Interaction

The recognition that interaction is integral to the learning process is evident, be it in-person or online. Nevertheless, there is not much consensus on how it is conceptualized and what inherent characteristics it carries. Notwithstanding this, a three-type interaction model comprising student-content interaction, student-teacher interaction, and student-student interaction is widely acknowledged by scholars and researchers, as initially proposed in Moore's (1989) conceptual framework.

Student-content interaction is indispensable in pursuing educational goals since it is the process of learners' intellectual interaction with the information or knowledge intended to be acquired. This interactive process expectedly contributes to the growth in learners' understanding, perspective, and cognitive structure of the mind (Moore, 1989). This type of interaction is also very much connected to a situation in which learners "talk to themselves" about the content they are working on in a text, a lecture, a program, and the like (Holmberg, 1986). Furthermore, it can be inferred that a relationship exists between content-interactive learning and self-directed learning. Some educational programs contain student-content interaction as part of their nature. They are equivalent to one-way communications with an expert in a subject matter and a course designer at times. Learning is greatly self-directed in such a context if no other teaching expertise is involved.

Student-teacher interaction is considered vital and highly desirable by educators and students. Apart from teachers acting as instructors, others involved in the course design, such as experts preparing the learning material and those developing the content program, are likely to contribute to this sort of interaction. They aim to attract students' interest in the content of the lesson, motivate them to learn, and enhance their learning behaviors, including self-direction and self-motivation (Moore, 1989). Together with student-content interaction, student-teacher interaction corresponds with a time when teachers play a more influential role in their students' learning as opposed to student-content interaction itself. Moore also states that when student-teacher interaction is available in the learning process through correspondence or teleconference, students can be better guided under instructional influences and draw upon their teachers' experience of interacting with the content. Besides, testing and feedback are other substantial elements involved in student-teacher interaction when the role of teachers is particularly valued, especially in response to students' application of new knowledge.

Student-student interaction, or inter-student interaction, is a mutual exchange of information among class members, whether or not with the instructor's presence. This type of interaction has recognized values to some extent and is sometimes an essential resource for learning (Moore, 1989). The desirability of student-student interaction highly depends on students' circumstances and personal factors, such as age, learning experience, and level of learner autonomy. Compared with younger learners, the acts of stimulation and motivation in the teaching process are usually performed with more ease and less use of peer-group interaction when it comes to adults and advanced students, as they are likely to be self-motivated. One typical instance of student-student interaction is that of students being required to make individual or group presentations. This was followed by preliminary discussion, elaboration on critical issues in groups, exchanges of feedback, and more in-depth discussion. Researchers found that interaction among members of a crowded undergraduate class was not effectively enhanced in face-to-face classrooms, whereas students achieved higher performance in group behaviors in online classes using different teaching techniques, such as employing recorded videos and computer-mediated interaction (Phillips et al., 1988).

Student-Interface Interaction

Hillman et al. (1994) argue that Moore's (1998) three types of interaction do not encompass all facets of interaction in distance education. The distinctive technological mediation inherent in online learning environments necessitates another type of interaction - specifically, the interaction that occurs between students and the technologies, referred to as student-interface interaction. It is seen as a process of manipulating technological tools to perform a specific task. However, to this end, students must have the necessary skills and competencies to deal with the mechanisms of the delivery system. As part of these requirements, students must "understand not only the procedures of working with the interface but also the reasons why these procedures obtain results" (Hillman et al., 1994, p.34). Hillman et al., 1994 suggest that it is essential to distinguish between the manipulation of the interface as another type of interaction and the employment of the interface as an inherent facet of all interaction in technology-mediated learning settings.

Students' Acceptance of Online Learning

The concept of students' acceptance of online learning pertains to the cognitive evaluations made by students regarding the utility and simplicity of such a medium, which subsequently shape their attitudes, perceptions, and behaviors toward online learning environments (Ngampornchai & Adams, 2016). More simply, it can be construed as a gauge of their comfort level and willingness to engage in and use online learning platforms and resources for educational purposes (Rajeb et al., 2022). Recent studies have reported various components that contribute to the acceptance of students in online learning. The Technology Acceptance Model (TAM) was first coined by Davis in 1985 and has since been widely used to understand user acceptance of information technology across various fields, including online learning (Tung & Chang, 2007). In accordance with TAM, two primary factors that determine students' behavioral acceptance of online learning are perceived usefulness and ease of use (Granic & Marangunic, 2019; Venkatesh & Davis, 2000; Venkatesh et al., 2003). The concept of perceived usefulness refers to an individual's belief toward how much a specific technological system would enhance his or her work performance and productivity, while perceived ease of use is delineated as the extent to which a person believes that using a technological tool would be effortless and stress-free (Davis, 1989). In addition to the two noticeable constructing elements of TAM, online learning acceptance has also been explained through multiple components, including students' satisfaction, behavioral intention, user recommendations, and motivation to use an online learning system (Rajeb et al., 2023). In the present study, the consideration of these components culminated in the framework for measuring students' intention to accept online learning as an alternative instructional form of learning.

Theoretical Framework

Interaction and Student Satisfaction with Online Learning

Given the pivotal role of interaction in learning in the field of distance education, a growing body of studies has underscored the impact of interaction exerted on student satisfaction levels in online learning environments (e.g., Ayanbode et al., 2022; Amoush & Mizher, 2023; Dharmadjaja & Tiatri, 2021; Eom & Ashill, 2016; Kim & Kim, 2021; Li & Jhang, 2020; She et al., 2021; Tran & Nguyen, 2022; Yilmaz, 2023). The findings of these studies have also unveiled a positive correlation between these two variables. As per the findings of Kuo et al. (2014), it was observed that high interaction with the instructor, fellow students, or the course material resulted in a heightened sense of satisfaction among students, thereby indicating a significant level of involvement in online learning (Kuo et al., 2014). Analogously, using regression analysis, Amoush and Mizher (2023) examined the relationship between interaction and university students' satisfaction with online courses. The study revealed that four factors, namely student-content interaction, student-teacher interaction, student-student interaction, and student-technology interaction, had a positive influence on student satisfaction with online learning. Among these, student-technology interaction was the most influential factor, followed by student-instructor interaction. Aydin's (2021) study shared similar findings in that student-content interaction, instructor-student interaction, and student-student interaction had a significant effect on students' online education satisfaction levels. However, unlike the above study, student-content interaction was found to be the most substantial contributor to student satisfaction. This finding was

corroborated by Hettiarachchi et al.'s (2021) study, showing that student-content interaction was the most crucial factor of all forms of interaction in shaping student satisfaction in online learning settings. These studies emphasized the importance of enhancing the interaction between students and learning materials in fostering satisfaction with online education. Moreover, She et al. (2021) conducted a study that employed a serial mediation model to elucidate the connection between interaction and online learning satisfaction. The researchers found a significant relationship between these constructs, and the mediating factors of students' academic self-efficacy and engagement in online classrooms played a crucial role in the association between these two variables. Another investigation conducted by Kuo et al. (2013) focused its attention on discerning the determinants of the level of satisfaction experienced by students enrolled in online educational programs. The findings of the study obtained through regression analysis revealed that student-instructor interaction, student-content interaction, and Internet self-efficacy had a significant role to play in determining student satisfaction. Conversely, student-student interaction did not exhibit a discernible impact on the degree to which students were satisfied with online education. Another investigation by Gameel (2017) found that student-student interaction and student-instructor interaction did not affect student satisfaction with massive open online courses. Based on an appraisal of the aforementioned findings, albeit with controversies, we hypothesized that:

H1: Student-content interaction has a significant positive effect on students' satisfaction with online learning.

H2: Student-teacher interaction has a significant positive effect on students' satisfaction with online learning.

H3: Student-student interaction has a significant positive effect on students' satisfaction with online learning.

H4: Student-interface interaction has a significant positive effect on students' satisfaction with online learning.

Student Satisfaction and Online Learning Acceptance

One factor impacting students' behavioral intention to adopt online learning systems is student satisfaction with online learning outcomes (Nikou & Maslov, 2022). The relationship between student satisfaction and the acceptance of online education platforms was also denoted in a few studies (e.g., Alassaf & Szalay, 2020; Baloran et al., 2021; Daneji et al., 2019; Han & Sa, 2021; Lee & Mendlinger, 2011; Palmer & Holt, 2009; Shao, 2019; Tan et al., 2023). Lee and Mendlinger's (2011) research showed that perceived self-efficacy positively affected students' satisfaction with online learning, which in turn affected their intention regarding online learning acceptance. Likewise, another study by Baloran et al. (2021) explored student satisfaction with online learning amidst the pandemic. The study's findings revealed that satisfaction was paramount in determining students' behavioral intention to continue with online learning. This suggested that students who were satisfied with the caliber of online courses were more likely to harbor a heightened inclination to persist in adopting online learning platforms. Similarly, Palmer and Holt (2009) concluded that learner satisfaction significantly influenced students' continuance with online learning. The study highlighted the importance of satisfaction in fostering student engagement and improving retention rates in online courses. Drawing upon the presented empirical evidence of the relationship between student satisfaction and online learning acceptance, we hypothesized that:

H5: Student satisfaction has a significant positive effect on students' online learning acceptance.

Research Model

Based on the hypotheses mentioned above, the hypothesized model of the present study is shown in Figure 1. As can be seen, the model encompasses six latent variables and illustrates the direct and indirect relationships between them. Specifically, the four types of interaction act as independent or exogenous variables, and online learning acceptance functions as a dependent or endogenous variable. In addition, student satisfaction is considered a mediator variable supposed to mediate the relationship between interaction and online

learning acceptance. It plays the role of a dependent variable, which is expected to be positively influenced by interaction. Simultaneously, it acts as an independent variable, which is assumed to significantly impact online learning acceptance.
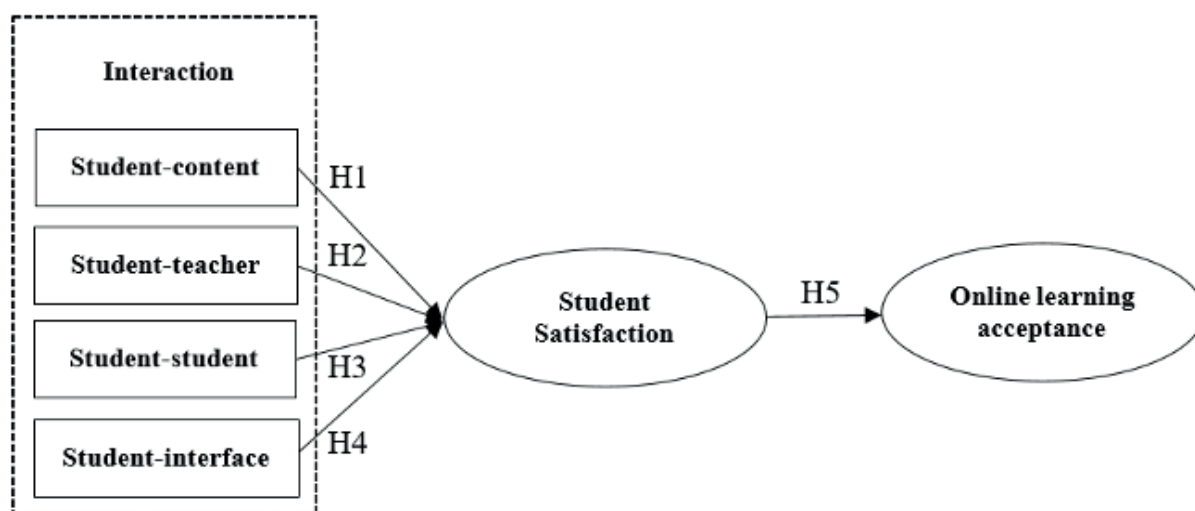

Figure 1. The hypothesized model

METHODS

Research Design

A quantitative research method was employed in this study to empirically assess the theoretical framework, specifically aiming at exploring the complex relationships between students' interaction, satisfaction, and online learning acceptance. The quantitative method is deemed sufficient to validate the theoretical framework and related hypotheses (Alarabiat et al., 2023). Such a method plays a crucial role in scientific inquiry as it offers a systematic and objective approach to studying a situation (Williams, 2011) and generalizes results (Ayanbode et al., 2022). In addition, using standardized measurement tools and statistical analysis techniques can ascertain the validity and reliability of research findings (Tirschwell & Longstreth, 2002). In the present study, SEM was employed as a multivariate statistical technique to examine the strength and direction of relationships between variables (Deng et al., 2017). It also provides a holistic framework for hypothesis testing and theoretical model evaluation (Schumacker & Lomax, 2004). Moreover, SEM is considered statistically appropriate in this study to understand the mediating role of satisfaction in explaining the nexus between interaction and online learning acceptance as it can incorporate these complex relationships and allow for the examination of mediating effects.

Participants

336 third-year and fourth-year (61.1% and 33.9%, respectively) university students from a private university in the Mekong Delta of Vietnam were invited to participate in this study. They studied at different faculties, including Foreign Languages (23.2%), Business Administration (18.5%), Pharmacy (21.7%), Law (20.2%), and Automotive Technology (16.4%). These participants were recruited through the convenience sampling method. The sample included 102 males (30.4%) and 234 females (69.6%), and their ages ranged from 19 to 22 years (M=19.52, SD=0.72). They had full-time experiences of online learning during the COVID-19 outbreak in Vietnam. They were required to take synchronous online courses lasting for 15 weeks via Zoom and Google Meet, with the support of asynchronous content, such as videos and digital documents. Thus, these participants were deemed suitable to partake in the present study. Nearly half of them spent 11 to 15 hours online every week, and the remaining participants spent between 16 and 20 hours. Table 1 summarizes the participants' demographic information.

Table 1. Demographics of the participants

Variables	Categories	Frequency	Percentage
Faculty	Foreign Languages	78	23.1
	Business Administration	62	18.5
	Pharmacy	73	21.7
	Law	68	20.2
	Automotive Technology	55	16.4
Gender	Male	102	30.4
	Female	234	69.6
Age group	19-22	336	100
Year of study	Third year	222	66.1
	Fourth year	114	33.9
Hours spent online per week	11-15 hours	208	61.9
	16-20 hours	128	38.1
Digital platform	Zoom and Google Meet	336	100
Mode of online learning access	Computer	14	4.2
	Laptop	277	82.4
	Mobile phone	45	13.4

Measures

A self-report questionnaire was employed as the primary research instrument to collect quantitative data for the study. The questionnaire included two sections. The first part was for eliciting the participants' demographic information, such as gender, age, year of study, and weekly online usage hours. The second part encompassed six measurement scales adapted from different sources aiming to assess the forms of interaction in which students typically engaged and their satisfaction with and acceptance of online learning, as shown in Table 2.

Table 2. Description of the questionnaire

Scales	Number of items	Sample items	Sources
Student interaction			
Student-content interaction	05	Online course materials helped me to understand the class content better.	Kuo (2010)
Student-teacher interaction	06	Overall, I had numerous interactions with the teacher during class.	Kuo (2010)
Student-student interaction	05	Overall, I had numerous interactions with fellow students during class.	Kuo (2010)
Student-interface interaction	05	Computers make me much more productive.	Chang (2013)
Student satisfaction	05	Overall, I was satisfied with this class.	Kuo (2010)
Student acceptance	05	In the future, I will be willing to enroll in online classes.	Rajeb (2023)

Note. *Not all items are included in the table. For each measurement scale/subscale, only one item is presented for reference.*

Before the administration of the instrument, it had been checked via expert review. Two senior lecturers and two experts in the field were invited to check for its validity. As a result, the questionnaire was marginally adjusted in terms of item clarity and readability based on their feedback. The questionnaire was subsequently piloted with a group of 30 students who shared the same characteristics as the target participants. All of them reported that they had no problems comprehending the questionnaire. These students were excluded from

the data collection process to maintain the independence and integrity of the data collected from the actual intended participants. Cronbach's alpha was performed to assess the reliability of the 31-item questionnaire. It was found that Cronbach's alpha of all the factors exceeded the recommended reliability coefficient threshold of 0.70 (Hair et al., 2014). The un-dimensionality of the items was also tested by computing item-total correlations. The observed items in the predetermined scales had coefficient values ranging from 0.64 to 0.85, all of which surpassed the widely agreed-upon lower limit of 0.30 (Coolidge, 2013). Thus, all items were retained for later analyses. These results collectively substantiated the internal consistency of the responses to the items in the present study. Table 3 presents the descriptive statistics of the reliability tests.

Table 3. Reliability of the questionnaire

Variables	Number of items	Cronbach's alpha	Item-total correlation range
Student-content interaction	05	0.91	0.71-0.85
Student-teacher interaction	06	0.91	0.67-0.83
Student-student interaction	05	0.92	0.74-0.82
Student-interface interaction	05	0.86	0.65-0.72
Student satisfaction	05	0.90	0.64-0.85
Student acceptance	05	0.90	0.69-0.81

Student Interaction Scale

Students' interaction in online classes was assessed using the student interaction scale adapted based on the existing literature. The scale consisted of 16 items adapted from Kuo (2010), and five items from Chang (2013). These items were selected as they were mostly relevant to the context of the present study. They were nested under four dimensions of student interaction in online classes, namely (1) student-content interaction (5 items), (2) student-teacher interaction (6 items), (3) student-student interaction (5 items), and (4) student-interface interaction (5 items). The 21 items were evaluated based on a 5-point Likert scale, ranging from (1) strongly disagree to (5) strongly agree. In combination, Kuo (2010) and Chang (2013) previously reported the scale's strong validity and demonstrated high reliability coefficients for the subscales specific to the four types of interaction.

Student Satisfaction Scale

To quantify university students' satisfaction with online learning, the study utilized the student satisfaction scale adapted from Kuo (2010) as it was appraised as appropriate for the target learning context and population. The scale constituted one latent variable with five observed items. It used a 5-point Likert rating, varying from 1 (strongly disagree) to 5 (strongly agree). Kuo (2010) proved that the scale was valid and reliable in measuring students' satisfaction with online learning.

Online Learning Acceptance Scale

The outcome variable of students' behavioral intention toward online learning acceptance was measured by the online learning acceptance scale, which was designed by Rajeb (2023). The scale consisted of one latent variable and five observed items, which were slightly modified so that they would be fully applicable to the participants. Students responded to each item using a 5-point Likert scale, ranging from (1) strongly disagree to (5) strongly agree. The validity and reliability of the scale were empirically established in Rajeb's (2023) scale development and validation study.

Data Collection Procedures

Questionnaires were initially administered to 415 students from 10 classes during their study hours with the assistance of the teachers of these classes. They were asked to fill in the questionnaire in a paper-and-pencil

format under the researchers' presence. Of 415 students, 395 completed the questionnaires with a return rate of 95.2 %. After the data screening, 336 responses were evaluated as valid and retained as the actual study sample. This number of participants was considered significant as it satisfied the sample size threshold needed for exploratory factor analysis (EFA), surpassing the requirement of being at least five times greater than the observed variables (Hair et al., 2014). Kline (2015) recommends a minimum of 100 observations for estimating SEM and 200 observations for obtaining reliable estimates. The sample size of 336 certainly met these requirements.

Data Analyses

Prior to SEM analyses, EFA was performed using IBM AMOS ver. 27, followed by confirmatory factor analysis (CFA) to evaluate the proposed model. EFA was used to investigate the correlations among the factors and their factor loadings (Hair et al., 2014), which aids in evaluating the convergent validity of scales measuring self-perceived constructs (Zhu et al., 2021). CFA is an advanced statistical method that employs the input of correlations to establish a structural model in which structural relationships between latent constructs and their observed variables are assessed (Alrabai, 2011). The theoretical model in this study was evaluated based on several types of omnibus fit indexes to determine goodness-of-fit to the sample data. These include the chi-square statistic (χ^2), degree of freedom (df), p-value, normalized χ^2 or χ^2 divided by df (χ^2/df), and other essential indices, such as the goodness-of-fit index (GFI), the comparative fit index (CFI), the normed fit index (NFI), the root mean square error of approximation (RMSEA), the standardized root mean square residual (SRMR), and the Tucker-Lewis index (TLI). It is suggested that values greater than 0.90 for GFI, CFI, NFI, and TLI are considered acceptable, and values over 0.95 indicate a good model fit (Hair et al., 2019). The acceptable values for RMSEA and SRMR are less than 0.1 and 0.05, respectively (Byrne, 2016).

Common Method Bias

Common method bias refers to measurement errors that substantially overestimate the relationship between variables measured with the same method (Kamakura, 2010; Spector, 2006). Podsakoff et al. (2003) suggest several statistical solutions to reduce bias caused by the homogeneous validity scales, one of which is Harman's single-factor test. It is known as a widely used method in this regard. Unrotated exploratory factor analysis was conducted using the 31 items loaded into one latent variable. The average variance accounted for by the single factor was only 23.8%, well below the recommended cutoff of 50%. Therefore, it could be concluded that no serious common method bias was observed in this study.

RESULTS

Exploratory Factor Analysis

An EFA was conducted on the 21 items constructing student interaction factors. First, Kaiser-Mayer-Olkin (KMO) and Barlett test of sphericity were examined for factor analysis compliance. The adequacy of the sample was measured by conducting the KMO test. A KMO value of over 0.05 is considered indicative of sufficiently high correlations among items, and therefore, they can be used to perform factor analysis (Tabachnick & Fidell, 2001). In this study, the KMO value was 0.877. Barlett's test of sphericity was then computed to assess the suitability of data for EFA (Korucu & Karakoca, 2020). A significant result of 0.000 was recorded in Barlett's test of sphericity. This means that the correlation matrix was not an identity one and was suitable for structure detection. Principal component analysis as an extraction method was employed to reflect on the data structure. The Kaiser criterion, which involves the examination of the initial eigenvalues, was applied to determine the number of factors to be extracted. In addition, Varimax rotation was adopted to ensure interrelations among factors. In this study, having the initial eigenvalues greater than 1.0, four factors underlying student interaction dimensions were ultimately extracted, which together explained 71.28% of the variance. A scree plot was used to confirm the number of suitable factors. The elbow in the scree plot suggested that four principal factors should be extracted. Hence, the remaining 28.72% of the

variance was accounted for by other possible variables which were not included in the study. Subsequently, the factor loadings and communalities of all the items were checked. Factor loadings greater than 0.4 are considered adequate for item retention in the model; likewise, communalities greater than 0.4 are deemed acceptable (Osborne et al., 2008). In the present study, the factor loadings ranged from 0.747 to 0.896, and communality values ranged from 0.582 to 0.825, as shown in Table 4. These values suggested a good fit of the items to their respective factors. As mentioned earlier, the Cronbach's coefficient alpha values for four factors were between 0.86 and 0.92, presenting sound reliability for each scale.

Table 4. Results on factor loadings and the communalities

Items	Factors				Communalities
	1	2	3	4	
STI3	.876				0.796
STI6	.861				0.778
STI5	.844				0.739
STI1	.837				0.719
STI2	.754				0.586
STI4	.752				0.582
SSI5		.881			0.801
SSI4		.873			0.794
SSI3		.860			0.792
SSI1		.840			0.723
SSI2		.821			0.691
SCI4			.896		0.825
SCI5			.868		0.786
SCI2			.845		0.760
SCI3			.821		0.707
SCI1			.793		0.660
SII5				.797	0.695
SII4				.791	0.683
SII2				.781	0.630
SII3				.773	0.624
SII1				.747	0.596

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 5 iterations.

Note. *SCI = student-content interaction, STI = student-teacher interaction, SSI = student-student interaction, SII = student-interface interaction, SAT = student satisfaction, ACC = student acceptance*

Normality Check

The normality of measurement items was examined using Mardia's skewness and kurtosis. The assumption of multivariate normality is a fundamental consideration in CFA, where the observed variables and their joint distributions are expected to adhere to a normal distribution (Dimitrov, 2010), and its violation can influence the estimation and interpretation of CFA models (Flora & Curran, 2004). For this study, skewness values ranged from -0.916 to +0.424, and kurtosis values fell between -0.380 and +2.544. All the values were within the acceptable limit, demonstrating that the data fit the normality assumption. The results of the normality assessment are illustrated in Table 5.

Table 5. Results of the normality assessment

Variables	Normality index	
	Skewness	Kurtosis
Student-content interaction	-0.289	-0.027
Student-teacher interaction	-0.578	0.213
Student-student interaction	-0.158	-0.380
Student-interface interaction	0.424	2.544
Student satisfaction	-0.916	2.145
Student acceptance	-0.344	-0.265

Convergent Validity

Convergent validity was checked based on factor loadings, composite reliability (CR), and average variance extracted (AVE) (Hair et al., 2019). In the present study, the measurement model was composed of six first-order latent constructs, namely student-content interaction, student-teacher interaction, student-student interaction, student-interface interaction, and students' online learning satisfaction and acceptance. The results indicated that the standardized factor loadings were within 0.64 to 0.88. The CR values of all factors exceeded the recommended threshold of 0.70. The AVE values for all constructs were greater than 0.5, and each construct's AVE was less than its respective CR. These results indicated that all six constructs had acceptable convergent validity. Table 6 shows the results of the convergent validity testing.

Table 6. Convergent validity measures

Variables	Factor loadings	CR	AVE
Student-content interaction	0.724-0.884	0.915	0.684
Student-teacher interaction	0.665-0.827	0.912	0.636
Student-student interaction	0.737-0.855	0.919	0.694
Student-interface interaction	0.666-0.761	0.861	0.553
Student satisfaction	0.641-0.872	0.899	0.643
Student acceptance	0.710-0.853	0.902	0.648

Discriminant Validity

The heterotrait-monotrait ratio (HTMT) of the correlations was employed as a criterion to examine the discriminant validity of the latent constructs. Henseler et al. (2015) assert that the HTMT ratio offers a more reliable and less biased evaluation of discriminant validity when compared to other widely employed methods, such as the Fornell-Larcker criterion and cross-loadings. HTMT values less than the cutoff value of 0.85 are typically regarded as satisfactory, whereas values surpassing 0.90 indicate a dearth of discriminant validity (Hair et al., 2019). In this study, all the HTMT values were far lower than 0.85, ranging from 0.082 to 0.454, as indicated in Table 7. Thus, the discriminant validity of the constructs was confirmed.

Table 7. Discriminant validity measures

	1	2	3	4	5	6
1. Student-content interaction						
2. Student-teacher interaction	0.312					
3. Student-student interaction	0.082	0.157				
4. Student-interface interaction	0.279	0.124	0.091			
5. Student satisfaction	0.454	0.385	0.086	0.273		
6. Student acceptance	0.258	0.162	0.432	0.157	0.115	

Measurement Model Assessment

As a prerequisite for SEM analyses, the entire measurement model with six first-order latent constructs was assessed using CFA to evaluate if the measurement model fits the data well. According to the CFA results, the model had a good fit, as evidenced by the following model fit indices: χ^2 = 585.328; df = 411; χ^2/df = 1.420; GFI = 0.902; CFI = 0.975; TLI = 0.972; NFI = 0.920; RMSEA = 0.035; SRMR = 0.039. Besides, the standardized estimated loadings of observed variables on latent variables were greater than 0.50, all of which were statistically significant ($p < 0.001$), demonstrating that the latent constructs were adequately operationalized by their indicators (Raykov & Marcoulides, 2008). Figure 2 depicts the six-factor measurement model based on CFA.
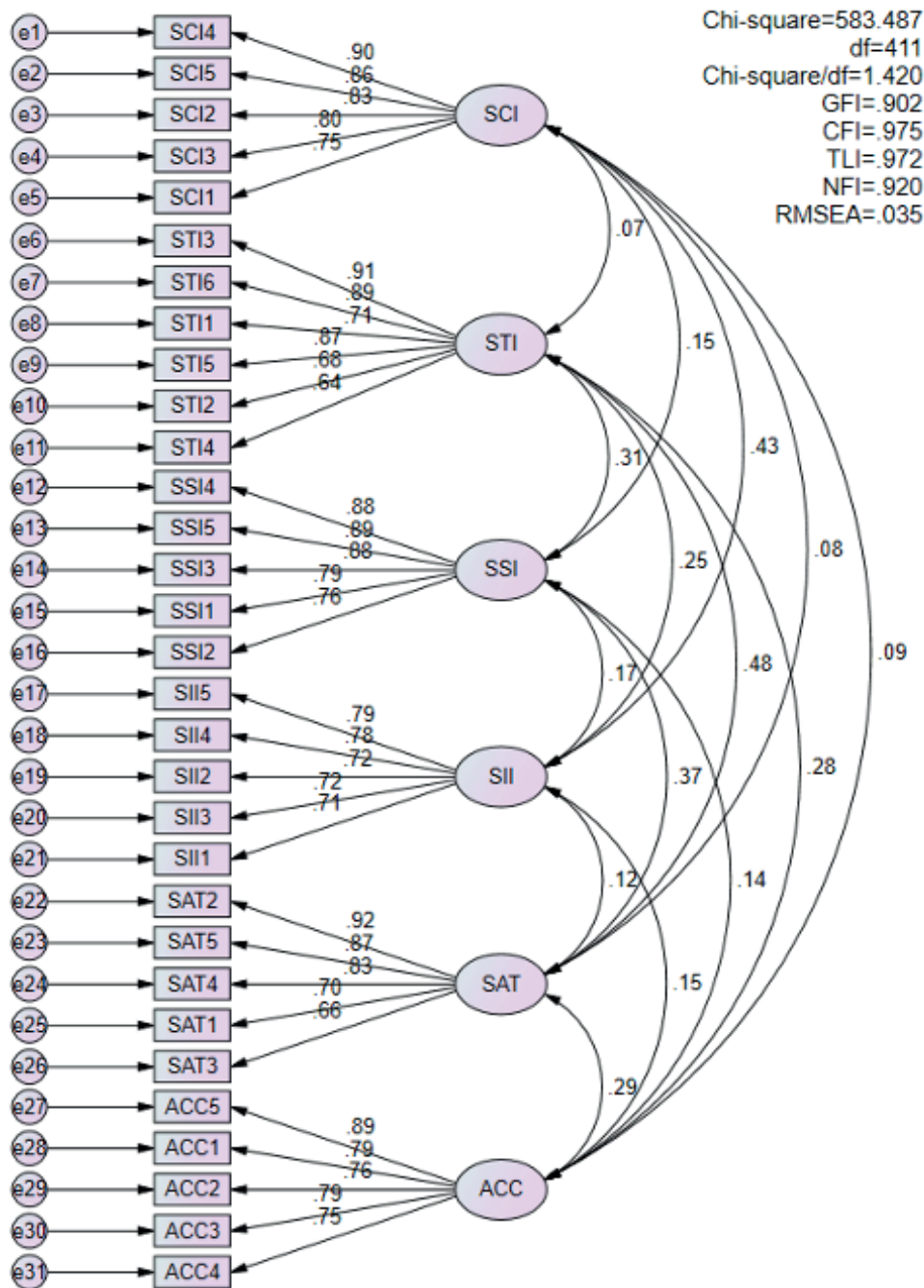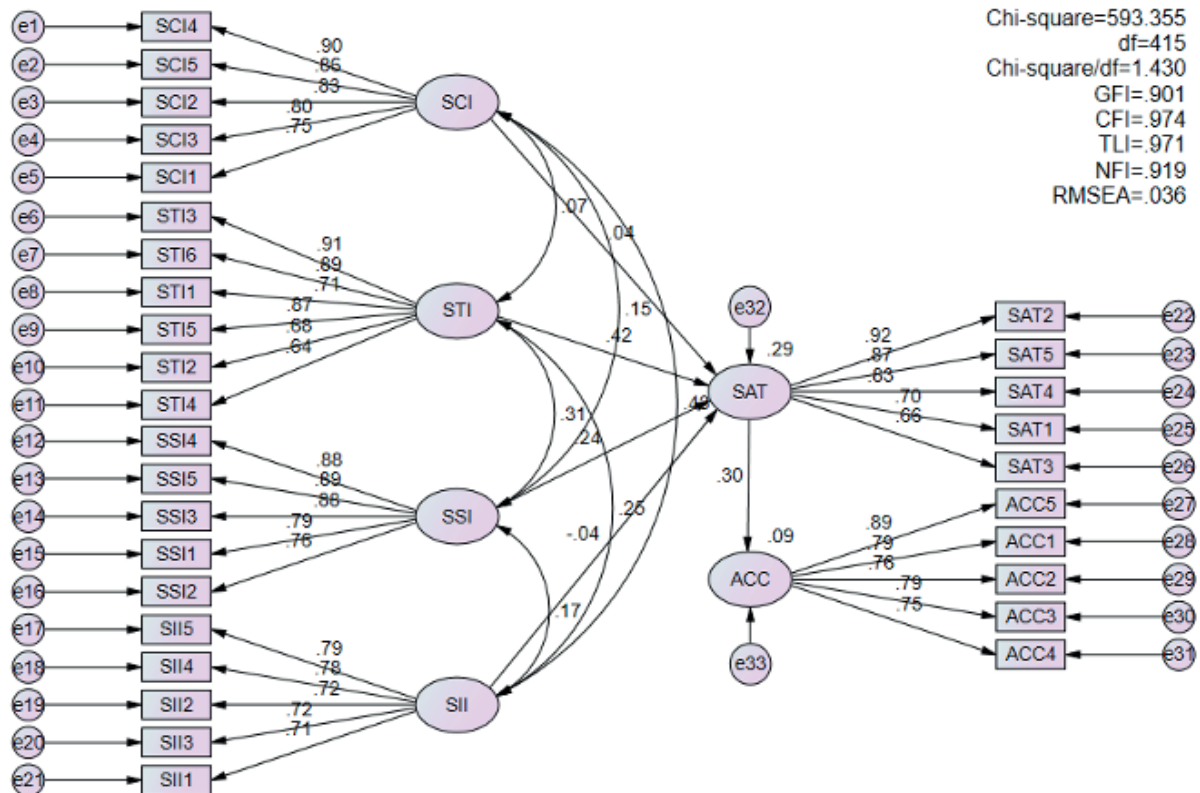

Figure 2. The six-factor measurement model based on CFA

Note. *SCI = student-content interaction, STI = student-teacher interaction, SSI = student-student interaction, SII = student-interface interaction, SAT = student satisfaction, ACC = student acceptance*

145

The Structural Model

The structural model was tested to determine the relationships between the constructs based on the hypotheses. The goodness-of-fit indices obtained from SEM showed that the proposed research model yielded a good fit to the data well (χ^2 = 593.355; df = 415; χ^2/df = 1.430; GFI = 0.901; CFI = 0.974; TLI = 0.971; NFI = 0.919; RMSEA = 0.036; SRMR = 0.048). The observed items loaded well on each of the factors, with their standardized estimated loadings both greater than 0.50 and statistically significant ($p < 0.001$). Figure 3 exposes the structural model based on SEM.

Figure 3. The structural model based on SEM

Note. SCI = student-content interaction, STI = student-teacher interaction, SSI = student-student interaction, SII = student-interface interaction, SAT = student satisfaction, ACC = student acceptance

The standardized path coefficients and p-values were utilized to test the significance of the hypotheses through the bootstrapping approach. 1000 bootstrapping samples and the 95% bias-corrected (BC) confidence intervals were executed to estimate the magnitude of the effect of each variable. The results revealed that student-teacher interaction (β = 0.442, p = 0.000) and student-student interaction (β = 0.216, p = 0.000) had a significant positive relationship with student satisfaction, with the former manifesting a stronger effect compared to the latter. Meanwhile, the opposite was true of student-content interaction (β = 0.035, p = 0.477) and student-interface interaction (β = -0.083, p = 0.471), which showed no influence on the perceived satisfaction. Furthermore, student satisfaction was found to significantly affect student's online learning acceptance (β = 0.397, p = 0.000). These results showed that H2, H3, and H5 were supported, while H1 and H4 were rejected, as presented in Table 8.

Table 8. Results of the hypothesis testing

Hypotheses	Hypothesized paths	SRβ	SE	CR	P	Results
H1	SCI → SAT	0.35	0.50	0.711	0.477	Rejected
H2	STI → SAT	0.442	0.060	7.424	***	Supported
H3	SSI → SAT	0.216	0.050	4.360	***	Supported
H4	SII → SAT	-0.083	0.115	-0.720	0.471	Rejected
H5	SAT → ACC	0.397	0.078	5.078	***	Supported

*Note. SRβ = standardized regression weights, SE = Standard errors, *** = p < 0.001*

Note. SCI = student-content interaction, STI = student-teacher interaction, SSI = student-student interaction, SII = student-interface interaction, SAT = student satisfaction, ACC = student acceptance

Mediation Testing

By extension, this study further explored the mediating effect of satisfaction in the linkage between each interaction factor and the acceptance outcome. To this end, Preacher and Hayes' (2004) bootstrapping mediation analysis was applied. Accordingly, mediations are established if the indirect relationships exhibit statistical significance after bootstrapping (p < 0.005). The results revealed that the indirect effects of STI (β = 0.125, p = 0.001 < 0.005) and SSI (β = 0.070, p = 0.001 < 0.005) on students' acceptance of online learning through satisfaction were significant, proving that satisfaction mediated the relationship of student-teacher interaction and student-student interaction with acceptance. In contrast, student-content interaction and student-interface interaction had insignificant indirect effects on acceptance (β = 0.012, p = 0.505 > 0.005 and β = -0.013, p = 0.400 > 0.005, respectively), suggesting that satisfaction did not play a mediating role in the relationships between student-content interaction and acceptance as well as between student-interface interaction and acceptance. For robustness check, the indirect path coefficients from the exogenous variables and the endogenous variable or the outcome were estimated using the BC bootstrap confidence interval method, as recommended by Cheung and Lau (2017). Following this method, if the 95% BC confidence intervals do not include zero, the mediating effects are observed in the nexuses between the studied constructs. Results from Table 7 show that the confidence intervals for the mediating effects from student-teacher interaction to acceptance (lower 2.5% limit = 0.058 and upper 2.5% limit = 0.210) and student-student interaction to acceptance (lower 2.5% limit = 0.033 and upper 2.5% limit = 0.120) did not contain zero, which substantiated the mediating role of satisfaction in the links of student-teacher interaction and student-student interaction with acceptance. Nevertheless, the confidence intervals for the mediating effects from student-content interaction to acceptance (lower 2.5% limit = -0.031 and upper 2.5% limit = 0.052) and student-interface interaction to acceptance (lower 2.5% limit = -0.051 and upper 2.5% limit = 0.020) did contain zero. Thus, satisfaction did not mediate the connections between these two interaction factors and acceptance behavior. Table 9 shows the results of the mediation testing.

Table 9. Results of the mediation testing

Mediating effects	SRβ	SE	P	Bootstrapping 95% BC confidence interval	
				Lower	Upper
SCI → SAT → ACC	0.012	0.020	0.505	-0.031	0.052
STI → SAT → ACC	0.125	0.041	**	0.058	0.210
SSI → SAT → ACC	0.070	0.022	**	0.033	0.120
SII → SAT → ACC	-0.013	0.017	.400	-0.051	0.020

*Note. SRβ = standardized regression weights, SE = Standard errors, ** = p < 0.01*

Note. SCI = student-content interaction, STI = student-teacher interaction, SSI = student-student interaction, SII = student-interface interaction, SAT = student satisfaction, ACC = student acceptance

DISCUSSION

The overarching aim of this study was to scrutinize the interplay between students' perceptions of interaction, satisfaction, and acceptance of online learning. More precisely, it aimed to examine the effects of the four types of interaction (i.e., student-content, student-teacher, student-student, and student-interface) on student satisfaction and to illuminate the mediating role of perceived satisfaction in the nexuses between these interaction factors and student acceptance of online learning. It was found that student-teacher interaction and student-student interaction significantly impacted student satisfaction, contrasting with insignificant effects observed for student-content interaction and student-interface interaction. The results also showed that student satisfaction and online learning acceptance were significantly related. In addition, with satisfaction playing the mediating role, student-teacher interaction and student-interface interaction were found to have an indirect effect on acceptance; nevertheless, satisfaction did not mediate the relationship of student-content interaction and student-interface interaction with perceived acceptance. These results are significant as they contribute to the understanding of the mechanisms that cultivate student satisfaction in virtual learning environments through a holistic examination of the interaction model, whereby expanding upon the extant e-learning literature that has centered on the behavioral intentions of students.

The study confirmed that of the four types of interaction, student-teacher interaction was the strongest determinant of student satisfaction (β = 0.442, p = 0.000). This result aligns with a myriad of previous research works which showed that student-teacher interaction was a key factor in formulating students' satisfaction with their online learning experience (e.g., Ayanbode et al., 2022; Aydin, 2021; Dharmadjaja & Tiatri, 2021; Eom & Ashill, 2016; Kim & Kim, 2021; Kuo et al., 2014; Wang et al., 2022; Yilmaz, 2023). Therefore, it could be deduced that by giving ample opportunities for student-teacher interaction activities in online classrooms, teachers can elevate students' contentment with online courses. Synchronous online activities, such as video conferencing and real-time discussion, should be well designed to enhance interaction between students and teachers, further contributing to increased satisfaction levels. Notwithstanding the commonly agreed-upon magnitude of this type of interaction, Chu et al.'s (2021), Gameel's (2017), Li and Jhang's (2020), and Suat's (2021) studies yielded a divergent result, which indicated that student-teacher interaction had no impact on student satisfaction. One of the interpretations of this relationship was supposed to be due to the sudden shift to online education during the pandemic, as well as teachers' inadequate competence in teaching online and students' unreadiness for such an alternative form of learning. This explanation seems plausible, considering the intrinsically multifaced nature of online education.

The results of the study also showed that student-student interaction significantly impacted student satisfaction, albeit with a lesser degree of influence as opposed to the aforesaid factor (β = 0.216, p = 0.471). This result is consistent with the findings of various studies in the existing literature on online education (e.g., Ayanbode et al., 2022; Aydin, 2021; Chu et al., 2021; Dharmadjaja & Tiatri, 2021; Eom & Ashill, 2016; Kim & Kim, 2021; Li & Jhang, 2020; Yilmaz, 2023), indicating that student-student interaction and perceived satisfaction were significantly correlated. As such, it is inferred that the more teachers foster student-student interaction activities in online classes, the more students are satisfied with their online learning experience. In a similar vein, Chu et al. (2016) recommended that students should be offered room to conveniently interact with each other through collaborative tasks so that their learning outcomes could be enhanced, which in turn would contribute greatly to student satisfaction. However, contrary to common belief in this nexus, Gameel (2017) and Kuo et al. (2014) found that there was not a significant positive relationship between student-student interaction and satisfaction. One possible reason attributed to this outcome was owing to that of students' insufficient interaction in a fully online learning environment, which neither teachers nor students had experienced beforehand.

Besides, it was found in this study that there was an insignificant relationship between student-content interaction and students' perceptions of satisfaction (β = 0.035, p = 0.477), which is in line with Suat's (2021) study unveiling that student-content interaction exerted no influence on student satisfaction. This implies that no matter how much students interact with the course materials, their level of interaction remains unaffected. However, this finding contradicts the general pattern found in the literature showing that student-content interaction was the strongest determinant of satisfaction levels in the context of online learning environments (e.g., Ali & Mirza, 2020; Aydin, 2021; Dharmadjaja & Tiatri, 2021; Hettiarachchi et al., 2021; Kim & Kim, 2021; Kuo et al., 2014; Li & Jhang, 2020; Ngo & Ngadiman, 2021). This

discrepancy raises intriguing inquiries about the possible causes resulting in the potential variability in this connection across diverse educational settings. It is suggested that future research should delve deeper into the nuanced connections between student-content interaction and satisfaction, taking into account the potential mediating role of contextual factors, such as prior experience with online learning and learning style preferences, in determining this relationship. Variances in the characteristics of the online learning environments, including the nature of the course content, instructional design, and technological infrastructure can also influence the impact of student-content interaction on satisfaction.

An insignificant relationship between student-interface interaction and student satisfaction was observed in this study (β = -0.083, p = 0.471). This result was somehow supported by Suat's (2021) study, which revealed that internet self-efficacy was not an indicator of online learning satisfaction. This infers that whether the level of student-interface interaction is high or low, regardless of its inherent characteristics of computer-mediated learning, does not impact student satisfaction. Nevertheless, some past studies show a different result, concluding that this type of interaction played a significant role in formulating satisfaction (e.g., Amoush & Mizher, 2023; Kuo et al., 2014). Amoush and Mizher (2023) found that student-technology interaction was the most influential factor affecting student satisfaction with online courses. This inconsistency appears to be reasonable as Wang et al. (2013) suggest that the multifaced nature of student-interface interaction can have varying effects on student satisfaction. In addition, the contradictory findings might be due to differences in the sample size, the analysis technique, or the specific context in which the studies were conducted. Therefore, future studies which aim to replicate these findings should use larger and more diverse samples to provide a more thorough understanding of the impact of student-interface interaction on student satisfaction in online learning environments.

Apart from the examination of the effects of interaction on satisfaction, this study sought to identify the connection between students' satisfaction and acceptance of online learning. The results showed that student satisfaction was significantly correlated with students' behavioral intention to accept this mode of education (β = 0.397, p = 0.000). This result is similar to studies by, for example, Daneji et al. (2019), Han and Sa (2021), and Tan et al. (2023), thus providing evidence for a positive relationship between students' satisfaction and acceptance intention. It can be implied that the more students are satisfied with online course deliveries, the more likely they are to hold positive perceptions toward online learning acceptance. This finding underscores the vitality of guaranteeing satisfying online education experiences for students, as their contentment significantly impacts their readiness to embrace this mode of learning. To date, with the proliferation of online courses, this finding offers valuable information for policy-makers, educators, and course designers to have effective strategies for promoting the prospects of online education through the enhancement of student satisfaction.

The present study distinguishes itself from other studies in that it sought to identify the mediating role of satisfaction in the link between interaction and perceived acceptance of online learning among university students. The results suggested that among the four types of interaction, learner-teacher interaction (β = 0.125, p = 0.001 < 0.005) and student-student interaction (β = 0.070, p = 0.001 < 0.005) had a positive indirect relationship with student acceptance. Despite being conducted with varying outcome constructs, various studies partly confirmed the role of satisfaction as a mediator in the context of online learning (e.g., Ayanbode et al., 2023; Tien et al., 2022). Tien et al. (2023) found that satisfaction significantly mediated the relationship between students' interaction and perceived progress. Ayanbode et al.'s (2023) study shared similar results, which resonates with the mediating role of satisfaction examined in the present study. Nonanalogously, it was established that satisfaction did not mediate the connection of student-content interaction (β = 0.012, p = 0.505 > 0.005) and student-interface interaction (β = -0.013, p = 0.400 > 0.005) with acceptance. These results indicate that satisfaction has a specific mediating role in certain aspects of online learning and may not be a universally applicable mediator. It is also inferred that students attach more importance to interpersonal interactions, herein student-teacher interaction and student-student interaction, compared to other interaction types and find them crucial for their overall satisfaction with the online learning experience. Therefore, it highlights the need for online learning platforms to prioritize and enhance features that facilitate meaningful interpersonal interactions, as these are critical drivers of student satisfaction and acceptance.

CONCLUSION

In the landscape of online education, the relationship between interaction and satisfaction has been explored in various contexts, shedding light on the intricate dynamics between these two constructs, each of which has a significant role to play in ensuring educational quality in this context and further enhancing the prospect of web-based learning. Central to this work is the examination of the interplay between students' interaction, satisfaction, and acceptance of online learning. The study revealed that student-teacher interaction emerged as the most influential determinant of student satisfaction, followed by student-student interaction, while student-content and student-interface interactions showed insignificant relationships with student satisfaction. These results add to the extant literature by shedding light on the differential impacts of various types of interaction on student satisfaction in online learning environments. Furthermore, the study confirmed a significant positive relationship between student satisfaction and acceptance of online learning, indicating that students' satisfaction with online courses influences their acceptance behavior toward online. This result emphasizes the importance of ensuring positive online education experiences for students to promote the prospects of online learning. Moreover, the study identified the mediating role of satisfaction in the link between interaction and perceived acceptance of online learning. Specifically, learner-teacher interaction and student-student interaction were found to have a significant indirect relationship with student acceptance, highlighting the significance of interpersonal interactions in shaping students' satisfaction and acceptance of online learning.

The implications of these findings for online learning practices are substantial. Educators and instructional designers should prioritize the development of strategies that promote interpersonal interaction in online learning environments. To guarantee student-teacher interaction, teachers should establish a sense of presence and accessibility in synchronous virtual classes. Research by Shea, Pickett, and Pelz (2003) stresses the value of teacher presence in online courses, emphasizing its significant role in boosting student satisfaction and promoting academic achievement. This type of interaction can be achieved through regular communication, prompt feedback, and creating opportunities for one-on-one interactions. Besides, it is the teachers' responsibility to create a supportive learning environment, as it is crucial for building a sense of teacher presence and accessibility in online learning settings. Concerning student-student interaction, this may involve the use of diverse communication tools, collaborative activities, and group projects that facilitate student-student interaction and peer-to-peer learning. By fostering a sense of community and connection among students, online learning experiences can be enhanced, leading to increased levels of student satisfaction and acceptance. Rovai (2002) suggests that a sense of community is positively associated with student satisfaction and retention in online courses. Additionally, incorporating opportunities for interaction can help alleviate feelings of isolation and promote a more engaging and interactive learning experience, ultimately improving overall learning outcomes in online education.

Limitations

Despite intriguing results, given the limited sample size of the current study, which only involved the participation of 336 students at a private university in the Mekong Delta of Vietnam, the results obtained may not be generalized to the larger population of tertiary students in the region and beyond. Therefore, future studies can be conducted with an escalated number of participants at both private and public universities to elucidate the research issue. A comparative analysis can also be performed to test whether there is a significant difference in the perception between students pursuing their learning in these educational institutions. In addition, as evidenced in the results of this study, student-content interaction and student-student interaction showed no effects on student satisfaction with online learning and acceptance, so duplicated research works can be implemented to give a common ground for the confirmation of this conclusion, or they can be done with the follow-up employment of an in-depth interview, which aims at better understanding students' perceptions of the impact of each factor in the proposed research model. Finally, the influences of contextual factors and student demographical variables, such as gender, age, and field of study, on student satisfaction with online learning can be taken into account in forthcoming investigations.

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INVESTIGATION OF PRESERVICE TEACHERS' METAPHORIC PERCEPTIONS REGARDING THE MEASUREMENT AND EVALUATION TOOLS IN DISTANCE EDUCATION

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ABSTRACT

The study used phenomenology to examine teacher candidates' metaphorical perceptions for measurement and evaluation practices in distance education. 210 teacher candidates at a foundation university in Istanbul were included in the study group. Researchers collected data using a three-part form. The first part gathered demographic information, the second focused on measurement and evaluation tools and the third asked participants to create metaphors for the tools. Data collected for content analysis was coded based on preservice teachers' perspectives on measurement and evaluation and the metaphors. Coders reached a consensus and developed 16 metaphor themes under 4 perspectives with above 80% consistency coefficients. It was found that preservice teachers used facilitator, constructive, quantitative and eliminative perspectives for measurement and evaluation. The category of facilitator perspective is used the most, followed by the eliminative, quantitative, and constructive. Additionally, written exams are often associated with negative metaphors while tools that rely on multiple-choice questions are linked with positive metaphors. Performance-based tools such as homework and assignments are more relevant with positive metaphors. The most remarkable finding is that using written exams and multiple-choice tests does not deliver effective feedback, unlike assignments. By conducting seminars for academics, experts should promote the utilization of feedback for other tools.

Keywords: Measurement and evaluation tools, assessment, metaphor, distance education, feedback.

INTRODUCTION

Distance education has grown in acceptance in recent years not because of how easy it is to obtain educational resources but also because it has become compulsory due to the pandemic (Gunawardena & McIsaac, 2013; Williamson, Eynon & Potter, 2020). Compared with conventional face-to-face education, however, this sort of education requires teachers to have unique skills and abilities, including adapting various measurement and evaluation practices for online learning environments. The transition to distance education worldwide

was a sudden emergency, leaving some educators scrambling to adjust their teaching methods immediately. It's crucial to reinterpret the importance of proactive planning to prevent similar situations in the future, especially training for teacher candidates. This research focused on exploring teacher candidates' metaphorical perspectives on prior experience with various assessment methods as students to gain insight into how they perceive measurement and evaluation in distance education.

Metaphors, which are defined as understanding one conceptual domain in terms of another conceptual domain (Kovecses, 2010), have been widely used in numerous educational studies (Amin, 2018; Csorba, 2015; Falani, et. Al., 2023; Jensen, Bearman & Boud, 2021; Lynch, & Fisher-Ari, 2017; Vladimirovich, Prokopievich & Filippovna, 2015). These studies emphasized the implications of metaphors in different ways, such as educational discourses, teacher education, science and mathematics education and online learning.

BACKGROUND

Metaphors have served as a source of inspiration for many researchers, aiding in the clarification of complex concepts and the development of new theories (Ghazionoory & Aghaei, 2024). They are seen as a means of conceptualizing the world (Zhang, 2021) and have been widely utilized in education to uncover teachers' beliefs, values, and attitudes towards education (Tobin, 1990). Furthermore, they have been integrated into classroom activities to assist students in grasping intricate concepts (Zhao et al., 2010). The core of a metaphor is in "understanding and experiencing one kind of thing in terms of another" by using something more familiar, concrete, and visible (Lakoff & Johnson, 2008; Zhao & Huang, 2008).

Recent research emphasizes the crucial role of metaphors in educational measurement and evaluation. Bramley (2020) delves into the role of metaphors in understanding and communicating psychometric concepts. Metaphors are not merely embellishments for poets and other creative individuals; rather, they are an integral part of how we express and comprehend the world. The paper explores how metaphors can shape the perception and interpretation of psychometric data, influencing both the theoretical and practical aspects of educational assessment. Through an analysis of various metaphors used in the field, Bramley underscores their impact on policy, practice, and the interpretation of psychometric evidence.

Moreover, the transition from traditional testing to relational evaluation underscores the necessity for comprehensive, co-inquiry-based approaches and the importance of enhancing educational experiences and promoting deeper learning and well-being (Gergen & Gill, 2020). These contributions indicate that metaphors significantly influence perceptions and practices in educational measurement, providing valuable frameworks for understanding and enhancing evaluation processes in teacher education. The importance of metaphorical perceptions in influencing students' and teachers' attitudes, beliefs and behaviors has been extensively studied in education. Though, regarding measurement and assessment activities, metaphorical thinking can be considered a method of grasping complicated concepts and procedures.

Studies have revealed that various preservice teachers have different views on how assessment and evaluation function within distance learning (Atjonen et al., 2022; Brown & Hirschfeld, 2008; Struyven, Dochy & Janssens, 2005). While some identify evaluation as a way of assessing students' learning (Bloom, 1971; Hayward, 2015; Lander et al., 2017), others consider it as a way to provide them feedback (Black & William, 1998; Lipnevich & Panadero, 2022). Parallel to this, some educators and researchers see evaluation as a tool to gauge student growth (Carless, 2020; Maclellan, 2001), while others see it as a way to confirm students' proficiency (Hamodi et al., 2017; Pitt & Norton, 2017). These differing perceptions can significantly impact how teacher candidates use assessment and evaluation practices in distance education. For example, those who view assessment as a means of providing feedback may be more likely to use formative assessments (Buck et al., 2010). In contrast, those who view it as a way of assessing student learning may be more likely to use summative assessments (Graham, 2005).

In conclusion, seeking metaphorical insights can shed light on the underlying mindsets, beliefs and attitudes of preservice teachers toward the measurement and evaluation methods used in distance education. The way preservice teachers perceive assessment procedures in distance education can significantly influence their implementation of these methods. Further research is required to comprehend how they interpret

assessment and develop these perceptions. Furthermore, examining metaphorical expressions to characterize these measurement tools could yield valuable insights.

PURPOSE OF STUDY

Turkish and global studies on the measurement and evaluation of distance education, while sharing a common interest in the conceptual metaphorical perspective, differ in their focus and approach. Globally, metaphors are widely recognized as powerful tools for enhancing the understanding of complex educational concepts, facilitating communication between educators and students, and aiding in the conceptualization of abstract ideas (Lakoff & Johnson, 2008). Similarly, Turkish studies underscore the efficacy of metaphors in bridging gaps in educational measurement and evaluation, aligning with global findings that metaphors can simplify and elucidate intricate educational phenomena (Demir, 2007).

However, global studies frequently adopt a broader theoretical lens, exploring underlying cognitive and pedagogical frameworks that contribute to effective distance education (Jensen et al., 2021; Usher & Hershkovitz, 2023; Yu et al., 2023). For instance, Saleh and Meccawy (2021) explore the perceptions of EFL female students towards cheating in distance education programs, highlighting the prevalence of academic dishonesty and suggesting improvements in technological infrastructure and awareness to mitigate cheating. Jou et al. (2022) examine cognitive factors influencing student satisfaction and achievement, suggesting a more integrated use of metaphors to support cognitive engagement. This study suggests a more integrated use of metaphors to support cognitive engagement and satisfaction in distance education. In contrast, Turkish studies, often influenced by the Covid-19 pandemic, tend to concentrate on more context-specific the immediate impact of distance education on students and educators. This is exemplified by Bekdas and Karaogullari's (2021) research, which highlights the role of metaphors in articulating students' experiences and challenges, including concerns about "lack of measurement and evaluation". Also, some studies have addressed this issue in various education and training processes (Arabaci et al., 2023; Ayyildiz & Yilmaz, 2021; Bozkus-Genc, 2022; Duman, 2020; Gunal et al., 2022; Kocak et al., 2017; Ozdemir et al., 2022; Ozmantar & Arslan, 2019. However, only one study (Tunc & Uluman, 2018) explicitly associated with measurement and evaluation tools was conducted in a conventional classroom setting before the pandemic.

This highlights a key distinction: Turkish research prioritizes the practical, context-specific impacts of distance education, while global studies lean towards developing generalized theoretical models with a stronger focus on cognitive and pedagogical principles. This study fills a gap by specifically examining metaphorical perceptions of measurement and evaluation tools in distance education, an area that has gained increased relevance due to the global shift toward distance education. The findings from this research can contribute to a deeper understanding of how metaphors influence educational practices, offering valuable insights for educators and policymakers both in Turkiye and internationally. Although studies reveal teacher candidates' positive and negative opinions about test processes and results (Aydogmus & Arslantas, 2021), no study examines the level of confidence in test results in this regard. The authors of this study concluded that addressing students' confidence in test results is necessary to better understand their metaphorical views on measurement tools. Therefore, this study aims to examine the metaphorical perceptions of preservice teachers towards measurement and evaluation tools and opinions of their results received at the end of distance education. In line with this purpose, answers to the following sub-problems were sought.

1. What are the opinions of preservice teachers about their results received measurement and evaluation tools during distance education?
   a. Which type of measurement and evaluation tool is the most trusted according to test results in distance education?
   b. Which factor affects the preservice teachers' credibility in test results in distance education the most?
2. What are the metaphorical perceptions of preservice teachers about measurement and evaluation tools in distance education?

METHOD

Research Design

Phenomenology, a qualitative research method, was applied in this study. Phenomenological studies are used in cases where the researcher intuitively realizes but does not have an in-depth and comprehensive understanding (Ozdemir & Dogruoz, 2021). In phenomenological studies, it is generally aimed to reveal and interpret individual perceptions of a phenomenon (Yildirim & Simsek, 2021). This study aims to determine the mental images of teacher candidates towards measurement and evaluation practices in distance education.

Participants

The groups who are experiencing the phenomenon the researcher is interested in contributing as data sources in phenomenological research (Yildirim & Simsek, 2021). The study group of the research had 246 preservice teachers at first. 210 participants, 175 female (83.4%) and 35 male (16.7%), remained after some were eliminated as missing values for data collection or processing. Data were collected in the spring semester of the 2020-2021 academic year from the preservice teachers studying in different programs of the education faculty at a private university in Istanbul. 50 (23.8%) were in the first grade, 58 (27.6%) in the second grade, 51 (24.3%) in the third grade and 51 (24.3%) in the fourth grade. While 115 (54.8%) of the preservice teachers had a GPA between 3.00-4.00, 92 (43.8%) had a GPA between 2.00-3.00 and 3 (1.5%) had a GPA of 1.99 and below. The frequency distribution of participants by programs is as follows: 48 students (22.9%) in elementary education, 44 students (21%) in special education, 25 students (11.9%) in Arabic language teaching, 27 students (12.9%) in preschool teacher education, 21 students (10%) in elementary mathematics education, 19 students (9%) in psychological counseling and guidance, 16 students (7.6%) in English language teaching and 10 students (4.8%) in Turkish language teaching program - the distribution of the study group according to demographic characteristics as a whole is presented in Table 1.

Table 1. Demographic characteristics of the participants

Variables		f	%
Gender	Female	175	83.4
	Male	35	16.7
Grade level	1st grade	50	23.8
	2nd grade	58	27.6
	3rd grade	51	24.3
	4th grade	51	24.3
Grade point average (GPA)	0 – 1.99	3	1.5
	2.00 – 2.99	92	43.8
	3.00 – 4.00	115	54.8
Programs	Elementary education	48	22.9
	Special education	44	21
	Arabic language teaching	25	11.9
	Preschool teacher education	27	12.9
	Elementary mathematics education	21	10
	Psychological counseling and guidance	19	9
	English language teaching	16	7.6
	Turkish language teaching	10	4.8

Data Collection

A form prepared by the researchers was used to collect the data. The form, expected to be completed in approximately 5-10 minutes, consists of three parts. The first part of the form contains demographic information to determine the gender, grade level, GPA and the programs they study. The second part includes three questions to evaluate which measurement and evaluation tool they encounter most and their opinion on the credibility of test results. In the third section of the form, preservice teachers are asked to generate metaphors and support them with arguments to express their opinions on measurement and evaluation tools in distance education. Before the metaphors were taken, the metaphor's definition and a sample had been given in the form (e.g. "What does a book look like? A book is like a seagull. Can you explain why? Because ....."). The inclusion of the concept of "because" provides a logical basis and justification for the metaphors, as stated by Saban (2008).

The research was conducted during the covid-19 pandemic process. Before the study, an application was made to the IAU Social Sciences Ethics Commission. After the ethics committee's permission (Meeting No: 2021/02) was approved, the data collecting tool was shared with the preservice teachers digitally through the campus automation system where all academic processes of the university are carried out.

Data Analysis

Qualitative data was mainly analyzed using content analysis, but some measures of central tendency were calculated using descriptive statistics. Programs like MAXQDA and SPSS were employed in that process. The purpose of using content analysis is to systematically summarize some words of a text with smaller content categories (Buyukozturk et al., 2022). Similar studies were used to determine the content analysis stages associated with the obtained metaphors (Saban, 2009; Hacifazlioglu et al., 2011; Radmard & Soysal, 2021). The obtained data underwent respectively a) data control, coding and extraction, b) classification and categorization and c) validity and reliability.

Data Control, Coding and Extraction

Since the data were collected online, they were transferred to Excel without any changes. In this process, blank answers, answers that did not specify a reason even though a metaphor was given and answers that were sent more than once because of technical issues were excluded. The rate of eliminated data is about 15% (36/246; the remaining data are for 210 participants).

No themes were pre-accepted for content analysis of the metaphors, the coding was carried out by three researchers. For each type of measurement tool namely a written exam, a multiple-choice test and assignments; data coding was completed at different times in two stages. Initially, each researcher completed the first round of coding for the metaphors on their own seeing the rationale behind the metaphor analogy. Afterward, to reach a consensus, they got together regularly to discuss and compare their codes.

Classification and Categorization

Based on a thorough examination of the metaphors used for measurement and evaluation tools, along with their underlying reasoning, a total of 16 metaphorical themes were identified. Furthermore, four distinct categorizations were discovered from the measurement and evaluation perspective. Table 2 below shows metaphorical themes and perspective categories for measurement and evaluation tools in that manner.

Table 2. Metaphorical themes and perspective categories for measurement and evaluation tools

Perspective categories	Explanation	Metaphorical themes	Explanation
Facilitator perspective	A way of assessing students' learning; focused on what and how they learned.	Comfort	The test-takers environment offers a variety of options and relief, such as question and topic choices, based on the assessors' kind understanding.
		Contentful	Rich learning outcomes, no single-answer restriction and extensive content.
		Disappointing	The disappointment of not receiving the expected evaluation results or not meeting the course requirements.
		Effort	Assigning challenging tasks that demand more effort and labor than ordinary.
		Unprofitable	Inefficiency of lectures and exams, content that is not beneficial, not permanent and leads to rote learning
Constructive perspective	A way of providing feedback; focused on enhancement	Formative	Students receive feedback on their knowledge, mistakes and deficiencies; they are also encouraged to conduct research, leading to meaningful and permanent learning facilitated by measurement tools.
		Skill-based	Promoting one's knowledge, skills and experiences through critical interpretation to precisely measure all desired outcomes.
Quantitive perspective	A tool to gauge student growth; focused on how it is scored	Dubious	Concerning the possibility of raters being biased, the chance factors affecting the results and the potential for cheating.
		Reliable	Ensuring fairness in evaluating the results, preventing any possibility of cheating and feeling certain of the reliability of tests.
		Tips & distracters	Complaining about test items when they have excessive tips or distractors that may affect results.
		Uncertain	Not sharing rubrics or giving inadequate instructions, such as unclear exam content or deadlines and unpredictability in assessment results.
Eliminative perspective	A way to confirm students' proficiency; focused on passing the exam or earning a high grade	Anxiety	Emotional intensity, such as excitement, tension and stress, may arise from fear of failure or missing deadlines.
		Restrictive	Limitations on scope and duration: either remaining incapable students' current knowledge and abilities to accomplish the test or insufficient time to complete the exam.
		Struggle	The struggle to succeed against time or other individuals, feeling in a race, competition or marathon.
		Torture	Assigning tasks that prevent passing the exam and that are damaging, painful or unachievable.
Other	Not categorized any perspectives or metaphorical themes	Other	e.g., "A written exam is similar to an assignment done quickly in a short time."

Validity and Reliability

In qualitative research, reporting the collected data in detail and explaining how the researcher reached the results are among the important criteria of validity (Yildirim & Simsek, 2008). To ensure the validity of this study, the data analysis process was explained in detail and quotations were presented in the findings section. Direct quotations were taken directly from the preservice teachers' metaphors without any changes. While writing the quotations, they were given in quotation marks and italicized and coding was used to show which preservice teacher said them.

To ensure reliability in the study, Miles and Huberman's (1994) formula was separately used to calculate each manner of tool (written exams, multiple-choice tests and assignments) according to the similarities and differences between inter-coders after every coding stage. Despite being conveyed in diverse ways, it was

discovered that most code themes assigned by coders' had the same or a similar meaning. By considering this situation, the inter-coder reliability index for coding the metaphors of written exams in the semantics sense was 61% at the first stage mentioned above. Then, the researchers gathered together several times in the second stage, collaborated on the metaphors relevant to written exams and unveiled the initial themes. Each researcher afterward independently coded the data relevant with a written exam using this initial code theme. The written exam metaphors had about a 96% coder reliability index at the final stage. The same procedure was applied for both multiple-choice tests and assignments.

The indexes calculated based on Miles and Huberman's (1994) formula [Reliability = Agreement / (Agreement + Disagreement) x 100] are presented in Table 3. Since reliability values above 80% were calculated for each coding, it was concluded that the coding was reliable (Miles & Huberman, 2015; Tavsancil & Aslan, 2001). The table below provides the inter-coder reliability indexes after these processes.

Table 3. Inter-coder consensus agreement indexes

Tools	Coder reliability index
Written exams	201 / (201 + 9) x 100 = 95.71
Multiple-choice tests	178 / (178 + 32) x 100 = 84.76
Assignments	176 / (176 + 34) x 100 = 83.80

FINDINGS

A survey was conducted of 210 preservice teachers at the end of the spring term of the 2020-2021 academic year. First, the researchers were interested in learning what measurement and assessment tools were employed to assess preservice teachers over the length of a semester. Hence, they were asked to sort the tools they encountered by frequency during the last semester.

Based on the cumulative frequencies, Figure 1 shows that the most widely used tool is the "assignment" which involves process-based assessment tools such as homework, projects and performance assignments. Then, the tools used were "Answer-Provided Test" (which contains question items such as open-ended, short answer and gap filling), "Answer-Improvided Test" (which includes question items such as multiple-choice, true-false and matching) and "Other" (which refers to tools for performance-based measurement that are completed quickly) in a gradually decreasing order.
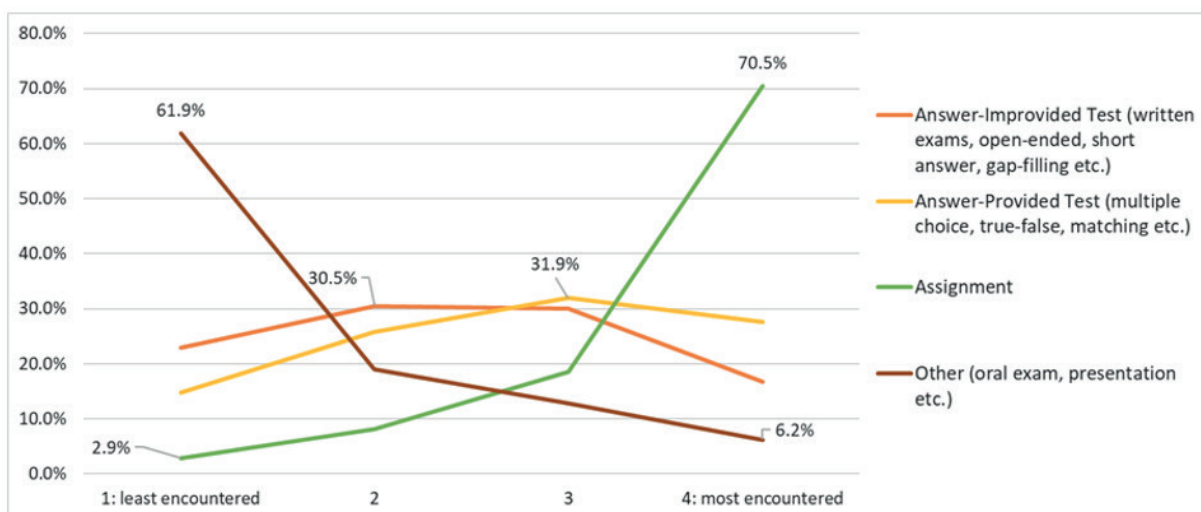

Figure 1. Frequency of encountering preservice teachers with measurement and evaluation tools

Considering this result, as seen in Figure 1, the findings covering the first research problem were organized according to all measurement tools that the preservice teachers examine. Nonetheless, the second research problem was analyzed according to the most frequently used assessment tools for pre-service teachers. These were answer-improvided, answer-provided and assignment. Accordingly, several expressions and meanings to be used herein are clarified to utilize the same language in terms of terminology in the field of measurement and evaluation and to present the findings more understandably. "Written exams" refer to online examinations that require students to provide their answers to gap-filling, open-ended and similar types of questions. Online tests with answer choices that include matching or true-false questions are pointed out as "multiple-choice tests". All process-based measurement and evaluation tools, including projects, portfolios, and homework, are collectively corresponded to as "assignments."

In the first section of the findings, preservice teachers were asked how much they trusted the results of the measurement and evaluation tools that they had previously examined. Afterward, opinions regarding the features that affect their confidence level were gathered. At the same time, the findings regarding preservice teachers' perspectives on measurement and evaluation, as well as the metaphors they created for measurement tools are presented in the second section. The findings obtained in this manner are given below to address the first research question.

Preservice Teachers' Opinions on Measurement and Evaluation Results in Distance Education

The preservice teachers were asked to rank their level of trust in the results of measurement and evaluation, with 1 as the lowest level of trust and 4 as the most. As indicated in Table 4, over fifty percent of preservice teachers placed the greatest trust in multiple-choice test scores. With a rate of 30%, Written exams came in second place, while assignments got third place rate of trust (26.7%). It was shown that other performance-based tools, such as oral exams and presentations, were the least credible tools regarding exam results.

Table 4. The level of preservice teachers' trust in measurement and evaluation results

Measurement and evaluation tools	1 (The least)	2	3	4 (The most)	Total
Multiple-choice tests	13.8%	10.5%	22.4%	53.3%	100%
Written exams	32.4%	22.9%	30.0%	14.8%	100%
Assignments	21.0%	26.7%	29.0%	23.3%	100%
Performance-based (oral exams, presentations, etc.	42.4%	23.8%	21.0%	12.9%	100%

Furthermore, preservice teachers were asked to score some of the features of validity and reliability that affect their credibility on evaluation results with a scale of 1 (least impactful) to 5 (most impactful). The acquired data were subjected to descriptive statistical analysis, and z-score comparisons were performed between these features. The features impacting trust in testing results are visually compared on a median basis in Figure 2.
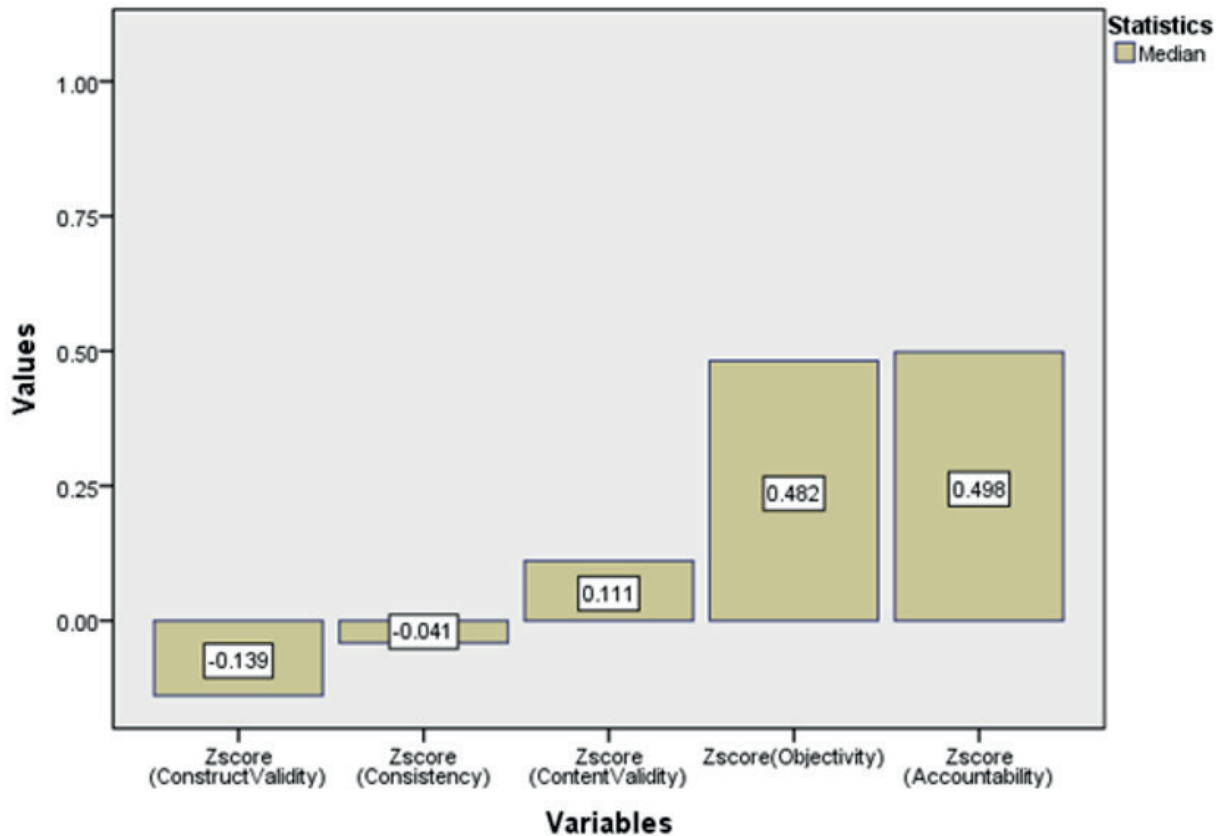
Figure 2. Comparison of the features affecting the credibility of measurement and evaluation results

Figure 2 indicates that accountability (sharing all evaluation procedures clearly, transparently and equitably with everyone) had the highest impact on the credibility of measurement and evaluation results. Objectivity adheres to this feature quite closely, which is utilizing the answer key or rubric to grade tests. Content validity (encapsulating every subject and learning objective in the curriculum), consistency (the state of consistency with other assessment results) and construct validity (measuring all characteristics to be assessed with accuracy and precision) follow these features respectively.

The Metaphors Developed by Preservice Teachers about Measurement and Evaluation Tools in Distance Education

The preservice teachers were given instructions to generate metaphors for written exams, multiple-choice tests and homework assignments and to explain the rationales for these metaphors, as these are the testing tools that they most frequently encounter. The researchers conducted a content analysis of the data and generated metaphorical themes concerning measurement and evaluation tools. Figure 3 displays the metaphorical themes that emerged on all written exams, multiple-choice tests and assignments on distance education.
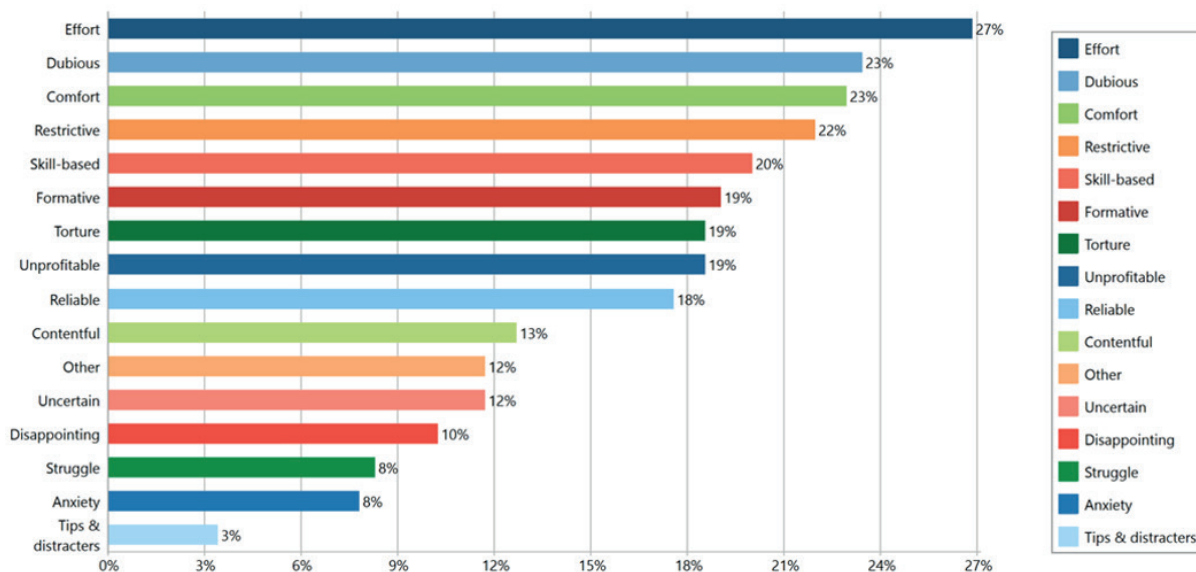
Figure 3. Frequencies of metaphorical themes for measurement and evaluation tools

After conducting a deep content analysis, it has been systematically classified preservice teachers' perceptions of measurement and evaluation tools into 16 distinct themes, as shown in Table 5. Thereby, effort, dubious, comfort, restrictive, skill-based, formative, unprofitable, torture, reliability, contentful, uncertain, other, disappointing, rivalry, anxiety, tips & distracters are the themes listed in order of most to least common. Metaphors in the "other" theme suggest mostly that the assessment methods used in face-to-face and distance education are similar. Thus, these metaphors were categorized as "other" because of their rarity and inability to be inserted into preexisting themes. Table 5 in which the quotations are presented can be examined to understand the metaphors' underlying meanings better.

Table 5. Quotations from metaphorical themes and perspective categories

Metaphorical themes	Quotations	Perspective categories
Comfort	*"Homework is similar to dinner. There are no time restrictions. The main topic of the assignment and the sub-topics are fixed. The assignment can be analyzed in the same way as a long conversation and comments over dinner." "It is easier than the written exam and a more moderate method on this rocky road. Both practical and satisfying." "Since homework is graded higher than other exams, it increases student motivation and determination."*	Facilitator: A way of assessing students' learning; focused on what and how they learned.
Contentful	*"Written exams are like the ocean because the answers can be endless." "Homework looks like a pomegranate. The shell is thick on the outside, but it contains many things inside." "Exams with open-ended questions are like a bottomless pit because answers have no end and no limitations."*	
Disappointing	*"Homework is like theft. No matter what I do, I can't get what I deserve." "It's like a turtle because you learn when your grade is published that you haven't made much progress despite your best efforts. The homework we have spent hours and days on is given low marks." "It is similar to cotton candy. It's on its way to becoming cotton, but it's not really cotton, it's in a dampness or a cloud, what I know melts away in the rain."*	
Effort	*"Written exams are like finding a key in the dark, because It is so difficult, challenging and time-consuming." "The assignments are similar to coronavirus. Because it was very tiring and exhausting both psychologically and physically." "Homework is similar to working like a bee. Much labor is expected. They expect us to work hard like bees gathering nectar from the flowers. We are asked to make honey."*	
Unprofitable	*"It's similar to theatre. In tests with multiple-choice questions, you memorize and study only enough to save the moment." "It is like a telephone without internet. Because without the internet, the telephone is useless and without face-to-face education, people become blind to learning." "It is like writing on water. Written exams are not more than theoretical knowledge and the permanence of theoretical knowledge is debatable."*	

Formative	"It's like a sturdy wall that I can lean against, it provides the most beneficial feedback in class." "Homework is akin to scientific research. Through in-depth inquiry, we gain a greater understanding and retain information more permanently." "It is like a piggy bank. Because homework is a continuous exercise and while doing it, we enrich ourselves in terms of knowledge as if we were putting money in a piggy bank."	Constructive: A way of providing feedback; focused on enhancement
Skill-based	"It's like a book I wrote by blending my knowledge and my thoughts. We were asked to take the information given to us in the lesson, filter it through our own minds and create it in line with the desired instruction." "Written exams are similar to turkeys. Since we think like turkeys and write our own opinions and thoughts. Sharing knowledge and thoughts can reveal new ideas." "Assignments are like honey. In other words, I can reflect on myself so much that this uniqueness and uncover the benefit of my capability when the time is given appropriately and when it is lesson oriented."	
Dubious	"When answering multiple-choice questions, even if the answer is not known, there is a chance of hitting the mark by randomly guessing one of the choices." "Written exams are like riding a bike on a hill. Because the results are not assessed fairly." "It's like fooling yourself. I think there's a lot of cheating going on."	Quantitive: A tool to gauge students' growth; focused on how it is scored
Reliable	"Written exams are like a proof. Since cheating is minimized, everyone can prove themselves." "It is similar to a judge. Answers are assessed fairly." "It looks like a dart. Multiple choice tests are more reliable and valid, resulting in higher success rates if we answer correctly."	
Tips & distracters	"It's like a life vest. Having the questions and answers in front of us can help us get a higher score." "Multiple choice tests are like a ball of string. Because all the choices look alike. What I know confuses me." "Multiple choice tests are like a morning when I wake up happy. Its ability to light up in my brain in a moment by quickly recalling or eliminating options pleases me."	
Uncertain	"Because everything is unknown and it is very uncertain how some classical exams are evaluated." "It is similar to an application form. In homework assignments, We can achieve passing grades by giving the exact answers requested by teachers. However, since we do not know the exact number of points available beforehand, I liken it to filling out an application form." "It is like a bomb. In some courses, we don't know the assessment criteria. If the assignment is not informative, there is uncertainty until we see our grade. It can raise the average a lot or lower it a lot."	
Anxiety	"We can finish the exam as early as we want, but it's stressful due to possible internet cutting-off issues." "It is frustrating and stressful to be unable to revisit unanswered questions, leading to hasty random guessing." "It looks like stress and hair loss due to an excessive amount of homework and lack of sleep."	Eliminative: A way to confirm students' proficiency; focused on passing the exam or earning a high grade
Restrictive	"It's similar to a quick breakfast snack. There isn't enough time to interpret and think because of the many questions. To be successful, it requires answers and passes quickly." "It's like a cliff. Because if you take one wrong step, you can't go back." "It is similar to a confined space. Setting a specific word limit can negatively impact the student's performance."	
Struggle	"Homework is like a never-ending road. As it continues from the first week to the last week." "It's like a baby trying to hold on to life in a cuvette. Even if we don't want to do it, get tired or bored, we have to do our homework no matter what, as the baby is fighting for their life." "It's like a race course because we're always in a race."	
Torture	"It's like a UAV (unmanned aerial vehicle). Because they behaved as if we were non-human beings. Everything was done to make us fail the exam." "It is like a snake that does not kill. It doesn't kill, but it makes you crawl." "It's like a cuckoo. Because cuckoos start their fight for life by destroying other eggs. Just like Open-ended questions destroy our efforts under stress."	
Other	"A written exam is similar to an assignment done quickly in a short time." "It's like a survey. No observer. Just the test and you." "It is like sending mail with a pigeon. We take an exam through a digital system and it is transmitted to our lecturers."	

Summarily, the following inferences were drawn after taking into account all metaphors. The general sentiments towards tools are often negative and unpleasant, with metaphors used to describe the association with effort, anxiety and torture. However, when it comes to skill-based assessment, both success and failure are acknowledged, making it a more balanced approach. Although occasional emphasis is placed on comfort and reliability, there is still a sense of dissatisfaction or skepticism associated with them. Overall, these metaphors suggest that success is a challenging endeavor that requires significant effort. Additionally, Table 6 presents frequency distributions of metaphorical themes that emerged from data analysis by various variables. These variables are gender, class level, grade point average and program.

Table 6. The level of preservice teachers' trust in measurement and evaluation results

Variables	Metaphorical themes	Anxiety	Comfort	Contentful	Disappointing	Dubious	Effort	Formative	Reliable	Restrictive	Skill-based	Struggle	Tips&distracters	Torture	Uncertain	Unprofitable	Other
Gender	Female	14	38	24	19	42	46	35	28	41	34	14	7	30	21	31	22
	Male	2	9	2	2	6	9	4	8	4	6	3	0	8	3	6	6
Grade Level	1. Grade	6	14	1	4	11	11	15	7	7	11	2	5	5	4	11	7
	2. Grade	4	13	6	7	15	17	5	14	17	10	4	1	13	12	6	5
	3. Grade	4	10	11	4	14	13	10	9	14	10	5	0	12	5	6	3
	4. Grade	2	10	8	6	8	14	9	6	7	9	6	1	8	3	14	13
GPA	1.00-1.99	1	0	0	1	1	0	1	0	0	1	0	1	0	0	0	0
	2.00-2.99	5	20	11	6	14	23	15	19	25	21	8	2	24	10	16	6
	3.00-4.00	10	27	15	14	33	32	23	17	20	18	9	4	14	14	21	22
Program	Arabic language teaching	0	5	2	1	5	5	7	3	7	6	4	0	7	1	5	6
	Elementary education	3	13	8	7	8	12	7	9	13	9	4	1	9	10	6	6
	Elementary math. education	3	2	1	1	5	6	4	5	7	4	1	1	5	3	2	1
	English language teaching	1	5	2	1	1	6	4	2	3	0	2	0	3	1	4	2
	Preschool teacher education	2	11	4	3	8	8	6	5	5	6	5	1	4	3	2	1
	Psyc. counseling and guidance	3	10	4	3	10	11	7	5	4	9	1	2	4	1	14	11
	Special education	2	1	3	4	10	4	2	6	5	3	0	1	4	5	2	0
	Turkish language teacher education	2	0	2	1	1	3	2	1	1	3	0	1	2	0	2	1
Total		64	188	104	84	192	220	156	144	180	166	68	28	152	96	148	112

It is clear from looking at Table 6 that females tend to create more metaphors than males. The table demonstrates that people with GPAs below 2.00 deployed barely any metaphor. The development of metaphors among preservice teachers is consistent across all grade levels. Among the programs, the elementary education program is accountable for creating the majority of the metaphors. However, as seen in Figure 4, it was noted that several themes concentrated on specific measurement and evaluation methods. For example, the metaphor "formative" is better used when referring to assignments, whereas the metaphor "uncertain" works well for written exams. In a similar vein, the metaphor "tips&distracters" is primarily intended for multiple-choice tests, which have never used metaphors for assignment techniques.
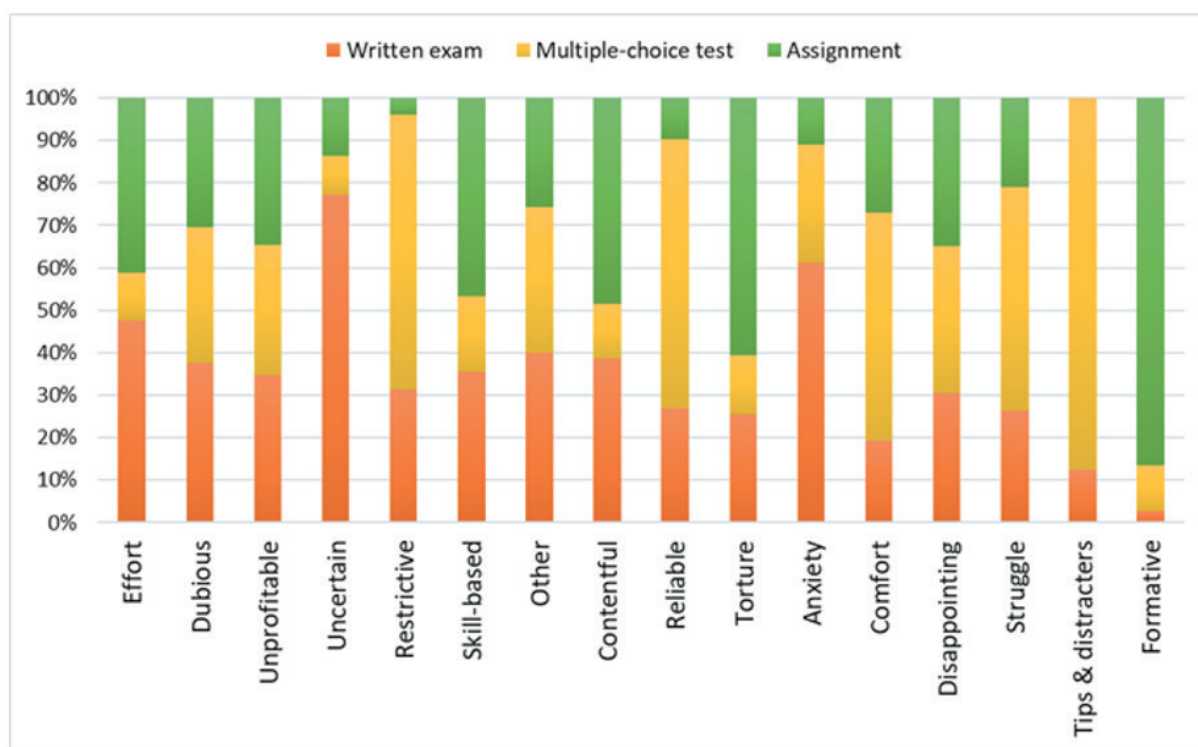
Figure 4. The distribution of metaphorical themes based on methods of measurement and evaluation

Figure 4 revealed that various metaphors have been linked to different assessment methods. Written exams were often characterized by metaphors such as uncertain, effort and anxiety. On the other hand, multiple-choice tests were associated with metaphors of reliable, tips/distracters, struggle, comfort and also restrictive. Lastly, assignments were commonly described using metaphors like formative, skill-based, torture and contentful. Moreover, an analysis of pre-service teachers' perspectives on measurement and evaluation tools was conducted out of the metaphorical themes. The analysis resulted in four different perspective categories. These are the facilitator, constructive, quantive and eliminative perspectives. Figure 5 shows the distribution of measurement and evaluation tools on perspective categories.
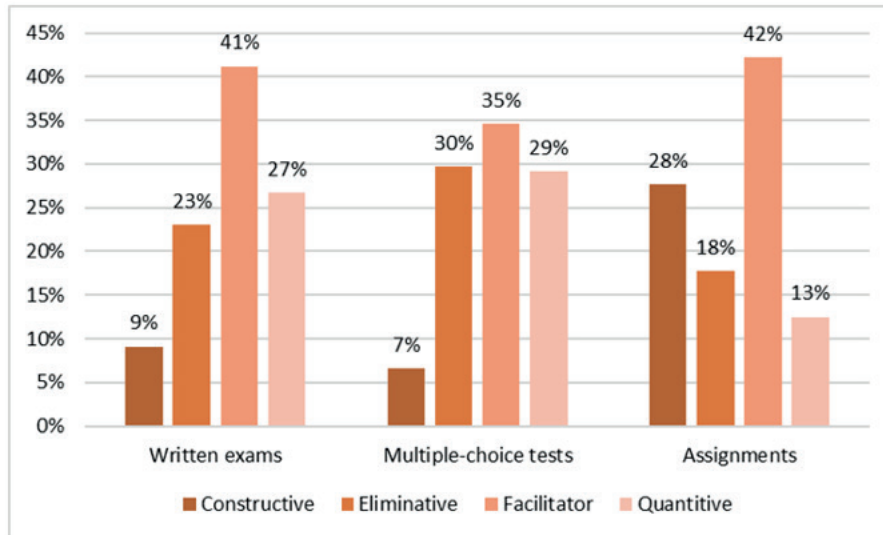
Figure 5. The distribution of measurement and evaluation tools on perspective categories

Figure 5 shows that preservice teachers approached written exams, multiple-choice tests and homework assignments in distance education at mostly rates with a facilitator perspective. For written exams and multiple-choice tests, however, they tended to employ a quantitive and eliminative perspective more often than they did for assignments. The most noteworthy finding was that, except for assignments, they did not consider other tools as effective feedback or learning formative tools.

DISCUSSIONS AND CONCLUSION

As a result of the research, it was revealed that preservice teachers trusted the results of multiple-choice tests the most in distance education, while they trusted the results of performance-based assessment tools the least. This opinion is based on the perception that online multiple-choice test evaluation procedures are more accountable and objective. Research conducted with undergraduates supports this result by demonstrating that providing exam instructions clearly and concisely enhances test takers' confidence in their scores (Shraim, 2019; Senel & Senel, 2021). Cetin and Akduman (2022) state that teachers believe that the reliability of online tests is quite low. They suggested that homework should be prioritized in distance education. The rationale for this was attributed to the significant likelihood of cheating in online tests (multiple-choice or open-ended questions) as well as the inability to monitor the exam then and there. Within this framework, research indicates that preservice teachers and teachers take divergent stances when it comes to the credibility of assessment instruments or test results from distance education. It becomes explicit that phenomenological research is required to understand how professional experience influences the perception of measurement and assessment when it is assumed that these two participant groups represent the same profile at various points in time.

This phenomenological study found that pre-service teachers view assessments in distance education from four broad perspectives. These are facilitator constructive, quantitative, and eliminating. The study's uncovering of metaphorical perceptions and perspectives could provide insights into how preservice teachers use tools for assessment when they begin teaching. Thereby, it is beneficial to outline what preservice teachers might anticipate from measurement and evaluation tools based on every perspective.

It was observed that preservice teachers mostly approached the assessment processes in distance education from a facilitator perspective. This perspective holds that preservice teachers consider assessment as goal-oriented and are motivated by the desire to more easily achieve learning outcomes. Stated differently, their emphasis lies both in making measurement tools inclusive of learning outcomes and in facilitating processes for evaluation to accomplish the intended result. Especially in written tests and assignments with open-ended questions, preservice teachers employed the facilitator perspective to describe what they had done all semester to pass their exams. Remarkably, metaphors were generated to characterize these assessment

tools as liberty bestowed upon them and challenging assignments since they were inadequate to convey their own comprehension. In this regard, it is advised to intend more structured and transparent rubrics for the assessment procedures like written tests and assignments with open-ended questions. Since pre-service teachers believe that procedures related to measurement and evaluation aid in learning, this perspective says. They did, however, appear to be disappointed when learning did not occur under their own awareness or when they failed to get a score on an exam that expected this. Yet, it is generally agreed upon in the literature that open-ended questions should be used to reduce the likelihood of success and to promote critical thinking and higher-order cognitive processes (Gronlund, 1998; Guler, 2014; Popham, 2003).

The constructive perspective on assessment tools unequivocally emphasizes their use for providing feedback and advancing students' thinking. It was discovered that in distance education, assessment tools other than assignments are not approached constructively and are therefore viewed as secondary. This highlights the shortcomings of written exams and multiple-choice tests as means of providing feedback for assessments. Although homework is the most commonly used method for assessing pre-service teachers in distance education, it is important to use other assessment tools to provide feedback on their cognitive learning. A recent study found that homework assignments, especially when given at regular intervals, help students better track their own learning progress and generate new ideas. Therefore, it is recommended that teachers explain the incorrect answers and possible reasons for them to the class or individual students after written exams and multiple-choice tests (Bialowas & Steimel, 2019; Martin et al., 2018). Assessment practices can play a crucial role in the learning process of pre-service teachers. Several studies have demonstrated that feedback not only helps to restructure the academic understanding of students but also enhances their social and emotional motivation (Chase & Houmanfar, 2009; Krause & Stark, 2010; Orozco et al., 2023; Yurt, 2022).

According to the eliminative perspective, pre-service teachers tend to focus solely on passing exams, achieving high scores, and improving their own competencies. It has been observed that pre-service teachers who have a result-oriented approach tend to use negative metaphors such as anxiety, workload intensity, and inability to complete the challenge. This approach towards all assessment tools can distract them from the learning process and make them resort to less effective learning methods like memorization and cheating to pass the exams. This approach is particularly prevalent in countries with an exam-oriented education system, where assessment practices are perceived as mere competition. Consequently, students tend to focus more on completing the exam rather than the actual content, which can lead to inefficient thinking during the exam. It is advisable to maintain a balance between the time allocated for assessment practices and the intensity of the required content to address these issues.

Lastly, there is a quantitative perspective that focuses on the scoring processes. However, the metaphors used in this perspective are often unrelated to the goals of learning and achievement. Preservice teachers have expressed their opinions that measurement and evaluation processes should be more reliable and discriminative. In this context, there are contradictory opinions regarding multiple-choice tests. While some believe that these tests are more reliable than other tools, others believe conversely that the tips and distractors in the choices make it difficult to measure what is intended to be measured. On the other hand, evaluation processes in tests with open-ended questions such as written exams and assignments are often unclear, with scorer bias being a common issue. Overall, it is found that the focus of preservice teachers with this perspective is on how an answer is scored rather than what the answer is. According to metaphorical perceptions, some students answer questions in a way that aligns with the point scale. For instance, they may randomly guess answers in multiple-choice tests or prioritize questions that can earn them the most points in open-ended tests. These actions indicate that the measurement tools used are incomplete in terms of measuring cognitive learning outcomes, and don't cover the actual content that the students should learn. Studies have shown that this situation is prevalent in distance education, and it is essential to prepare assessment procedures that not only measure the level of knowledge but also prevent inappropriate behaviors during the exam. Therefore, transparency should be a critical aspect in the preparation, implementation, and post-implementation processes of these measurement tools. All criteria should be shared clearly and firmly with the class before the implementation.

Limitations and Suggestions of the Study

Despite the insightful findings of this study, it is important to acknowledge several limitations. One significant constraint is the collection of data during the pandemic period, which may have introduced bias due to the study's reliance on self-reported data. Additionally, the relatively small sample size may affect the generalizability of the findings. Future research should consider addressing these limitations by increasing the sample size to enhance generalizability and incorporating multiple data collection methods to mitigate bias. It is recommended that forthcoming studies expand on the foundation laid by this research and provide a more thorough understanding of how to effectively use measurement and assessment methods in distance education for both pre-service and in-service teachers with varying perspectives on the assessment concept.

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ONLINE CLASSROOM-BASED READING ASSESSMENT: COMPREHENSION AND PRACTICE DEVELOPMENT

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ABSTRACT

In this paper, we investigated the impact of an online classroom-based reading assessment on implementing practices in reading instruction among 30 EFL learners in an intermediate reading course at a public university in East Java, Indonesia. Our study aimed to develop an online classroom-based reading assessment and evaluate its efficacy in measuring students' reading skills. The online classroom-based assessment, characterized as systematic, comprehensive, instructional, diagnostic, and adaptive, yielded positive outcomes, as evidenced by specific trends in the qualitative analysis. While limitations were considered, the study's findings showcase the practical implications of incorporating online classroom-based assessment in monitoring student performance and evaluating teaching quality. The results emphasize the importance of online classroom-based reading assessment as a robust evaluation tool for aligning learning goals and needs. Overall, our study contributes valuable insights into the benefits of online classroom-based reading assessments and their potential to enhance traditional assessment methods in English as a Foreign Language (EFL) settings in this technologically advanced era.

Keywords: Classroom-based assessment, EFL classroom, online assessment, reading assessment, technology inclusion.

INTRODUCTION

Reading is a fundamental skill that significantly impacts all facets of life, including academic achievement, employment efficiency, and social relationships. Proficiency in reading involves meeting cognitive demands, encompassing the comprehension of explicit and implicit meanings, content organization, and retention of relevant information (Hoi, 2021). With dual objectives of fostering literary experiences and facilitating knowledge acquisition, reading skills form the bedrock of language learning environments (Duke & Carlisle, 2011; Murphy et al., 2009).

Within the context of language proficiency enhancement, evaluating reading abilities is of utmost importance, especially in English as a Foreign Language (EFL) classes (Ekpang et al., 2021). Contrary to the widespread misunderstanding that assessment is just used to evaluate student performance, its more

considerable function includes monitoring progress, matching teaching methods with learning goals, and adapting instructional materials to different levels of competence (Hoi, 2021). Based on Vygotskian ideas that emphasize the importance of language in social interaction, classroom-based evaluation plays a crucial role in evaluating and promoting literacy development (Vygotsky, 1981; Guthrie & Wigfield, 2000; Maplethorpe et al., 2022).

Recognizing the importance of classroom assessment in shaping students' learning paths, educators need to provide top-notch evaluations, particularly in reading. In addition to their inherent academic significance, proficient reading abilities broadly impact both professional and social contexts. Moreover, the changing media and information environment, driven by technological progress, highlight the crucial importance of reading in English as a Foreign Language (EFL) settings, requiring web-based English language teaching and readily available online evaluation tools (Raine, 2018).

Although widely recognized standardized reading assessments like the TOEFL and IELTS reading examinations are familiar (Khabir et al., 2022), their practical use in classrooms often exposes a lack of teachers' understanding of reading assessment procedures (Sawaki et al., 2009; Tengberg, 2018). The heavy dependence on standardized tests and a lack of recognition for teacher-created assessments in the classroom highlights the necessity for empirical investigation into reading assessments that focus on learning in the classroom setting.

The increasing need for online reading assessment in classroom settings necessitates developing customized methodologies aligned with the unique characteristics and requirements of English as a Foreign Language (EFL) classes. Indonesian EFL environments lack systematic, comprehensive, and diagnostic classroom-based learning-oriented reading evaluations. This study aims to fill this void by creating reading assessment tools similar to standardized instruments to evaluate comprehension abilities, identify reading difficulties, and assess the complexity of instructional materials in Indonesian EFL classes at the intermediate competency level. Our investigation aims to improve reading assessment methods and instructional methodologies in the Indonesian English as a Foreign Language (EFL) context.

LITERATURE REVIEW

Reading Test

The development of reading tests is a critical aspect of educational assessment, and several studies have emphasized the importance of their validity and reliability. Mullis et al. (2016) underline the importance of creating instruments that accurately measure intended aspects and produce consistent, replicable results. Ozdemir and Akyol (2019) further stress the need for reliable, validated tests to reflect students' learning outcomes accurately.

Despite this, traditional test development methods often lead to assessments that fail to gauge student achievement accurately. Hanafi (2016) points out that many teachers develop tests without proper guidelines, leading to inadequate measurement of learning outcomes. Similarly, Brown (2004) identifies that a lack of understanding of reading abilities and the reading process can result in flawed test development.

Selecting appropriate skills to assess and measure varied reading abilities is key to effective test development. Nisa and Helmanda (2019) argue that factors like reading materials, test formats, and types of reading should be considered to create comprehensive and valid assessments. This critical analysis underscores the importance of teachers engaging with past theories and methodologies in test development to ensure substantial achievement of validity, reliability, and accuracy. It also suggests that incorporating authentic classroom-based assessments could better align with learning goals and student needs.

Keenan et al. (2008) emphasize that comprehension is the primary goal of reading, and the ability to measure and understand it is increasingly demanded. Reading tests typically involve students responding to questions about texts that traditionally focus on single-source texts from printed materials. However, as Grabe (2009) notes, profound reading activities like integrating background knowledge and forming inferences are necessary for fully understanding text information. Agota (2020) identifies two primary purposes of reading tests: ensuring equitable grading across abilities and serving as a benchmark for evaluating teaching practices. Diagnostic exams, in particular, assess various reading sub-skills and identify strengths and weaknesses.

Recent research advocates for reading assessments based on classroom evidence (Andronova, 2021). According to Snow (2002), reading comprehension is deeply embedded in a sociocultural context involving the reader, task, and text, significantly influencing comprehension outcomes. Yu (2021) suggests that considering the intricacy of tests is crucial when examining reading comprehension to have a more profound appreciation of these associations. Additionally, readability assessments using computational methods are increasingly used to estimate text difficulty.

This study intends to reinforce using classroom-based assessment as an effective tool for diagnosing student comprehension and selecting appropriate instructional materials. Educational institutions may find the results of such assessments crucial for improving academic quality. The findings will also contribute to future research on classroom-based assessments in various language skills.

Types of Reading Test

Reading tests should encompass diverse tasks that address different reading strategies, such as scanning, skimming, and comprehensive reading. The first type of task generally assesses students' overall understanding of the reading material. The second focuses on analyzing specific components and the content of the text, while the third type evaluates the ability to comprehend detailed text information (Andronova, 2021; Walvoord, 1998). Nisa and Helmanda (2019) elaborate on various reading types that should be incorporated into reading tests.

According to Nisa and Helmanda (2019), reading materials can be classified into selective, participative, and comprehensive categories. Selective reading includes tasks involving graphics, true/false questions, and short response queries. Participatory reading involves interactive elements with the text, such as anecdotes and short stories. Comprehensive reading refers to longer texts like professional articles and essays.

Reading comprehension tests can be objective-based or essay-based (Nisa & Helmanda, 2019). Objective tests may include formats like true/false, multiple-choice, and match-up questions. In contrast, essay-based tests require test-takers to write responses, often evaluating their ability to defend answers using their own thoughts.

While the transition to online testing in reading comprehension offers advantages such as flexibility and instant feedback, it also presents several challenges and limitations. Technical issues are a primary concern, as online tests rely on stable internet connections and functional computer systems. Technical difficulties during testing can disrupt the process and affect student performance (Kostaki & Karayianni, 2022). A further significant obstacle is the disparity in technology. Unequal accessibility to essential technology among learners results in discrepancies in test-taking possibilities (Johnson et al., 2016). This lack of access can disproportionately affect students from lower socio-economic backgrounds.

Security concerns are heightened in online testing environments. The potential for cheating and unauthorized assistance increases due to the remote nature of these tests (Newton & Essex, 2023). Additionally, online tests often lack the immediate human interaction and support available in traditional settings, which can be crucial for some students, especially in understanding and interpreting test questions (Barrot et al., 2021).

Adapting to different learning styles is also more challenging in online formats. Traditional methods may cater more effectively to diverse learning preferences, thus providing a more inclusive assessment environment (Santiago et al., 2021). Online tests might also struggle to assess higher-order thinking skills as effectively as traditional essay-based questions (Fensham & Bellocchi, 2013; FitzPatrick et al., 2015; Koksal & Ulum, 2018). While online tests can provide immediate feedback, the quality and depth of this feedback may be limited compared to traditional classroom settings (Lu et al., 2021). This limitation could impact the learning and improvement opportunities typically derived from thorough and personalized feedback.

Therefore, while online reading tests offer notable advantages in efficiency and scalability, educators and test developers must consider and address these challenges to ensure fairness and effectiveness in assessment (Andronova, 2021; Nisa & Helmanda, 2019). A balanced approach to reading test administration is crucial, one that leverages the benefits of technology while mitigating its limitations. This understanding is essential for developing effective and equitable reading assessments in ELT contexts.

The Construction of Reading Test

Teachers need to consider factors such as validity and reliability when creating a test. To be valid, a test fulfills the course goals and objectives, test purposes, and comprehension processes such that they do not work in isolation from one another or the students' learning context (Mullis et al., 2016). The constructed instruments must be capable of measuring the aspects to be assessed (Fatimah et al., 2018). Furthermore, reliability means consistency. The test is considered reliable if the same test results are consistently obtained using the same strategies under the same conditions. A reliable test, however, is not necessarily valid. Although the results are replicable, they are not always accurate. Hence, developing a reading test as a formal assessment instrument necessitates several crucial decisions, and testing must be reliable and valid (Ozdemir & Akyol, 2019).

However, most teachers commonly develop tests without considering test development guidelines, resulting in inaccurate and invalid assessments that cannot gauge students' achievement (Hanafi, 2016). Consequently, there is a widespread occurrence of exams that are not valid or trustworthy and that do not effectively assess students' learning results. In his 2004 publication, Brown outlines several phases of the test development process. The creator should decide which skills to examine to begin the test development process. This assessment might be based on a logical analysis of the requisite reading abilities or a psychological understanding of the reading process (or both). Both factor analysis and experimentation can be used to evaluate the independence of different skills from one another.

Second, while developing a reading test, the test developer must determine how to measure the varied reading skills. Because test results are frequently misinterpreted by readers (and even educational specialists), test creators must also specify how and when their tests should be used (Schwartz, 1984). There are several techniques for measuring each reading skill, and test developers typically pick one or the other based only on personal choice. Reading theories are generally beneficial in selecting measuring techniques because they provide crucial test variable specifications. The next stage in developing a test is determining how the test will be graded. Several distinct scores have been used, and a test can produce multiple types of results.

Furthermore, teachers can administer tests online or offline using paper and pencil. However, in this technologically advanced era and response to the characteristics of today's digital native students, online tests are preferable. Students' Z-generation characteristics have led them to choose online-based assessment over offline assessment, and it is vital to meet students' reading learning preferences to perform better in reading comprehension (Ming & Aziz, 2019). Additionally, incorporating technology in classroom practices resulted in a favorable perspective of technological integration among instructors and students (Cahyono et al., 2023). Online tests are also more effective than paper and pencil tests because they run more smoothly in emergencies such as the COVID-19 pandemic (Sudarwati et al., 2021). Besides, online tests have several advantages over paper and pencil tests. It allows for adaptive assessment phases in which the test can be conducted (Spivey & McMillan, 2014), automatically randomizing the order of questions and answers for multiple-choice and matching questions to reduce the possibility of student cheating and providing instant feedback and reports.

As a result, in this study, we developed an online classroom-based test for EFL reading comprehension. As previously stated, the test for EFL reading comprehension is considered necessary because classroom-based learning-oriented assessments tailored to EFL classroom-specific features and needs and can be easily implemented in classroom instruction are still in their infancy. Furthermore, a few educational institutions still administer standardized competency examinations that can be used as diagnostic reading assessments.

To summarize, this research project was intended to produce an online classroom-based test for students in the English Language Education major's intermediate reading class. The informational and literary reading texts are accommodated in the content. The product of this study is a set of classroom-based learning-oriented tests for reading skills, which contain 40 multiple-choice test items. In brief, the product is expected to benefit teachers and students in the intermediate reading course by demonstrating how classroom-based learning-oriented assessment is built and functions to assess students' reading proficiency vigorously, diagnosing students' competency level and areas for teaching improvement, and contributing to the advancement of assessment theory in English Language Teaching (ELT).

The results of a classroom-based reading test formulation and tryouts for second-year university students participating in an intermediate reading course are examined in this study. It intends to create reading test instruments similar to standardized assessment tools for assessing students' comprehension, diagnosing reading difficulties, and defining instructional material difficulty levels for usage at the intermediate competency level in the Indonesian EFL setting. This research seeks to tackle the following inquiries:

1. What are the findings of the classroom-based reading test validation?
2. How are the results of the developed classroom-based reading test tryouts?
3. What are the ramifications for the tryout results?

METHOD

This study employed a two-stage approach encompassing research and development (R&D) for constructing an online classroom-based reading assessment. The methodology drew upon Borg and Gall's (1983) design, which was integrated with McGrath's (2016) design and eventually integrated with McGrath's (2016) stages, as illustrated in Figure 1. The R&D process was divided into three major phases: 1) exploration, 2) development, and 3) validation and implementation.
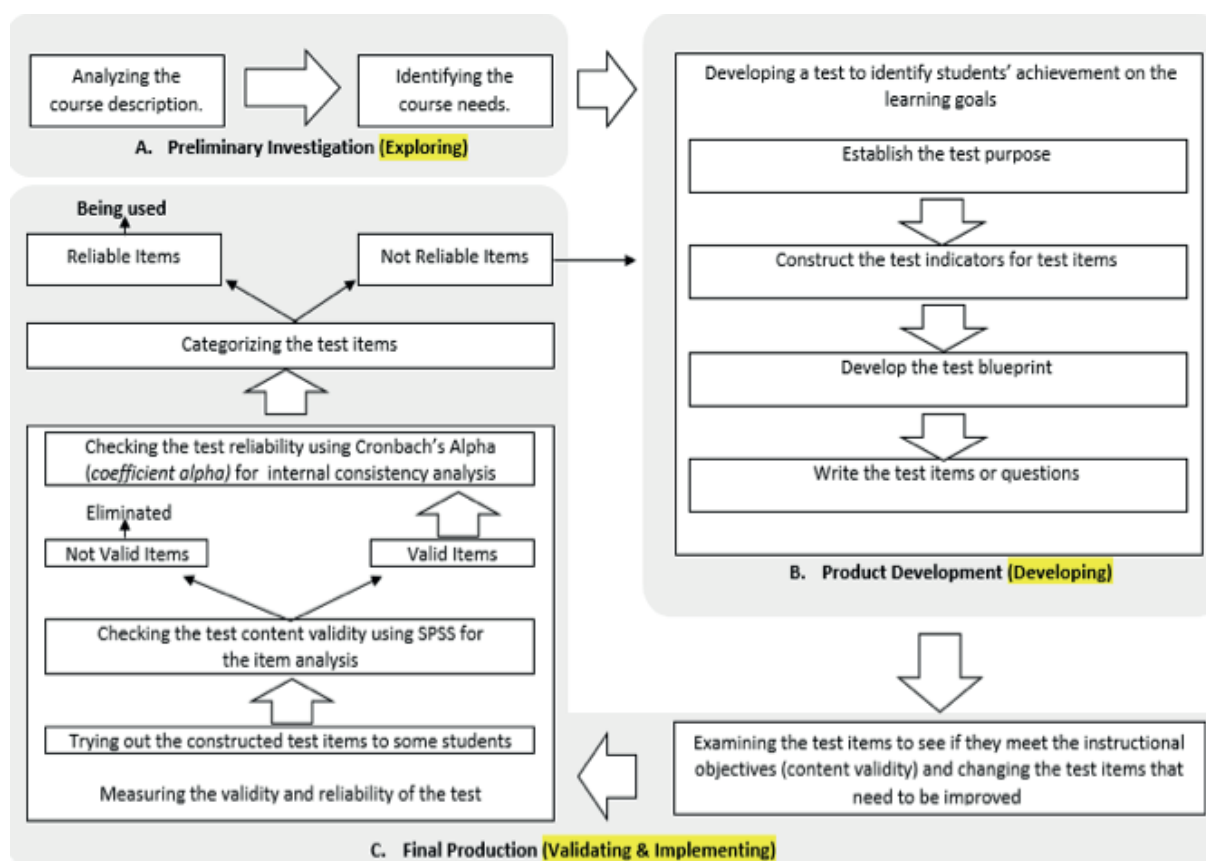
Figure 1. Material Development Procedure

The first stage entails doing a preliminary inquiry or exploration. During the initial inquiry phase, we comprehensively evaluated the English Language Education Study Program's intermediate reading course at an East Java public institution. This process involves the examination of course descriptions, conversations with instructors, and a comprehensive evaluation of pertinent literature. We systematically analyzed the course description to identify explicit objectives and competencies related to reading as outlined in the curriculum. Subsequently, we proceeded to conduct interviews with the teachers. We engaged in discussions with experienced instructors of the intermediate reading course. These discussions generated subjective

insights regarding teachers' evaluations of students' reading ability, challenging areas, and their expected educational goals. Afterward, an extensive review of pertinent literature was undertaken to discover practical approaches for assessing reading proficiency in English as a Foreign Language (EFL) contexts. This measure ensured compliance with established industry norms.

The second phase entailed product development, which began with identifying the test's objective. The assessment's diagnostic nature was acknowledged, leading to further processes of identifying test signs, creating a test blueprint, and composing test items. We generate and develop test metrics based on the findings from our investigation. Five essential indicators were devised, which include detecting keywords and themes, making inferences, interpreting dictions and figures of speech, assessing culture-bound diction, and examining text organization and idea development. Subsequently, a test blueprint was produced by delineating the framework and allocating test items according to the discovered indications. In addition, we developed test items that were aligned with the specified indicators and test plan.

The last phase involved the process of validating and implementing. The validation method encompassed face validity tests and content validity and reliability assessments. During face validity testing, we evaluated whether the test items aligned with instructional objectives, if the reading texts were suitable, and if the things followed proper syntax and vocabulary usage. Items that did not pass face validity testing were revised as required. Concurrently, regarding content validity and reliability, the examination was given to 30 students in an intermediate reading class of 18 females and 12 men. The Quizizz program was utilized for this purpose. This program was selected based on its user-friendly interface, efficient management capabilities, and rapid score analysis (Rahmad et al., 2019).

Additionally, it was picked for its high level of user involvement and accuracy (Zhao, 2019). The material's validity and reliability were evaluated through internal consistency analysis. Statistical analyses were used to identify items that were both valid and reliable. In contrast, known test item development techniques were followed to reconstruct things that were found to be invalid and unreliable.

This rigorous approach aimed to create an online reading assessment for intermediate English as a Foreign Language (EFL) students in Indonesia that is both relevant to their culture and successful in measuring their skills.

FINDINGS AND DISCUSSION

An analysis of the course description was performed in the preliminary study to determine the student's learning objectives in reading and the test goals. The study's findings were then used to guide the construction of the test blueprint. The expert validation testing and tryout were carried out as the blueprint was built. The following parts describe the results of the course description analysis, expert validation testing, and tryout.

Course Description Analysis

We selected an intermediate reading course offered as part of the English Language Education major at a public university in East Java, Indonesia. The course was chosen because it covers literary and informative text categories commonly found on standardized reading tests. In addition, the course text types serve two specific functions of reading: to engage with literature (Duke & Carlisle, 2011) and to gain and apply knowledge (Murphy et al., 2009). The test was then generated, which included several steps, including a) deciding the test purpose, b) analyzing the test goals according to the course outline to construct the test blueprint, which includes the instructional objectives, test indicators, and the targeted learning outcomes, c) creating the test items based on the blueprint, d) reviewing and revising the constructed test items, and e) getting expert validation for the test items.

The findings indicate that seven competencies should be developed as instructional indicators for students' reading ability. These seven abilities are identifying keywords and underlying themes, making inferences, interpreting dictions, figures of speech, and culture-bound expressions, examining juxtaposition, examining structure and development of ideas, classifying text types, and appraising short stories. However, only five of those seven skill categories could be further developed into reading tests since categorizing text genres and appraising short stories are intended to be utilized in teaching and assessed through students' performance as a part of productive skill performance. As demonstrated in Table 1, the intermediate reading course focuses on two primary purposes that comprise the majority of reading undertaken by intermediate language level students: reading for literary experiences (Duke & Carlisle, 2011) and reading to gain and apply knowledge (Murphy et al., 2009).

Table 1. The Course Goals, and Instructional Objectives

Course Goals

The students are able to read and comprehend popular articles and short stories and develop their reading strategies by identifying keywords, making inferences, analyzing figures of speech, analyzing dictions, analyzing juxtaposition, analyzing the organization, and development of ideas, identifying text types, and appreciating short stories

Reading Purposes

- Literary experience
- Acquire and use information

Instructional Objectives

At the end of the lesson, the students are able to:

1. identify keywords and the underlying theme,
2. make inferences from the content of a text,
3. interpret dictions, the figure of speech, and culture-bound dictions,
4. analyze juxtaposition in a text,
5. analyze organization and development of ideas (the development of the plot of a text)

It should be underlined that reading goals and purposes and instructional objectives reflecting comprehension processes in integration do not operate independently (Mullis et al., 2016).

Test Blueprint Development

Table 2 displays the indicators for the intermediate reading test and the construction of the test blueprint by referring to the course goal and instructional objectives. Based on the blueprint, we developed 40 items of classroom-based learning-oriented tests for an intermediate reading course as a product. The test consists of forty items, each with ten test item indicators and a time restriction of 60 minutes. Additionally, there are five alternative responses for each item. Because the test items are intended to evaluate students' higher-order thinking skills, they span comprehension, analysis, and application skills. Furthermore, each item scores 2.5 for the correct answer and 0 for the incorrect answer.

Table 2. The Test Blueprint

Instructional Objectives	Indicator of Test Items	Material	Test Format	Bloom's Taxonomy Classification	Number of Test Items & Item Weight	Question Number
At the end of the lesson, the students are able to:	Given a short story, students are able to:	Literary text in the form of short story	Multiple choice			
identify keywords and the underlying theme	identify the underlying theme of the story			comprehension	3 (2.5 points each)	1, 2, & 31
make inferences from the content of a text	make inferences from what the characters say or do and by how the author portrays them			comprehension	3 (2.5 points each)	8, 32, & 35
interpret dictions, figure of speech, and culture-bound dictions	interpret dictions of rhetorical questions and part of speech of the text			application	4 (2.5 points each)	4, 5, 34, & 36
analyze juxtaposition in a text	analyze juxtaposition in a text			analysis	5 (2.5 points each)	3, 6, 7, 33, & 39
analyze organization and development of ideas (the development of the plot of a text)	analyze organization and development of ideas (the development of the plot of a text)			analysis	5 (2.5 points each)	9, 10, 37, 38, & 40
At the end of the lesson, the students are able to:	Given an expository text, students are able to:	Informational text in the form of expository text	Multiple choice			
identify keywords and the underlying theme	identify underlying theme of a particular paragraph in the text			comprehension	4 (2.5 points each)	11, 17, 21 & 26
make inferences from the content of a text	make inferences from particular words, phrases, or sentences in the text			comprehension	5 (2.5 points each)	13, 15, 19, 22, & 24
interpret dictions, figure of speech, and culture-bound dictions	interpret dictions, illustrations, graphics, and the figure of speech of the text			application	3 (2.5 points each)	12, 14, & 18, 27 & 28
analyze juxtaposition in a text	analyze juxtaposition in a text			analysis	3 (2.5 points each)	20, 23, & 25
analyzes organization and development of ideas (the development of the plot of a text)	analyze organization and development of ideas of the text			analysis	3 (2.5 points each)	16, 29, & 30
Total Items					40 items	

Expert Validation Test Results

Validity is one of the factors to consider when developing a test. The developed test should be capable of measuring the aspect to be assessed (Fatimah et al., 2018). Two EFL instructors from Indonesian institutions were involved in the validation process. Experts provided analyses, comments, and recommendations for improving the developed classroom-based reading test items. Experts appraised three aspects: materials, construction, and rhetorical devices. The experts' validation results are demonstrated in Table 3.

Table 3. The expert Validation Results

Aspects	Expert 1	Expert 2
Materials	The texts used were appropriate for the course outline.	The texts used were appropriate for the course outline and student level.
Test Construction	The composition of the distractors (concerning sentence length) in several items required revision.	The order of the items should be adjusted depending on the difficulty level and location of the clue for the answers in the text.
Grammar/ language structure	Some items' sentence construction required to be simplified.	The phrasal and clausal complexity of Reading 4 should be simplified.

In addition to the validation results, experts recommend using the online method for some considerations, such as the possibility to randomize the item order and answer choices, the ability to review and change answers before submitting the test, the more appealing visuals and program features, as well as the immediate report for the test results and feedback. The experts' recommendation to use an online method for administering the test is consistent with previous research (e.g., Ming & Aziz, 2019; Raine, 2018; Spivey & McMillan, 2014; Sudarwati et al., 2021), which found that technological tools in assessment provide beneficial impacts for both students and teachers in terms of effectiveness and efficiency.

The test that was created has been deemed to meet the requirements for both content and language. This was achieved by adjusting the test items based on expert feedback and addressing the specific areas noted in the feedback.

Trial Results

After having expert validation, a tryout was conducted online using the Quizizz application. The Quizizz assessment medium was chosen because it provides simple test development, control or supervision, an accurate final score, and quick analysis (Rahmad et al., 2019; Zhao, 2019). Furthermore, the features included in Quizizz applications are easily accessible and usable by students with no prior experience. Thirty students from the intermediate reading class were chosen to participate in the tryout. The validity and reliability tests and the difficulty level of the test items were accessed. The validity of the test is determined through the processing of the data using the SPSS version 25 program. Table 4 shows the first trial result.

Table 4. First Trial

1	Moderate	0.080	Not significant	Revised
2	Easy	0.367	Significant	Used
3	Moderate	0.445	Significant	Used
4	Moderate	0.504	Very significant	Used
5	Moderate	0.465	Very significant	Used
6	Moderate	0.525	Very significant	Used
7	Moderate	0.493	Very significant	Used
8	Moderate	0.627	Very significant	Used
9	Easy	0.445	Significant	Used
10	Moderate	0.464	Very significant	Used
11	Moderate	0.585	Very significant	Used
12	Moderate	0.617	Very significant	Used
13	Moderate	0.719	Very significant	Used
14	Easy	0.897	Very significant	Used
15	Moderate	0.250	Not significant	Revised
16	Moderate	0.687	Very significant	Used
17	Moderate	0.686	Very significant	Used

18	Moderate	0.412	Significant	Used
19	Moderate	0.421	Significant	Used
20	Moderate	0.593	Very significant	Used
21	Moderate	0.297	Not significant	Revised
22	Moderate	0.729	Very significant	Used
23	Moderate	0.618	Very significant	Used
24	Moderate	0.522	Very significant	Used
25	Moderate	0.352	Not significant	Revised
26	Easy	0.706	Very significant	Used
27	Moderate	0.922	Very significant	Used
28	Moderate	0.947	Very significant	Used
29	Moderate	0.653	Very significant	Used
30	Easy	0.717	Very significant	Used
31	Moderate	0.705	Very significant	Used
32	Moderate	0.636	Very significant	Used
33	Moderate	0.563	Very significant	Used
34	Easy	0.811	Very significant	Used
35	Moderate	0.728	Very significant	Used
36	Moderate	0.725	Very significant	Used
37	Moderate	0.862	Very significant	Used
38	Easy	0.463	Very significant	Used
39	Moderate	0.571	Very significant	Used
40	Moderate	0.605	Very significant	Used

Table 4 shows four test items categorized as low validity since the correlation scores are more or equal to the reliability of Table > 0.361 (from 30 participants). Those questions were number 1, 15, 21, and 25. Since a test must be reliable and valid (Ozdemirl & Akyol, 2019), the four question numbers were eliminated and replaced with new questions based on the indicators specified in the blueprint. Meanwhile, the other significant test items proceeded with reliability analysis. The result of the reliability analysis is 0.955, which is in the high category. This high-reliability rating denotes that the test results are more consistent or reliable.

Following the initial tryout, we adjusted the test items based on the results of the validity and reliability tests. We not only revised the invalid items but also altered the sequence of the items and modified the linguistic structure based on the test complexity (Yu, 2021). Structuring the sequence of the presentation of the test items from easy to difficult is vital to provide the test takers a pleasant impression when they first access the test and not frustrate the students at the beginning of the test. Then, we had the second tryout. Table 5 displays the results of the second tryout.

Table 5. Second Trial

1	Moderate	0.401	Significant	Used
2	Moderate	0.384	Significant	Used
3	Moderate	0.464	Very significant	Used
4	Difficult	0.502	Very significant	Used
5	Moderate	0.458	Significant	Used
6	Moderate	0.531	Very significant	Used
7	Moderate	0.485	Very significant	Used
8	Moderate	0.633	Very significant	Used

9	Moderate	0.440	Significant	Used
10	Moderate	0.471	Very significant	Used
11	Moderate	0.590	Very significant	Used
12	Moderate	0.614	Very significant	Used
13	Moderate	0.723	Very significant	Used
14	Difficult	0.892	Very significant	Used
15	Moderate	0.386	Significant	Used
16	Moderate	0.694	Very significant	Used
17	Difficult	0.682	Very significant	Used
18	Moderate	0.418	Significant	Used
19	Moderate	0.414	Significant	Used
20	Moderate	0.602	Very significant	Used
21	Moderate	0.375	Significant	Used
22	Moderate	0.725	Very significant	Used
23	Moderate	0.619	Very significant	Used
24	Moderate	0.502	Very significant	Used
25	Moderate	0.417	Significant	Used
26	Moderate	0.708	Very significant	Used
27	Moderate	0.919	Very significant	Used
28	Difficult	0.940	Very significant	Used
29	Moderate	0.656	Very significant	Used
30	Moderate	0.711	Very significant	Used
31	Moderate	0.705	Very significant	Used
32	Moderate	0.639	Very significant	Used
33	Moderate	0.548	Very significant	Used
34	Moderate	0.814	Very significant	Used
35	Moderate	0.728	Very significant	Used
36	Moderate	0.727	Very significant	Used
37	Difficult	0.859	Very significant	Used
38	Moderate	0.468	Very significant	Used
39	Moderate	0.568	Very significant	Used
40	Moderate	0.608	Very significant	Used

Table 5 shows that all the item questions were valid, and most of them were categorized as a very significant category. In detail, 21 test items are classified as very substantial, and the rest are significant since all the correlation scores are more or equal to the reliability Table > 0.361 (from 30 participants). Furthermore, the reliability result of the analysis is 0.955, which is in the high category. This means that all items are reliable. The higher the reliability rating, the more consistent or reliable the test results. This study demonstrated that the classroom-based learning-oriented test for intermediate reading generated with the Quizizz application was reliable and valid. Therefore, all test items can be used in the test. Distractors' consistency and complexity are essential in tasks that assess misunderstandings and critical thinking. The quantity and quality of mistakes students make while responding to test items are critical for developing the assessment blueprint and information about students' comprehension and ability to accomplish the instructional objectives.

Reflection and Implications: Towards the Development of Students' Comprehension and the Practice

As an online classroom-based assessment, we accommodated two reading purposes in the test items mandated by the course outlines: reading for literary experiences (Duke & Carlisle, 2011) and reading to

acquire and use information (Murphy et al., 2009). Furthermore, the reading materials included literary and informational text types (Nisa and Helmanda, 2019) that incorporated social context (Snow, 2002). As a result, teachers can immediately assess whether or not their students have met the learning objectives. The findings also demonstrate that the created examination successfully fulfills the primary purpose of an evaluation, which is to enhance teaching and learning procedures by providing feedback on the outcomes.

Moreover, constructivism acknowledges the student's active role in the learning process. Classroom-based reading assessment effectively combines teaching and assessment by aligning the curriculum with students' contexts, fostering their development (Yang & Qian, 2022). Considering that learning activities, including assessment and the thinking that goes with them, are deeply ingrained in specific cultural practices and norms, it is argued that applying classroom-based assessment principles to students' learning needs and contexts is beneficial for assessment teachers, practitioners, and assessment scholars. It is required for the ongoing development of frameworks for classroom-based evaluation.

Interestingly, even though the exam has been seen to be valid and reliable, some students earned low points. This might be because, due to the COVID-19 pandemic, some students did not participate in profound reading activities during their online learning (Grabe, 2009), lowering their reading skills. Furthermore, some students may be unwilling to practice their reading comprehension independently at home while participating in remote learning during the pandemic. To confirm this conclusion, we conducted informal interviews with students about their development of reading abilities throughout the pandemic. Their answers highlighted their lack of independent reading comprehension learning at home. Students emphasized that teachers' support is required when reading. Therefore, they do not do it effectively when they are left to learn independently at home.

According to the findings, we also propose in this study that relevant, contextual, and classroom-based assessment be utilized to accurately exhibit students' reading skills (Andronova, 2021) because it meets the instructional objectives. Furthermore, analyzing data from students' scores can confirm the effectiveness of classroom-based learning-oriented reading assessment, and it is known that proper classroom-based learning-oriented reading assessment can benefit teachers and students. Classroom-based learning-oriented reading assessment not only measures students' performance and progress in their learning but also analyzes the effectiveness of the instructions, including teaching strategies or methods.

Furthermore, both students and teachers regarded the use of technology in test delivery positively because having an online test delivery method allows them to access and finish the test efficiently (Raine, 2018), especially during emergencies such as the Covid-19 pandemics (Sudarwati et al., 2021). Furthermore, the teachers and students who took the test also discussed the advantages of using an online test delivery technique. According to teachers and students, online tests provide flexible testing schedules during which the test was administered (Spivey & McMillan, 2014). Furthermore, the teachers emphasize that automatically randomizing the order of questions and answers for Quizizz's multiple-choice option reduces the chance of student cheating while simultaneously providing fast feedback and reports. As a result, it can be stated that the online classroom-based reading test using the Quizizz application is practical for testing students' reading comprehension.

CONCLUSION

Ultimately, the generated online classroom-based reading test conducted using the Quizizz program proves to be a reliable assessment of students' reading skills. This may be ascribed to the fact that it is highly relevant to the context, fitting perfectly with the demands of students and the goals of instruction. As a result, it produces precise depictions of their comprehension and proficiency in the curriculum. The test effectively examines the literary aspects and information acquisition in reading comprehension. It provides diagnostic insights into students' strengths and weaknesses in different reading sub-skills. The exam satisfies the urgent need for a systematic, thorough, and instructional diagnostic reading evaluation by meeting these requirements.

Moreover, the study emphasizes the broader influence of efficient assessments conducted within the classroom. These evaluations reveal insights into individual students' performance and development and offer helpful feedback on the effectiveness of teaching strategies and approaches. This dual functionality is

crucial in continuously enhancing education, benefiting students, teachers, practitioners, and academics. Adopting online classroom-based assessment features customized to students' language and cultural settings is essential to advance assessment frameworks, as learning and assessment are closely intertwined with these contexts. The online text form also correlates with the students' technologically dependent characteristics and is beneficial regarding efficacy and efficiency.

Although the research has produced significant benefits, it lacks constraints. Further research is required to explore the intricate complexity of the online classroom-based test, driven by the emphasis on validity, reliability, and diagnostic value. Gaining a deep understanding of the complexities in designing tests for intermediate reading comprehension in a classroom setting would provide a more thorough viewpoint, enhancing the ongoing discussion on successful assessment methods. Thus, this study is a foundation for future research efforts to improve and progress classroom-based evaluation systems.

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PRACTICAL DIMENSIONS OF THE METAVERSE IN DISTANCE EDUCATION: CASE STUDY WITH INDIGENOUS STUDENTS FROM A COMMUNITY IN MEXICO

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ABSTRACT

This research aimed to explore the dimensions and implications of the early use and integration of metaverses in public high schools in the region of the Altos de Chiapas, Mexico, through a sequential mixed methods approach. Initially, a standardized survey was administered to a stratified probabilistic sample of 1402 students from various schools to characterize their current situation regarding access, ease of use, preferences, and perceived utility of 3D immersive virtual educational platforms. Subsequently, interviews and focus groups with an intentional subsample delved into their experiences and subjective evaluations. The quantitative results show a still limited penetration, but pedagogical potential in terms of motivation and active learning. Qualitatively, their perception stands out as fun environments that foster collaboration and interaction among peers in a more dynamic and immersive way. In conclusion, the findings provide empirical background and practical recommendations to guide the progressive incorporation of these digital pedagogical innovations, grounded in the needs and visions expressed by student protagonists, mitigating possible biases through the participatory design of culturally sensitive educational metaverses.

Keywords: Immersive virtual reality, computerized simulation, digital learning, online education, distance education, digital divide.

INTRODUCTION

Metaverses constitute three-dimensional immersive virtual environments that are rapidly emerging as one of the most disruptive digital technologies with the greatest potential for transformation in various domains, including, of course, the educational context (Kapp et al., 2022; Lee et al., 2022). According to several authors, virtual reality environments open up unexplored possibilities for teaching and learning by introducing highly motivating elements of simulation, interaction, collaboration, and gamification among the new generations of digital learners (Garzon & Pavon, 2021; Southgate et al., 2019). While studies on the pedagogical applications and implications of metaverses are still in their infancy, they report promising

initial effects in terms of students' active engagement with educational content (Hew et al., 2022; Xie et al., 2020). Latin America faces significant challenges in pedagogically integrating these emerging technologies into its public school systems, which are characterized by budgetary constraints, connectivity issues, and digital infrastructure limitations (Aliaga-Franco et al., 2021; Sunkel, 2019).

It is in this context that the present study seeks to characterize the dimensions related to the early use of educational metaverses among Maya-Tzeltal adolescents from rural communities in the Highlands of Chiapas, Mexico. This initial approach is particularly important as it is among the first to explore the possibilities and challenges of pedagogically integrating 3D virtual reality platforms into intercultural public high schools in Latin America. Therefore, it is estimated that its empirical results will provide highly valuable guiding foundations for both educational research in this emerging area and for the design and contextualized implementation of educational interventions supported by metaverses for the region. Thus, the aim is to contribute to the growing body of studies that warn about the complexity and ethical implications of integrating digital educational innovations based on artificial intelligence, big data, the internet of things, and, of course, immersive virtual reality into educational systems, while not neglecting legitimate requirements of traditionally marginalized student groups.

In this regard, it is expected to provide specific considerations about challenges to overcome and socio-academic factors to consider during the planning and implementation of advanced pedagogical strategies with metaverses to reduce potential biases and exclusionary barriers rather than reproduce them, as various researchers have shown that virtual reality environments are emerging as a cutting-edge educational technology due to their capacity to increase motivation and facilitate deep learning through immersive simulations (Kavanagh et al., 2017; Radianti et al., 2020). Particularly, the evidence highlights their effectiveness in the contextualized teaching of sciences and medical disciplines, allowing for the spatial representation of complex concepts through manageable 3D anatomical models or the deployment of hyper-realistic professional scenarios for situated practical training (Jensen & Konradsen, 2018; Potkonjak et al., 2016).

However, most studies have focused on individual virtual reality experiences, leaving the potential for enabling new possibilities for interaction and pedagogical innovation at a multi-user scale within emerging networked educational metaverses largely unexplored (Wang & Zhu, 2022; Xie et al., 2022). These shared virtual reality platforms are demonstrating advantages over other immersive technologies by combining persistent digital worlds, synchronous collaboration through avatars, and the ability to create/exchange content among their inhabitants (Bourke, 2022; Kaplan & Haenlein, 2022). While diverse initiatives from pioneering universities implementing campuses and complete courses in these environments have proliferated (Fominykh et al., 2022), empirical studies on effectiveness and associated psychosocial impacts among participating students remain scarce (Hew et al., 2022; Pham et al., 2021).

For instance, Souza et al. (2021) reported 16% higher scores on an exam after a veterinary anatomy course deployed in a multi-user 3D virtual reality software. Participants highlighted the realism of manipulating hyper-realistic anatomical models and the usefulness of annotations from their fellow students during surgical simulations. In another experience, Bagwell (2020) described greater ease in connecting abstract concepts and making complex geometric deductions among students in a Quantum Physics class partly taught within JanusVR. Participants reported a greater sense of presence and immersion when interacting with each other as avatars, positively valuing the contextualized feedback from their peers during simulated laboratory practices related to orbital mechanics and wave reading.

While initial results in higher education contexts are promising, research among other educational levels and socio-cultural profiles of students is still in its infancy (Tutkun et al., 2022). This poses particular challenges in Latin American countries historically lagging behind in terms of technological infrastructure and teacher training for the integration of digital innovations (Aliaga-Franco et al., 2022; Claro et al., 2018). Another important limitation of the few available studies is the limited representation of ethnic minorities and vulnerable socio-educational sectors (Hew et al., 2022), when precisely these underrepresented groups could benefit the most from disruptive educational alternatives that circumvent the restrictions of their contexts through new formats, scenarios, and dynamics of active learning within immersive three-dimensional metaverses (Jorgensen, 2022).

Hence, there is an urgent need to expand research to intercultural public schools in provinces serving diverse student populations (Montoya, 2016; Fombona & Vazquez-Cano, 2017), so that specific needs and interests can be anticipated to guide the design and contextualized implementation of pedagogical interventions with culturally sensitive and empowering virtual educational worlds (Kim et al., 2022). In this line, Cobo and Moravec (2011) warn about the paradox that metaverses could exacerbate inequalities by uncritically integrating these environments highly mediated by algorithmic profiling and monetization logics so distinctive of the exclusionary Silicon Valley model, replicating systemic microaggressions under the veil of innovation and technological progress. Hence, Gonzalez-Martinez et al. (2021) emphasize the ethical responsibility of educational researchers to evidence biases and inequities that could be institutionalized and invisibilized through the accelerated adoption of metaverses in the schools of the future, while safeguarding their potential for more emancipatory and humanizing pedagogical alternatives.

From a sociocritical perspective, Jensen and Konradsen (2018) advocate for research oriented towards genuinely giving voice to and genuinely addressing the interests and concerns of vulnerable students regarding the use of their data and identity construction within virtual worlds, to counteract adult-centric views of generational naivety predominant among designers and politicians. In this line, Freire (2021) proposes the concept of "guided autonomy" for teachers to assume facilitator roles that guide reflectively their students during participatory action research processes, so they can co-create agency through the collaborative design of more friendly, safe, and inclusive educational metaverses.

At the regional level, Aliaga-Franco et al. (2022) recommend focusing on local issues felt among young students to guide culturally situated content and ludic mechanics within immersive virtual worlds for the creative revitalization of threatened ancestral imaginaries and practices that subvert dominant power relations. In line with this, Hartsell and Kristjansson (2021) propose the co-creation of educational metaverses aimed at making visible narratives, values, and collective problem-solving forms distinctive of historically oppressed indigenous communities, as a means for epistemic re-existence, collective healing, and community empowerment from the digital humanities.

The collaborative design and validation of instruments sensitive to cultural differences are key to envisioning interests and differentiated barriers among ethnic groups that allow for anticipating challenges and potential inequities (Montoya, 2009), while identifying key facilitators for the social appropriation of culturally informed 3D immersive educational platforms. Among the specific areas for future research, there is still a need for greater empirical evidence to guide the universal and ethical design of next generations of educational metaverses (Xie et al., 2022), from a genuine and profound understanding of intersections between ethnic, socioeconomic, gender, and functional diversity in terms of immersive and collaborative user experience within these persistent three-dimensional spaces (Kim et al., 2022), as well as their comprehensive medium-term impacts within public school systems in Latin America and other regions of the Global South.

It is in this complex and historically neglected context that the present study seeks to characterize differentiated needs and perceptions regarding the growing 3D immersive virtual educational platforms among Maya-Tzeltal young students from marginalized rural areas in southeastern Mexico, through the systematic approach of mixed methods described in the following section. The aim is to contribute with situated knowledge and contextualized recommendations that allow for informing the responsible design, implementation, and evaluation of pedagogical models mediated by educational metaverses in diverse Latin American countries during the following decades. The initially exploratory nature of this mixed-methods study will lay guiding foundations for subsequent experimental works that compare academic, motivational, and other psychosocial variable results associated with the pedagogical implementation of immersive virtual reality metaverses in various intercultural public school contexts in Mexico and Latin America. Thus, it is expected to contribute to the growing body of research on the effectiveness and implications of incorporating educational innovations supported by emerging digital technologies such as web 3.0, the internet of things, big data, artificial intelligence, and, of course, immersive virtual reality simulations known as metaverses, which are demonstrating enormous transformative potential on 21st-century teaching-learning processes, provided their gradual integration into school systems addresses ethical challenges and requirements for design centered on the socio-cultural needs and identities of their target students.

METHOD

The present study utilized a sequential mixed methods approach to explore the topic of interest. This consisted of a first cross-sectional quantitative phase through a survey, followed by a second qualitative phase through a focus group, aiming to complement the population-level statistical results with a deeper understanding of participants' subjective experiences (Creswell & Creswell, 2018).

The design involved the standardized collection of numerical data in a broad probabilistic sample, followed by a qualitative exploration of meanings and perspectives within an intentional subgroup. The integration of these approaches provides a more complete, comprehensive, and contextualized overview of the phenomenon under study within its natural setting (Hernandez & Mendoza, 2018).

The quantitative survey was administered to a representative sample of 1402 students selected through probabilistic sampling from the population of high school students in the Altos region of Chiapas. From this total sample, two equivalent and comparable experimental subgroups were formed for the educational intervention. The first was a group of 700 students who used an educational metaverse implemented for the Mathematics VI subject during a full semester. The second was a control group of the remaining 702 students, who took the same course through the institutional Moodle platform.

The educational metaverse was developed by a team of Computer Systems Engineering students from the Universidad Mesoamericana, on the Mozilla Hubs platform. It contained six thematic rooms corresponding to the main topics of the Mathematics VI curriculum: analytic geometry, differential and integral calculus, linear algebra, probability & statistics, and formative assessment. All rooms featured immersive and interactive 3D multimedia resources on their respective contents, aiming to leverage the realism and gamification possibilities conferred by virtual reality environments compared to conventional LMS platforms.

On the other hand, the courses in Moodle for the control group also followed the official program, although limited to two-dimensional digital materials such as documents, presentations, videos, and quizzes. Their activities and assignments were similarly restricted to traditional file submission formats.

Before the start of the intervention, a pre-diagnosis was conducted on both groups to verify their initial equivalence in various variables such as demographic, socio-economic, and academic characteristics, as well as in mathematics knowledge through a standardized questionnaire with 45 questions about numerical and logical-mathematical skills expected for their school level.

Participants

The target population consisted of the 27,991 students enrolled in the 2023-B semester in public high schools in the Altos region, Chiapas. This total population was distributed among 10 COBACH campuses, 7 EP campuses, 3 CETIS campuses, 2 CBTA campuses, and 1 Telebachillerato according to official data collected (SEP, 2023).

Table 1. Distribution of students by educational subsystem

Educational subsystem	Number of institutions	Number of students	Percentage of total	Sample size (5%)	Adjustment	Selected students
COBACH*	10	9860	35.12%	493.00	+1	494
EP**	7	6920	24.64%	346.00	-	346
CETIS**	3	2970	10.58%	148.50	+2	150
CBTA***	2	1990	7.08%	99.50	+1	100
Telebachillerato	1	6251	22.58%	312.55	-	312
Total	**23**	**27991**	**100%**	**1399.55**		**1402**

*Note. *Colegio de Bachilleres de Chiapas; **Escuela Preparatoria del Estado; ***Centro Tecnologico Industrial y de Servicios; ****Centro de Bachillerato Tecnologico Agropecuario*

As shown in table 1, for the quantitative sample, a necessary size of 1402 adolescents were estimated through stratified probabilistic sampling, considering a 95% confidence level and 3% acceptable error according to standards in educational research (McMillan & Schumacher, 2023).

Data Collection and Analysis

The quantitative instrument consisted of a self-administered survey comprising 45 Likert-scale items, covering four dimensions of the educational metaverse: access, interaction, learning, and digital competencies. It underwent prior validation by the judgment of five experts (V of Aiken > 0.8) and exhibited good internal consistency in the scales (Cronbach's Alpha > 0.7).

The digital implementation during December 2023 received support from educational authorities. Controls were employed to verify the exclusive participation of the randomly selected 1402 students, thus ensuring the representativeness of the gathered data.

Quantitative analysis in SPSS encompassed descriptive and inferential statistics to address the study's questions and objectives regarding the dimensions measured in the validated survey.

In the qualitative phase, a 90-minute in-person focus group was conducted, recorded in audio, transcribed, and analyzed in NVivo 12 to identify emerging categories and themes linked to participants' subjective experiences with educational metaverses.

A comprehensive and participatory triangulation was carried out to complement and integrate the quantitative and qualitative findings. This was accomplished through a matrix that connects the objective results with the meanings attributed by the subjects, resulting in more robust conclusions.

The Scale

The validity and reliability processes in data collection and analyses should be described sufficiently.

The content validity of the instrument was established from the design phase, subjecting the survey to the judgment of 5 experts in distance education, immersive technologies, and research methodology. All items obtained Aiken's V coefficients exceeding 0.80 in the categories of relevance and clarity.

The instrument's reliability was examined by calculating Cronbach's Alpha for the scales of each dimension, resulting between 0.71 and 0.83, indicating acceptable to good levels of internal consistency among the items according to conventional limits.

Furthermore, in the qualitative phase, the coding of the content from the focus group was performed through inter-judge agreement between two expert researchers, yielding a Cohen's Kappa coefficient of 0.89, considered a strong level of agreement beyond chance (McHugh, 2012), as can be observed in Table 2.

Table 2. Inter-judge agreement in qualitative coding

	Code A	Code B	Code C	Code D	Total Judge 1
Code A	80	3	1	1	85
Code B	1	65	2	2	70
Code C	0	4	48	3	55
Code D	0	0	5	58	63
Total Judge 2	81	72	56	64	**N: 273**

Note. Cohen's Kappa Coefficient = 0.89

This provides objective and quantitative evidence that criteria standardization was achieved and codes were systematically applied beyond individual judgments on the analyzed content, thus ensuring quality, reproducibility, traceability, and absence of biases in the qualitative processing of data collected in this phase of the study.

FINDINGS

The equivalent distribution of the total sample between the intervention group using the metaverse (n=700) and the control group in Moodle (n=702) enables experimental comparison to identify differences attributable to the manipulated study factor, namely, the type of educational platform used by each condition during the implementation phase.

As part of the quasi-experimental design, before initiating the intervention, a standardized diagnostic assessment on Mathematics knowledge was administered to all participants in the metaverse and Moodle groups. No statistically significant differences were found in the average scores of the initial diagnosis between the groups (p=0.122), confirming their equivalence, an indispensable requirement for the causal attribution of any subsequent effect. Thus, these pre-test results ensure that both comparison groups started from a similar level in terms of initial performance in Mathematics.

Following the implementation phase of one semester using the 3D immersive metaverse (experimental group) versus the Moodle platform (control group), the standardized test of mathematical knowledge was applied again as a post-test.

Table 3 displays the average scores of each group before and after the intervention. It is observed that the metaverse group evidenced a gain (post-pre difference) of +19.2 percentage points, whereas the control group only advanced by 2.1 points.

Table 3. Pre-post comparison between groups

Group	Pretest	Posttest	Difference
Metaverse	57.4	76.6	+19.2
Moodle	59.1	61.2	+2.1

Note. Group comparison metrics

When applying the ANCOVA test while controlling for the effect of initial scores, this difference in favor of the intervention group using the metaverse was highly significant (p<0.001). Hence, the greater efficacy of the 3D immersive metaverse in improving students' effective learning in the subject, compared to the traditional face-to-face model mediated by the Moodle educational platform, is consistently supported by the hypothesis proposed.

In addition to knowledge assessment, the quantitative survey administered after the implementation also explored students' subjective opinions and evaluations of the educational platform they used in dimensions of ease of use, perceived usefulness, and motivation.

The results in Table 4 reveal statistically significant differences in favor of the metaverse group in all these attitudinal variables. For example, the metaverse scored 4.7 vs 3.2 for the Moodle group in ease of use according to the Likert scale (with 5 being very easy and 1 being very difficult).

Table 4. Post-intervention perceptions by groups

Variable	Metaverse	Moodle	p-value
Ease of Use	4.7	3.2	0.032
Utility	4.5	3.8	0.041
Motivation	4.8	3.4	0.021

Note. Post-intervention insights

These quantitative findings are relevant because student acceptability and evaluation of educational technologies constitute a key factor that can either facilitate or hinder their effective and sustained integration into teaching-learning processes.

A total of 12 thematic categories with their respective representative codes were computed, which emerged directly from the interpretative qualitative analysis of the contents of the interviews and focus groups conducted in the respective phase of primary data collection.

Furthermore, delving into individual testimonies, Table 5 presents illustrative quotes that exemplify the predominantly positive perceptions expressed by participants regarding their learning experience of mathematics through the 3D immersive simulations of the implemented metaverse.

Table 5. Textual quotes on learning experiences in the metaverse

Testimony	Textual quote
Student 1	"I could see formulas come to life before my eyes within the scenarios, that clicked in my head"
Student 2	"I never imagined learning math could be fun, I felt like I was in a game"
Student 3	"My classmates and I actively solved math problems to progress in the missions"
Student 4	"Virtual reality helped me visualize abstract geometric shapes better"
Student 5	"I'm very satisfied, I didn't miss any concept by interacting like this in the metaverse"
Student 6	"I enjoyed discovering the formulas myself by exploring virtual labs"
Student 7	"Everything seemed too real, I was impressed to see the effects of variable changes before my eyes"
Student 8	"We competed solving math challenges, motivating each other as a team to find solutions"
Student 9	"The content made more sense applied in realistic games and simulations of everyday life"
Student 10	"We could manipulate 3D objects to understand unit conversions and measurement scales"

Note. Student testimonials

As can be observed in the various selected testimonies from the participants, there are similarities in the perception of enhanced conceptual learning facilitation in mathematics through three-dimensional graphical representations, the playfulness of contextualized simulations, as well as the collaborative possibilities among peers provided by real-time multi-user interaction within the immersive virtual environment of the educational metaverse implemented.

Furthermore, the statistical analysis of the frequencies of codes applied in thematic coding (Table 6) provides greater objectivity and precision in determining the most prominent topics by participants when narrating their subjective experiences about learning in the educational metaverse developed in this research.

Table 6. Main qualitative codes by frequency

Code	Frequency
Perceptual immersion	185
Intrinsic motivation	172
Interactivity	149
Collaborative work	139
Active learning	125
Contextualized simulation	119
Satisfaction	112
Extrinsic motivation	99

Note. Key qualitative codes

As revealed by Table 8 with the results of code frequencies, during the shared reflections in interviews and focus groups, elements such as the sensation of perceptual immersion produced by the high reality simulation of the 3D software used prominently stood out in the spontaneous discourse of the youth.

The triangulation matrix (Table 7) articulates the quantitative findings on the greater efficacy of the metaverse for improving learning with the qualitative perceptions of students about their experiences of immersion, increased interactivity, and motivation during the educational process mediated by the 3D virtual reality platform.

Table 7. Triangulation matrix

Dimension	Quantitative finding	Qualitative theme
Learning	Higher performance of the metaverse group in the knowledge test	Perception of active, meaningful, and collaborative learning
Motivation	Higher motivation scores in the metaverse group survey	Descriptions of greater engagement, satisfaction, and interest in the metaverse

Note. Qualitative-quantitative integration matrix

The articulation of these multimodal findings also strengthens the validity and robustness of the final inferences required to address the questions and objectives that guided this study from its initial conceptualization.

This empirical work laid the groundwork by generating evidence on the initial benefits and implications of implementing immersive metaverses among students from intercultural high schools, an emerging field without previous research in this context.

DISCUSSIONS AND CONCLUSION

The findings of the present study corroborate previous research demonstrating the increased motivation and engagement generated by immersive learning through 3D virtual reality simulations among adolescent students (Han et al., 2022; Huang et al., 2022). Specifically, the attribution of higher scores in perceived utility and satisfaction metrics among those who used the educational metaverse aligns with the results reported by Hew and Cheung (2021) in another Asian school context.

Additionally, the recurrent qualitative perception regarding the potential to generate active, deep, and situated learning is consistent with theories of embodied cognition that emphasize the importance of embodied sensory experiences for building effective understanding (Johnson & Sherwood, 2022; Lindgren & Moshell, 2011). This supports the potential of educational metaverses over traditional LMSs by providing more plausible scenarios for the multi-modal deployment of skills closely linked to real-world problem-solving situated practice.

At the same time, these pioneering findings shed light on key ethical, cultural, and pedagogical considerations to be incorporated into the design of 3D virtual environments specifically intended for Maya-Tzeltal adolescent students in rural areas, such as the perceived need to preserve traditional socialization spaces among peers and with adult mentors from their community.

In summary, this work constitutes one of the first mixed-methods studies to explore dimensions linked to the metaverse applied to the educational field within intercultural public high schools in Latin America, generating empirical evidence about its possibilities and challenges in this specific context.

The findings suggest promising opportunities for motivation, active engagement, and new ways of learning in three-dimensional digital scenarios that simulate real contexts. However, they also introduce situated reflections on key contextual, sociocultural, and pedagogical requirements to consider during the design, implementation, and evaluation phases of formative interventions focused on immersive virtual reality platforms to foster optimal experiences among all students equally.

It is recommended to continue participatory research lines with indigenous recipients that allow for co-creation of culturally sensitive content leveraging their epistemic richness, while developing specific indicators to monitor positive effects and negative externalities as metaverses are gradually integrated into hybrid educational models that combine the best of face-to-face and digital pedagogy.

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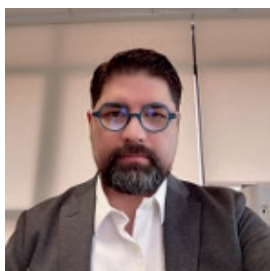
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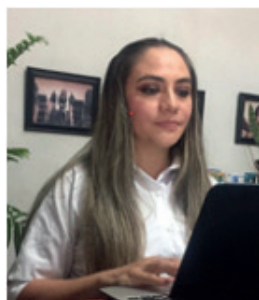
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THE BLENDED LEARNING STATION ROTATION MODEL IN EFL TEACHING: OPINIONS OF THE IMPLEMENTER

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ABSTRACT

The study's purpose is to reveal the implementer's opinions toward the use of the Station Rotation Model (SRM) of blended learning, in terms of features, challenges and effectiveness of the model including further implementation and suggestions for the station rotation model. A mixed research approach was conducted using qualitative data analysed within the quantitative method. A qualitative method approach was employed to collect data from the implementer. A semi-structured interview was conducted with the implementer (an English language teacher) to gather feedback on SRM implementation. The findings revealed that the implementer mostly mentioned fulfilling hobbies as a feature of the model, and most students faced challenges in the group working station, while the pair working station was identified as the most effective Furthermore, the results of implementer's further implementation of the model and suggestions for SRM are discussed.

Keywords: EFL learners, blended learning, station rotation model, implementer's attitudes, online instruction, pair working, group working.

INTRODUCTION

In the last two decades, blended learning practices, which combine face-to-face instruction with e-learning methods, have become increasingly common in educational institutions to enhance the effectiveness and efficiency of learning. Definitions of blended learning vary considerably. For example, organizational blended learning can be a combination of face-to-face teacher-led learning and individual online learning (Graham & Allen, 2005). Some educational researchers believe that blended learning should include the use of mixed media as a definition (Osguthorpe & Graham, 2003). G. Picciano (2007) claims that blended learning means different things to different people, while Watson (2008) explains that blended learning combines the best features of traditional learning with the advantages of online learning to provide personalized, differentiated instruction for a group of students.

The creation of blended learning materials and intricate blended learning environments must be grounded in research, primarily to ensure their practical applicability. According to Levy (2002), blended learning materials provide conceptualizations or visions for the design(s). A model should be used to develop and design the material, and the model should be flexible based on the learning environment, such as the learner's needs, level, and language proficiency.

Christensen et al. (2013) found that blended learning models combine teacher-centered instruction with online technology to enable student-directed learning. In a blended learning model, lessons are pre-designed and topics are pre-recorded. By reviewing the recorded material, students can benefit from learning in their own space and time. Classroom time is used for practice and to solve problems or work through tasks. Horn and Staker (2012) divided the definition of blended learning into four widely accepted models: (1) rotation, (2) flexible, (3) elective, and (4) enriched virtual. It is worth noting that the rotation model of blended learning is a course or subject in which students rotate flexibly through a fixed program or the teacher's learning strategies, at least one of which is online learning. This model may include activities such as small group or whole class instruction, group projects, individual tutoring and pencil-and-paper assignments. Apart from homework, students learn the topics mostly in the classroom. The rotation model is a variety of instructional approaches in which students are guided through activities that include at least one online learning component. The rotation model is further divided into four subcategories: (1) station rotation, (2) laboratory rotation, (3) flipped classroom, and (4) individual rotation (Horn & Staker, 2012). These models are characterized by variations in the form of classroom sessions and content delivery.

The station rotation model (SRM) is one of the blended learning models where learners rotate through various stations in the classroom. According to Staker and Horn (2012) this model includes at least one station for online learning. Other stations include activities such as small group or face-to-face teaching, group projects, individual tutorials and pencil-and-paper exercises. Walne (2012) emphasised the benefits of SRM, noting that it enables instructors to manage their classroom time effectively and work with small groups of learners. This model is therefore well-suited to foreign language teaching classrooms, as all language skills can be integrated effectively.

SRM in language teaching is primarily used to improve basic language skills in some researches. Lim (2015) conducted SRM on Thai school English learners' listening comprehension and speaking skills, finding that students initially had difficulty working independently and were more dependent on their teachers; however, students gradually became able to work independently and speak more freely with their classmates. In terms of speaking skills, Pimpiban (2016) provided Thai primary school students with interactive language-based activities, productive language-based group activities, and individual online conversational activities under their teachers' guidance. The study revealed a significant improvement in the students' speaking skills and a greater motivation to learn English.

Exploring the impact of the Station Rotation Model (SRM) on secondary school students' reading comprehension, Ogude and Chukweggu (2019) found no significant performance difference between students taught using the SRM and those taught using traditional methods. Consequently, they recommended the adoption of technology-based learning strategies, advocating for the use of computers and various software in education. In contrast, Nisa and Mubarok (2018) noted a superior effectiveness of SRM over traditional methods in enhancing reading comprehension, with students demonstrating higher comprehension rates.

In Cairo, Nagy and Mohammed (2018) applied SRM to enhance the writing skills of EFL preparatory students, observing increased student motivation. Additionally, studies like those by Smalls (2019) have assessed the efficacy of station rotation and flipped classroom models in secondary education to elevate seventh graders' academic English scores. These models proved beneficial for student development. Nurkamto et al. (2019) utilized similar models for teaching advanced English academic writing in Indonesia, finding that blended learning models afforded students the flexibility to learn anytime and anywhere at their own pace. Thus, the primary aim of these studies in foreign language teaching is to adapt these models for broader or more flexible use.

Further, research includes integrating effective learning strategies within SRM, comparing SRM to conventional teaching methods, and adapting SRM for remote education. Sulistyorini (2018) examined SRM's role in EFL classes, noting marked improvements and significant student performance differences pre-and post-SRM implementation. McCollum's comparison of SRM with traditional teaching in primary education showed enhanced reading performance in blended learning environments.

Skolastika (2020) aimed to convert the traditional SRM into a virtual model in order to meet the need for teacher adaptation and increase student participation in the lesson. Skolastika proposed four different types of virtual station rotation activities: teacher-led station, online station, offline station, and extension activity.

At teacher-led station activities such as small-group instruction, skill-building, troubleshooting, feedback, and question-and-answer session can be assumed. At the online station, functions such as personalized practice, research and exploration, online collaboration, multimedia lessons and edpuzzle videos can be performed. Functions such as laboratory experiments, active reading, creativity-related activities and non-technological options can be included in the offline station. At the extension activity station, passion projects, further exploration and games can be given to early finishers. Skolastika's work has emerged as a result of the pandemic, which has forced almost all schools and other educational platforms to convert traditional learning into an online learning system. As a result of SRM's flexibility, it can be easily applied in distance education based on the situation, needs, and interests of students, as well as the state of technology.

The results of recent studies have demonstrated the advantages of blended learning models, prompting a significant shift in educational methodologies. Dinh et al. (2024) explored English lecturers' perspectives on blended learning in Vietnam, acknowledging its potential for student learning despite challenges such as workload and technical issues. Similarly Anjarani et al. (2024) conducted qualitative research involving observations, questionnaires, and interviews to explore the attitudes of elementary school teachers towards blended learning. The researchers discovered that the rotation blended learning model was straightforward to implement and yielded positive outcomes for elementary school students.

Contemporary studies emphasize the importance of blended learning models, as they significantly provide enhancements in the field of education. Usama et al. (2024) examined 12th-grade students' writing errors related to inflectional morphemes and compared the effectiveness of the Rotation Model (RM) and the Grammar Translation Method (GTM), finding that RM significantly reduced errors over a forty-day period, implying that instructional interventions can improve morphological accuracy in English. Yukhymenko et al. (2024) examined how effective SRM is in Ukrainian higher education, and found out that the model was positively received by teachers and helped students develop critical thinking and digital communication skills. However, the study also noted that the implementation of the model required advanced digital skills and additional time. The results highlight the importance of carefully selecting appropriate platforms for the model to work effectively. Arianto et al. (2024) conducted a study to examine the influence of cognitive styles on students' collaborative skills in SRM. The study revealed that specific cognitive styles were more conducive to different variations of the model. Furthermore, the results indicated that cognitive styles exert a considerable influence on the efficacy of the SRM.

To understand teachers' experiences and attitudes towards SRM's effectiveness in blended learning, it is crucial to first elucidate the SRM framework. Thus, the following section of the study will cover the methodology, SRM application processes, participants, data collection, and analysis.

PURPOSE OF THE STUDY

Although the SRM model has been in existence for over two decades, it has not yet been implemented with Kazakh EFL learners. The literature presented above demonstrates that there is no Kazakhstan example of the implementation of SRM. To fill this gap, the opinions of a single implementer were analyzed following the implementation of SRM at Ahmet Yesevi International Kazakh-Turkish University. A single implementer's opinions indicate the impressions in the field of EFL teaching and hold significant importance for the future dissemination of SRM implementation. Therefore, the current study aims to reveal the implementer's perceptions who conducted the Station Rotation Model (SRM), one of the blended learning rotation models for Kazakh students who learn English as a foreign language. To determine the impact of the SRM, this study focused on the implementer's observations and experiences during implementation. In order to achieve the aim, the study addresses the following research questions:

1. What kind of features did the implementer notice during the implementation of SRM?
2. What kinds of difficulties did the implementer and students encounter during SRM implementation?
3. What effects of the SRM did the implementer see?
4. What are the implementer's thoughts about the future implementation of SRM?
5. What are the implementers' suggestions regarding SRM?

METHOD

The current study employed an exploratory sequential mixed-method design. Initially, a qualitative analysis was conducted through semi-structured interview with an EFL teacher who implemented the Station Rotation Model (SRM). The aim of this phase was to explore the implementers' perceptions and experiences with SRM in depth. The interview questions were open-ended, yielding rich and nuanced insights. The research then shifted to a quantitative phase, where the qualitative findings were analyzed using ratio analysis. This process involved categorizing interview responses into themes and quantifying their occurrences to provide a numerical perspective on the teacher's views. Although focusing on a single participant limits generalizability, this approach offers a detailed and contextual understanding of SRM's practical application in EFL teaching, revealing valuable insights for the field.

Procedure of Implementation

The Station Rotation Model (SRM) applied to A2 level English students (n=13) at Akhmet Yesevi International Kazakh-Turkish University Faculty of Philology, following the guidelines of CEFR (2020). For A2 level students can be easily involved with SRM activities because in this level students "can easily understand the essential information from recorded passages, the important points of the story" (p.50) and "can give a short, rehearsed presentation on a topic pertinent to their everyday life, and briefly give reasons and explanations for opinions, plans and actions" (CEFR, 2020:66). In the beginning, the course book was examined by the researcher in order to design SRM, and the topics to be covered were chosen according to syllabus.

To carry out the application, the teacher who agreed to conduct the application was chosen from among English teachers according to their willingness to implement the model. The detailed information about the implementation of the model was introduced to the teacher in detail by the researcher. SRM was designed with a circle formed by the triple stations of online instruction, pair working, and group working.

While designing the course, specific station tasks, topic categories, and the organization of content were established. These stations in SRM integrated elementary language abilities, learning techniques, and various cognitive tasks. Subsequently, topics and activities were selected to ensure consistency and coherence in the curriculum.

Thirteen students in the class were divided into three different stations (groups) and each station's activities were performed in a different capacity. Students who completed the activities at one station moved forward to the next station's activities. Thus, the activities at the stations were used cyclically throughout the lesson, and the students learned the functions of all the stations as well as performing the activities. Activities for listening and reading comprehension were available at the online instruction station. Speaking skill activities, on the other hand, were designed for two students at the pair working station. Two students were given topic-related question cards and asked to express themselves and talk to each other. The questions were prepared for the topic, particularly when students told their friends about their own thoughts or events, what their family and close acquaintances had gone through, and stories they had heard from someone. For the group of four to five students, tasks on collective writing, animation, project-based work, and collaborative work were prepared at the group working station.

Following the application, an interview with the implementer (an English language teacher) was held. The implementer's perspectives were recorded during the interview. Although the interview was conducted with the voluntary participation of the implementer, the implementer was informed that any audio recordings made during the interview would only be used for scientific research.
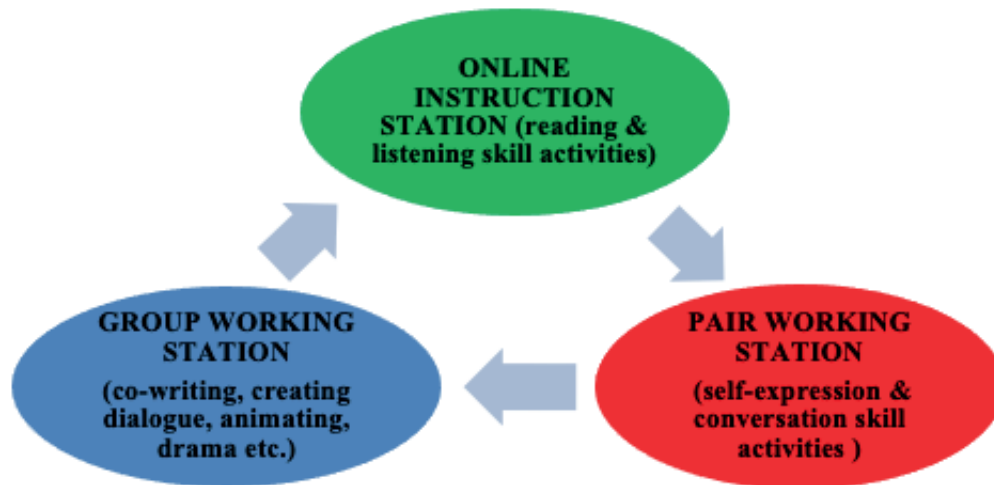
Figure 1. Course design of station rotation model

Participant

The participant is an implementer who applied the SRM to Kazakh students who came to learn English as a foreign language at Akhmet Yesevi University Philology Faculty. In terms of qualification and background, the participant holds a PhD and has extensive experiences in teaching adult learners. The decision to work with a single participant requires clarification and specific criteria tailored to the research objectives. This participant was selected for their profound understanding of foreign language teaching education, proficiency in integrating interactive methods with digital tools, and familiarity with SRM. In accordance with the ethical standards governing research, the participant's name and gender were kept confidential throughout the dissemination of research findings.

Data Collection

A semi-structured interview form was prepared to examine various aspects of the implementation of the SRM deeply. Interview questions were based on a comprehensive literature review and built according to the study's objectives. Furthermore, experienced educators and language education experts supervised the interview process in order to verify its validity and clarity. For the semi-structured interview to be conducted in a healthy manner, an empty faculty class was identified and permission was requested to use it. Following the implementation of SRM, an interview was conducted with the teacher who used the model. As the communication with the teacher prior to and during the application was positive, the interview following the application was conducted in a relaxed and sincere manner. The implementer's conversations during the interview were recorded with their permission. After that, the audio recordings transcribed and digitized by the researcher.

Data Analysis

The content analysis method was utilized to analyze all of the interview data. The QDA Miner Lite program (version 1.4.1) was used to analyze the data from a semi-structured interview with the implementer. In order to analyze the data, the interview transcripts were carefully reviewed to identify key themes and concepts relevant to the research questions. Categories were organized based on the interview questions. The codes were created based on data collected from the implementer's responses.

Table 1. Content analysis of implementer's perceptions

№	Category	Code
1.	Features	student-oriented
		creativeness
		fulfilling a hobby
2.	Challenges	no difficulties
		group working
		same topics
3.	Effectiveness	pair working
		awareness
		skills improvement
4.	Further implementation	future plans
		additional stations
5.	Suggestions	sufficient draft
		visuality
		dialogue & text
		grammar
		feedback
		evaluation
		homogeneous group

This study used content analysis with both numerical (percentage) and verbal data presentation to investigate the broader context of phrases containing attitudinal resources. To increase reliability of the coding system researchers independently reviewed and coded the data. Disagreements and inconsistencies in creating codes were resolved through discussions and it led to the improvement and finalization of code system. Following the data coding and analysis, the findings were interpreted in accordance with SRM research experiences.

FINDINGS AND DISCUSSIONS

During the interview, the teacher discussed the differences between SRM and traditional teaching methods and techniques, the model's features and challenges in use, the stations with which students felt comfortable or had difficulty, the model's impact on language skills, the students' interest in using the model, the model's use in future lessons, the ideas that should be added to the model. In an attempt to interpret the implementer's perceptions, questions which were addressed to him/her were analyzed individually in relation to the categories.

Features of SRM

The data presented as percentages in the findings represent the frequency and quantity of the subjects as explained by the implementer. In response to interview questions regarding the differences between the Station Rotation Model (SRM) and conventional teaching methods, the implementer's responses yielded codes such as *student-oriented, creativeness,* and *fulfilling a hobby*. Consequently, the implementer predominantly emphasized the aspect of fulfilling a hobby about SRM features, followed by creativeness and student-oriented learning (see Fig.2):
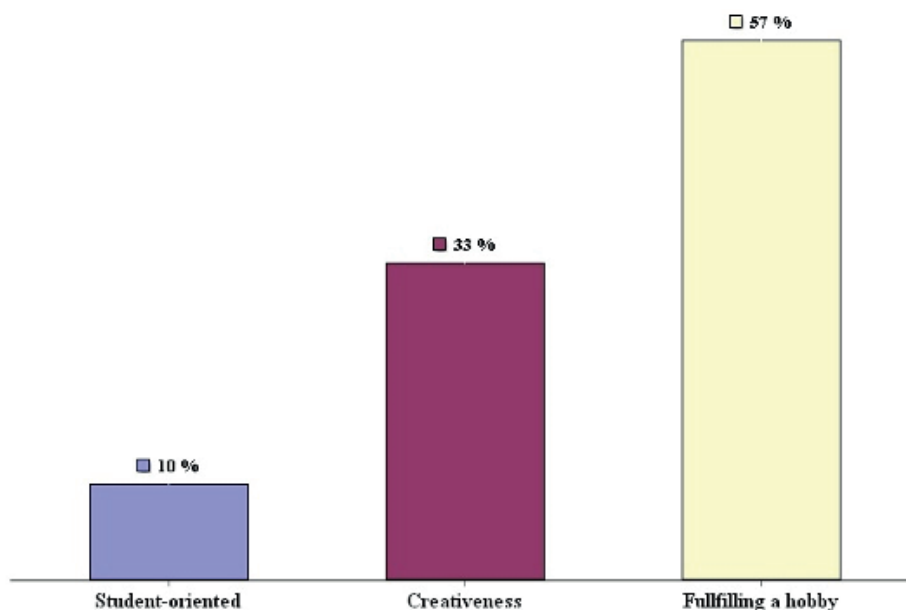
Figure 2. Implementer's Perception on the Features of SRM

The percentages mentioned in the figure represent the frequency of recurring patterns onserved in the codes indicated in implementer's responses. According to fulfilling a hobby the implementer emphasizes on students' psychological well-being, fostering creativity and engagement alongside language learning.

> Of course there are benefits of working in groups, I think language teaching is not only writing, speaking or listening. Painting has a benefit for the students, I mean; they say that it does not contribute to our language learning. Actually, it is a relaxation, it is like fulfilling a hobby in the lesson, I mean, we didn't tell all the students to paint, we just told them to develop an idea, to come up with an idea. Designing a video and drawing a poster or a picture, these are things that relax the students. Yes, it may be thought that what can it contribute to language teaching directly, but we should also take into account the psychological state of the students a little bit, and constantly loading them with lessons will also bore them. For example, if the student cannot draw a picture, they can make a video, if they cannot make a video, they can make an interview, or other things can be planned in group work that they will like, so I think these are useful.

The use of station rotation model also improves students' creativity where they could develop ideas for the purpose of solving problems and exploiting opportunities (Cimernova, 2015). Continuous encouragement, relevant training, and necessary conditions can enhance creative potential in individuals, as stated by Senel (2018). Such an atmosphere can be provided by SRM activities:

> It helps the student to develop a sense of comfort in expressing an idea, whether it is right or wrong, and contributes to the development of creative ideas. Of course, in order to do this, I think you need to divide the lesson in two. In other words, you teach a unit, no matter what the theme is, you need to create enough infrastructures for it, and this station rotation model should be the model that closes the deficiencies of traditional teaching.

Rahmadani et al. (2019) assert that leveraging technologies like multimedia in the classroom is a key strategy for fostering a student-centered learning environment. Consequently, in the context of SRM (Station Rotation Model), activities predominantly employ digital tools, which, as highlighted by the implementer, effectively facilitate student-oriented learning:

> During the implementation I realized that it contributed positively to the normal lesson. I mean, it obviously brought dynamism to the lesson. The transition to a student-oriented lesson, gaining self-confidence, autonomy, and most importantly, expressing oneself without embarrassment, decreases the feeling of shyness and increases the feeling of self-confidence.

SRM is a blended learning model that combines face-to-face and online teaching, making it an effective solution to bridge the gaps in traditional teaching as per the teacher's opinion. In language teaching, the use of SRM has led to positive contributions and improvements by building basic language skills.

Challenges of SRM

During the implementation of SRM, the participant was asked about his/her experience with managing rotations and the challenges that students faced in completing activities at specific stations. The participant's responses were used to create topics based on the content which included *no difficulties, group work,* and *the same topics*. According to the implementer's response, the most challenging station for students was group work, followed by no difficulties encountered during the implementation, and same topics which bored some students (see Fig.3):
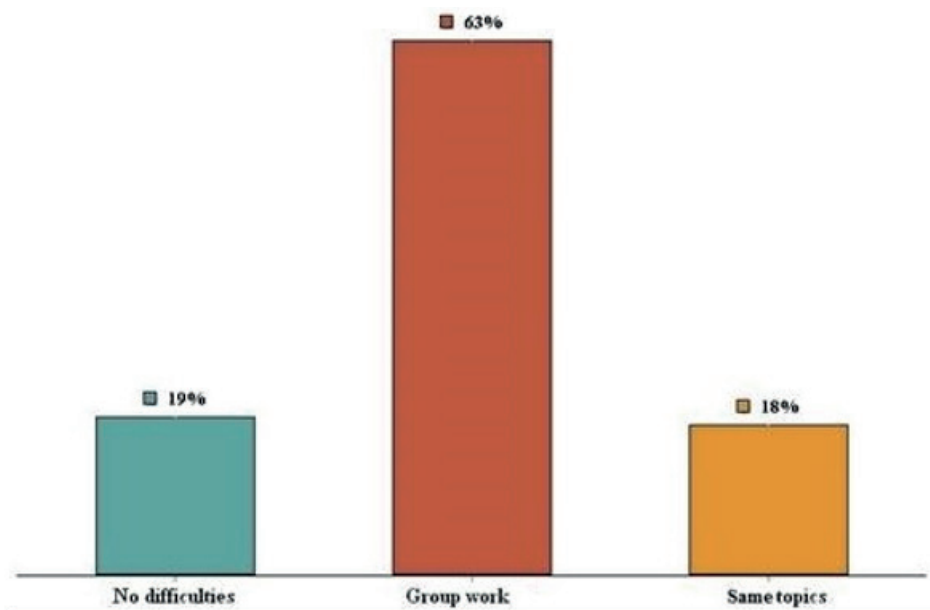
Figure 3. Implementer's Perception on the Challenges of SRM

The implementer mentioned about his/her lack of difficulties during the implementation where he/she could only observe some students' challenges in collaboration activities:

> I did not encounter too many difficulties; the students did not cause any difficulties especially at the individual and pair work station. They followed the instructions and did not need much support from us because they knew what to do themselves.

According to the implementer's response the most challenging station for students was group working. As Alfares (2017) notes, working in a group can present a number of challenges. For instance, mixed-ability groupings can result in low-ability students asking numerous questions to clarify their understanding. Furthermore, low proficiency in the target language can make learners feel less confident about contributing to the group. However, the implementer also identified a lack of responsibility as another issue.

> There were some difficulties only at the group work station, and there may be several reasons for this. The biggest reason was that the students did not have enough sense of responsibility. There, some of them had difficulties in evaluating the moment of working with the group positively and turning it into a gain. Maybe I can say a little bit of group work that was only a little bit difficult for the weaker students.

The implementer emphasized the importance of discussing varied topics across all stations, as discussing the same topics repeatedly can make the students feel bored. It is crucial to identify different types of topics

that align with students' interests and present them as discussion topics to create an environment that fosters communication and collaboration among the class members (Barjesteh et al., 2012). Hereby the implementer emphasizes about diverse student interests and perefences:

> *The second thing can be this, that is, instead of the same topic at the stations, maybe different topics can be created. It may be possible to reduce the boredom of a student who is bored with a theme.*

According to the implementer, there were issues with the model's implementation, such as some students not feeling responsible in group work stations and being unable to cooperate with others. Another reason for all of this is that group work tasks are not assigned during traditional classroom instruction, so students are not accustomed to them. It was also observed that not only in language teaching but also in other courses, activities and tasks related to students working as a team were not provided, resulting in students not developing habits about how to behave and work in groups. Additionally, some weak students found it difficult to participate in the group work station due to issues such as not being able to adapt to group work.

Effectiveness of SRM

During the interview, the implementer was asked a series of questions. One of these was about which station the students felt most comfortable in. Another was whether the implementer had observed a positive change in the students' language use during the implementation of SRM. The implementer's responses were then subjected to analysis, with codes such as *pair working, awareness,* and *skills improvement* being created based on the content. The analysis revealed that the majority of students enjoyed the pair working station activities, which provided an opportunity for them to engage and interact with their peers. Furthermore, the implementer indicated that the students had demonstrated improvement in their awareness and skills (see Fig.4):
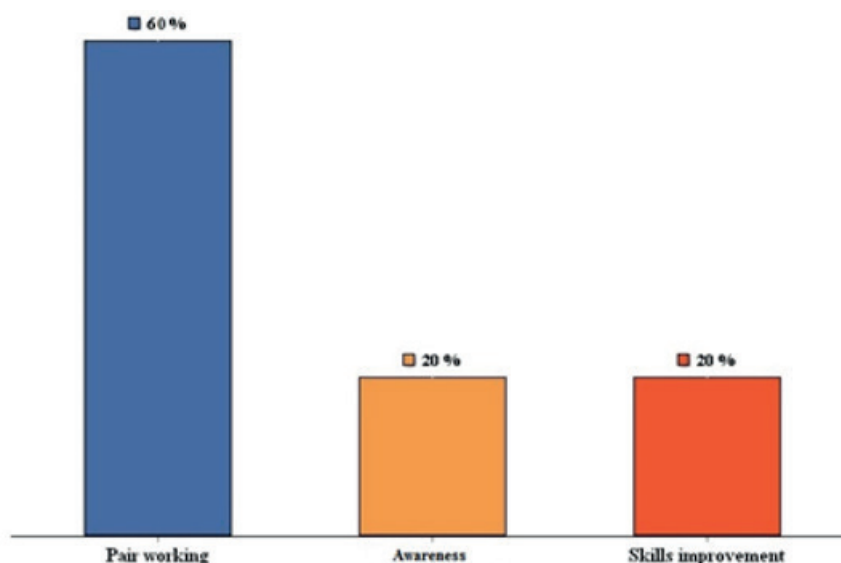
Figure 4. Implementer's Perception on the Effectiveness of SRM

Students were mostly engaged in pair working station as mentioned by the implementer in his/her interview. Harmer (2003) states that pair work can allow students to practice language, and discuss the text. Pyun (2004) considers that learners have enough opportunities to be involved in creative and meaningful interpersonal communication. Thus the implementer indicated the following pair working station activities:

> *I think they felt very comfortable at the individual station and especially at the pair working station where they had conversation because we gave them that feeling of moving freely there. We didn't tell them to be careful not to make mistakes, we just told them to try to speak in the target language as much as possible without adding words from their mother tongue. I think they felt most comfortable at the pair working station.*

During implementation, students realized their capacity to speak when they were in a state of awareness. Zhao et al. (2021) defined awareness as noticing and understanding. Therefore, the implementer explained the following statement:

> *It definitely happened, so I can answer yes to the question without hesitation. The good student got better; the weak student realized that he/she could speak a little more independently.*

In response to the implementer's query, it was established that students have the potential to enhance their competencies and language abilities, which will facilitate their communication with others (Beitchman et al., 2001). It is of paramount importance that learners are able to express their thoughts and ideas through a shared language, as this can have a significant impact on their emotional and social development (Cohen, 2001). Consequently, the implementer highlighted the importance of monitoring the progress of students' language skills:

> *I saw that they made progress within their own competencies, their writing improved a lot, and their speech improved a lot, their comfort in establishing dialog with each other improved a lot.*

Based on the implementer's observations, students showed significant improvement in speaking and writing skills, as well as progress in dialogue and communication. Consequently, within the Station Rotation Model (SRM), it appears that the most effective development of students' skills occurs during pair working stations.

Further implementation of SRM

During an interview about the effectiveness of SRM, the interviewee was asked whether they would like to implement the model in their future classes. Based on his/her response, codes such as *future plan* and *additional stations* were created. The interviewee emphasized the importance of adding new stations without replacing existing ones, and suggested creating a plan for using SRM in their classes (see Fig.5):
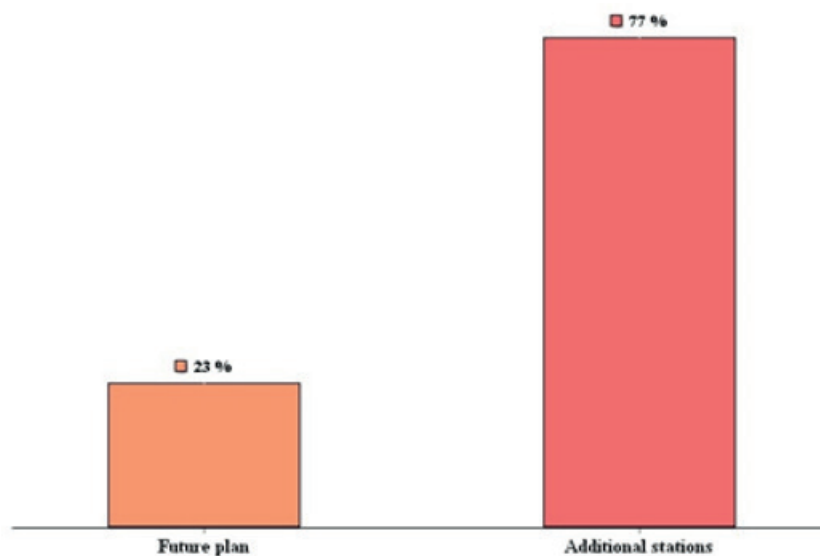
Figure 5. Implementer's Perception on the Further Implementation of SRM

Concerning to further implementation of SRM, the implementer stated the following:

> *If I have enough time, I want to make a design in the summer and use it. For the second semester, if I have time during the break, I plan to create stations with various designs and apply this model to students.*

The implementer not only mentioned about adding a new station but also extending and diversifying the existing activities:

You can use the station rotation model and make new additions to the stations. So it's not just about changing the model, you can enrich the existing model you have with other ideas or you can add another model. We think that students are bored, but students were also bored in the traditional method, which is very fun if you ask me. Let me say that the model can be enriched, other models can be applied.

The teacher is of the opinion that the station rotation model can be effectively combined with traditional teaching methods. The activities at each station can be made more enriching and utilized more efficiently. It is important to note that this model includes a feature that should be integrated with face-to-face instruction. Therefore, it can be implemented in various ways depending on the class and students' level, needs, and the availability of materials and technology.

Suggestions for SRM

During the interview process, questions were asked based on the suggestions provided by the implementer. For instance, the interviewee was asked how they would proceed if they were adding to the existing draft or creating a new one. Additionally, the researcher was asked if they had any suggestions regarding the model. The implementer's responses were used to create codes such as *sufficient draft, visuality, dialogue and text, grammar, feedback, evaluation,* and *homogeneous group*. The implementer suggested that it would be beneficial to create dialogue and reading text for students, evaluate students and provide feedback, design sufficient drafts, pay attention to the importance of students' visuality, add grammar topics, and implement the current model to homogeneous groups (see Fig.6):
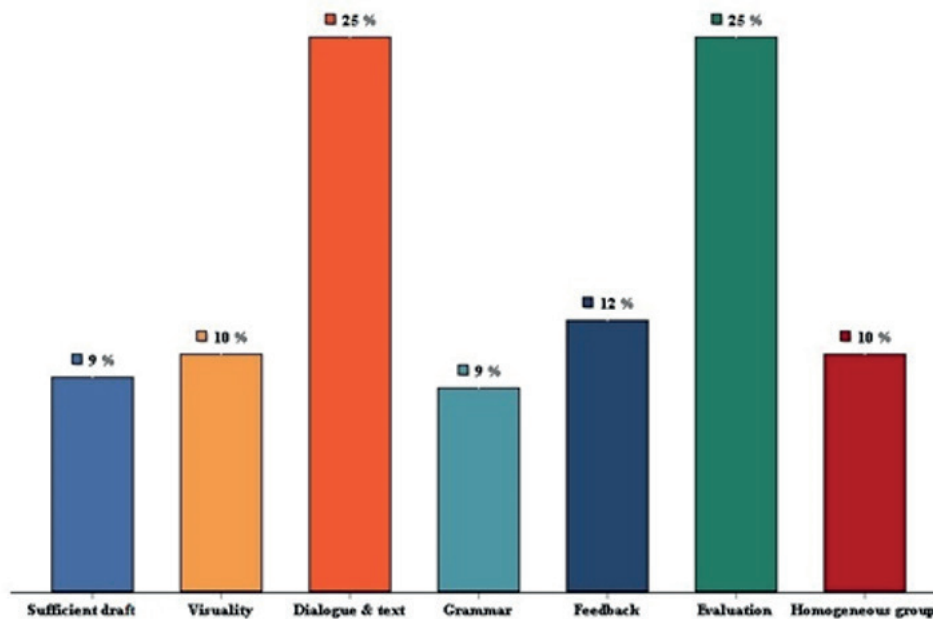
Figure 6. Implementer's Perception on Suggestions for SRM

The implementer recommended that in order to carry out SRM activities effectively, sufficient draft should be prepared in advance.

I didn't see any major problems in this draft, it was designed according to our course book. If that is the course book we should take as a basis, some additions can be made here, but there is no such thing as I would replace it with this design from the beginning, I think the draft was sufficient.

The importance of visuality in searching the topics is pointed out by the implementer:

> *Let's say you are going to make an application on any subject, it can be a university theme, it can be a dormitory theme, and these are more concrete things. We need to give importance to visuality, that is, the student will both see the visuality and ask himself how he can do it. How can they do this? They can create a video or make a poster.*

Acting out dialogues and reading texts were the most frequently mentioned types of activities:

> *… if there is a text, it should be in the form of dialog and text. Dialogue means talking to someone else. The student will read, create a dialogue and act it out; you can even have them write a prose text. You can ask the student make a dialogue, you can require from the student record the dialogue and you can ask the student to create the assessment and evaluation questions himself/herself. I think this can improve his/her ability to ask questions and how to answer that question. It will improve his/her sense of self-confidence, he/she will test himself/herself, and he/she will more or less realize his/her mistakes in grammar…*

Interestingly, the implementer proposed the inclusion of grammatical activities, particularly for online stations:

> *I also believe that grammar is necessary in grammar if you don't overdo it. There, for example, something about grammar can be added at the online instruction station. Verb and word matching can be done; true/false matching can be done. You need to place grammar somewhere there without making them feel too much and without being too boring.*

The implementer noted that feedback should be given after each SRM class, which was the most notable shortcoming of the model:

> *In order to get feedback in this process, there must be a process evaluation form in the classroom, both for your feedback to the students and for the students' feedback to you. What will be the benefit of this? It will tell you whether this student is making progress in the process, which student shows more interest in which station, and where the student is inadequate in the same station, where the student makes more mistakes in the process.*

Further to feedback, the implementer referred to post-implementation evaluation, which was conducted by the researcher; however, self-evaluation by students was not conducted:

> *So you need to have a process evaluation form and you need to plan it very well. We will have something to test everything. After 3 months of this process, you will look at the student's situation, this student is failing in the online instruction station, this student is failing in this subject, this student has not contributed enough to the group work or has contributed less, you need to grade these, so that you can control the process.*

Finally, the researcher who designed and prepared the draft SRM model received suggestions from the implementer regarding its implementation in the homogeneous group:

> *I have some suggestions for the researcher. Of course, it can also be aimed at eliminating some deficiencies. Now, if the researcher is going to use this somewhere in the future or use it in a lesson process, I think that the class should have a homogeneous structure, or he/she will spend a little more time and separate the class and plan other studies for students with low levels.*

Among the ideas suggested by the implementer to enrich the stations, creating videos or posters, writing texts or dialogues are strategies that can be very useful. In addition, it is also very useful ideas to have students prepare questions for assessment and evaluation according to the material they create themselves, but it may be more appropriate to use this strategy from the pre-intermediate level onwards rather than at the elementary level. The implementer expressed that grammar-related activities could be added to the station activities. However, Kress (2010) discusses the concept of *grammar* in English and literacy teaching, emphasizing the social context and the developing authority of meaning-making. Even if the learner understands the grammatical structures (noun, verb, predicate, subject, etc.) well when learning a foreign language, he/she does not use them much in social life. Patrick (2019) argues that learning a language through conscious effort improves proficiency. Explicit knowledge of language mechanics helps to edit the language produced. Therefore, integrating grammatical structures with basic language skills and teaching basic language skills holistically in language teaching improves students in all aspects.

CONCLUSION

After evaluating the opinions of the implementer regarding the use of SRM (station rotation model) with Kazakh students who are learning English as a foreign language at Yesevi University Philology Faculty, it was concluded that the implementer used self-created strategies as well as traditional teaching methods and techniques in language lessons. Moreover, the implementer emphasized that student-centered and teacher-centered teaching should be considered as a whole. The implementer had a positive opinion on the station rotation model and expressed his/her intention to use it again in the future. The implementer also recommended different activities that could be incorporated into the station rotation model. Based on these suggestions, it can be inferred that the station rotation model is an effective approach to teach English as a foreign language. The implementer (teacher) meant by the homogeneity of the class that there was no difference in the level of the pupils. However, in the class where the model was used, the majority of the students were at elementary level, some were at pre-intermediate or even intermediate level, while others were at beginner level. This is due to the system of the institution. The mass of students were not classified by level, but by department, i.e. the departments they would study in one year. As a result, during the implementation of the model, it was found that students with pre-intermediate or elementary language levels could easily complete the tasks.

In contrast, students with lower levels struggled, which is natural. However, classifications should be divided into levels. The teacher also suggested that the student's work should be evaluated. During the implementation, the researcher carried out evaluations in addition to observations. However, due to time constraints, the students were not able to respond, so the students were not able to learn what was missing and what was correct in their work. These ideas suggested by the implementer to the researcher will be considered, as will all opinions, before implementing the model in the future. As a result, the implementer rated the model positively and effectively. Based on the conclusions drawn from the implementer's perceptions of the use of the Station Rotation Model (SRM) in teaching English as a foreign language, here are some suggestions tailored to improve the implementation and effectiveness of the model in future educational settings:

- In SRM, multiple types of activities should be developed, since these activities should be suited to various proficiency levels, ensuring that all learners, regardless of their starting point, will find the tasks both challenging and accessible.

- Rather than considering students' departments or years of study, classes should be reorganized based on their language proficiency levels. In this way, specific instruction can be tailored to the needs of every student, resulting in more homogeneous groupings.

- Systematic and timely feedback mechanisms for students should be provided as this can involve the use of digital tools that allow for quicker assessment of student work, promptly enabling learners to understand their strengths and areas for improvement.

- As group tasks or projects can promote peer learning and support, especially beneficial in mixed-ability settings, the integration of more collaborative learning opportunities within the station rotation model should be encouraged.

- Ongoing professional development opportunities for instructors to explore innovative strategies within the station rotation model should be provided. Trainings can include workshops on creating differentiated learning activities and effectively assessing student work in a blended learning environment.

- To support differentiated learning and assessment technology should be leveraged. Utilization of technology in SRM includes the use of educational software that adapts to each student's level, and providing personalized learning paths within the station rotation framework.

- The effectiveness of the station rotation model should be evaluated regularly through both instructor observations and student feedback. Continuous assessment can identify areas for refinement, ensuring that the model remains responsive to the needs of learners.

- Strategies that promote student autonomy within the station rotation model should be encouraged. Allowing students to have a say in the selection of activities or tasks can increase engagement and motivation.

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FEEDBACK ON FEEDBACK: AN EXPLORATORY CASE STUDY OF ONLINE FACILITATORS' PERCEPTIONS REGARDING THEIR FEEDBACK PRACTICES IN HIGHER EDUCATION

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ABSTRACT

Feedback is one of the most powerful tools for teaching and learning. Providing meaningful feedback to students is of particular importance in an online context as it is a direct way for the facilitator to engage with their students and to provide them with individual, tailored support. This study sought to explore the perceptions of online facilitators (OFs) regarding meaningful feedback in a Higher Education (HE) online learning environment. Using a qualitative exploratory case study design, 45 OFs affiliated to a South African based private higher education institution (PHEI) were approached particpate in this study to share their understanding of what they believed constitutes meaningful feedback. Data were collected through focus groups and analyzed using content analysis. It was found that whilst each of the OFs who participated in this study sincerely believed their feedback to be meaningful there were aspects of their practice that did not align with what the literature suggests about the nature of meaningful feedback. Their understanding of meaningful feedback is feedback that emphasizes students' processes and strategies rather than personal attributes. They perceive meaningful feedback as detailed, specific, and focused on task requirements and strategies, ensuring that students understand their successes and areas for improvement. Implementation of feedforward practices, despite an understanding of its importance, and the use of different methods and platforms to provide feedback were found to be areas for development. It could be concluded that the way in which the participants viewed the quality of the feedback that they provided to their students was not always in keeping with the benchmark criteria as set out in the research. In response to these findings the researchers have made suggestions that future research and professional development initiatives should focus on addressing these barriers and finding practical ways to provide accessible feedback to students more meaningfully and efficiently.

Keywords: Meaningful feedback, higher education, open distance learning, online facilitators.

INTRODUCTION

In 2018, as part of its annual internal audit process, a South African based private higher education institution (PHEI) initiated a stand-alone teaching and learning audit project for the purpose of ongoing quality assurance. This institution elected to focus on the development of practice from the perspective of their lecturers and their perceptions regarding the development initiatives provided to them by the institution. Although it was understood that perceptions are, by definition, not neutral, the institution still believed that there was value in being able to better understand how these developmental initiatives were interpreted and received by their lecturing team. To gauge these perceptions an online survey was distributed to the full

academic body numbering approximately 1 200. For this qualitative case study, however, the researchers have elected to specifically focus on the data collected from those facilitators who were associated with the institution's distance mode of delivery to interrogate these perceptions more closely within an Online Distance Learning (ODL) context.

86% of the Online Facilitators (OFs) completed and submitted the survey. Of particular interest to the researchers was the data collected on the notion of feedback to students, and the fact that 100% of the OFs indicated that the feedback they provided to their students was 'meaningful' in nature. This assertion inevitably raised the question of how the institution's OFs understood the concept of meaningful feedback and how their practice mirrored these perceptions. To interrogate the data further, the OFs who completed and submitted the survey were invited to participate in focus groups to discuss the ways they provide their students with feedback and what, according to their understanding, made their feedback meaningful.

LITERATURE REVIEW AND THEORETICAL FRAMEWORK

As Carless (2006) suggests, lecturers within a Higher Education (HE) setting spend an inordinate amount of time compiling feedback on the work submitted by their students, most of which is in the form of written comments or annotations. Over the years, there has been ample research to support the idea that feedback is one of the single most powerful contributing factors to the academic success of students (Carless and Boud, 2018; Hattie, 2009; Jensen, Bearman and Boud, 2021; Wisniewski, Zierer, and Hattie, 2020).

Traditional Feedback Practices

In traditional learning environments, feedback is often provided in a monologic way whereby the lecturer provides feedback and comments on students' assignments. Ajjawi and Boud (2018) conclude that this form of feedback is limited as students often do not understand the feedback or know how to implement it. Furthermore, students may have moved on to new learning units and content by the time they receive the feedback. This suggests the need for sustainable and dialogic feedback, as advocated by Carless (2016) and Williams (2024), where students play an active role in seeking, accessing, and using feedback to close the feedback loop.

Online Feedback Practices

With the increase of online learning, the development of Learning Management Systems, AI tools and ChatGPT, and other online educational teaching and learning tools and taking into account the technological and social learning styles and needs of Generation Z students (Seemiller and Grace, 2018), a dialogic feedback method has been proposed as a suitable fit (Ajjawi and Boud, 2018). Lecturers have access to platforms such as Journals and Discussion Forums, which makes such feedback possible. In addition to feedback provided by the lecturer, peer and self-evaluation tools have been advocated for the modern online classroom to develop 21st-century workplace skills of self-reflection, critical thinking, and collaboration (Brookhart, 2017). However, the question arises if and how various methods and platforms are used by Online Facilitators (OFs) to provide meaningful feedback to students.

While the importance of feedback in an educational context is certainly not a new topic for discussion, a review of the literature suggests that most studies have focused on feedback as it is provided and received in face-to-face settings (Arts et al., 2021; Drikx, Joosten-ten Brinke, Arts, and van Diggelen, 2019; Storai and Salvadori, 2023). As noted by Rockey and Saichaie (2020), whilst online classes and tools for instructional purposes have developed, there is a gap in empirical research on feedback in courses that are offered via an online mode of delivery. The current study aims to address this apparent gap by engaging with OFs tasked with guiding the learning process in an Online Distance Learning (ODL) setting to determine their current feedback practices and whether these align with what is suggested by the literature.

Lecturers' Perceptions of Feedback

Previous studies conducted into perceptions of feedback focused on schoolteachers and lecturers from contemporary higher education institutions. In these studies, participants viewed feedback positively and as being valuable (Williams, 2024). However, Williams (2024) states that teachers found it challenging to engage students with their feedback and guide them on how best to use their feedback for future learning. Thus, Williams (2024) concludes that there is a need to explore the relationship between students' and teachers' feedback literacy and their perceptions of assessment and feedback quality.

The proliferation of studies that have interrogated the nature and impact of feedback across a range of academic settings has inevitably led to a substantial number of definitions of the concept. For this study, however, the researchers have selected the definition by Henderson, Molloy, Ajjawi, and Boud (2019:15), who define feedback as "a process where the learner makes sense of the performance-relevant information to promote their learning". The reason for selecting this definition is the suggestion that feedback in this context is a forward-looking process rather than simply a means to justify a grade (Henderson et al., 2019). This future-focused idea of feedback aligns with Gen Z and online learning, leading the researchers to select this definition and Hattie and Timperley's (2007) model as the theoretical framework for this study.

Theoretical Framework

A Model for Feedback (Hattie and Timperly, 2007)

According to Panadero and Lipnevich (2022), there are numerous pedagogically oriented models that focus on the various ways in which feedback can be delivered for maximum effect. Among these are the models of Mason and Bruning (2001), Nicol and Macfarlane-Dick (2006), and Carless and Boud (2018), to name just three. It is, however, the work of Hattie and Timperley (2007) that has served as the foundation for the theoretical framework upon which this study is based. The reason for this is twofold, firstly it is one of the few models that includes the notion of feedback as having a feedforward function (Lipsch-Wijnen and Drikx, 2021), and secondly, the model includes an additional perspective that differentiates between feedback that is delivered on the task, the process, self-regulation, and the self (Panadero and Lipnevich, 2022). What is significant is that by adopting this perspective each of these levels may be categorised as both the content and the function of feedback (Panadero and Lipnevich, 2022). An example of this would be where feedback that is self-regulatory in content is intended to increase the self-regulation of the student. As Panadero and Lipnevich, (2022) explain, the Hattie and Timperley (2007) model highlights how content and function are interrelated. In other words, "the function could be considered the main purpose of the feedback, whereas the content is the manifestation of that purpose" (Panadero and Lipnevich, 2022:10). The figure below is based on the work of Hattie and Timperley (2007) and illustrates the framework of meaningful feedback used for this study.
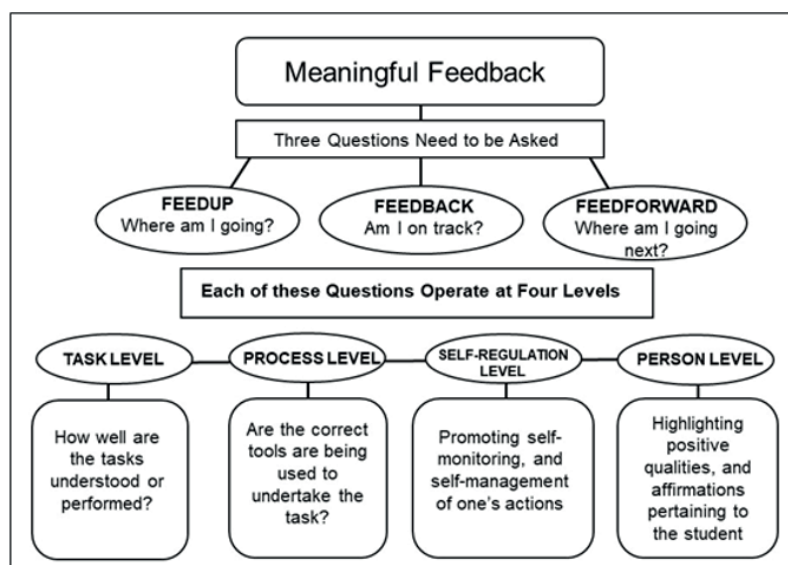

Figure 1. A Framework for Meaningful Feedback – based on the model of Hattie and Timperly (2007).

Although not specifically developed for an online learning environment, the Hattie and Timperley (2007) model has been applied to several studies conducted in higher education settings (Egelandsdal and Krumsvik, 2020; Storai and Salvadori, 2023; Winstone and Carless, 2020; Wisniewski, Zierer and Hattie, 2020), as such the researchers believe that the premise of this model remains relevant to this study as it speaks to the fundamental criteria upon which meaningful feedback is based regardless of the mode of delivery in which it is provided.

Three Questions Applied at Four Levels

Three questions

Underpinning the Hattie and Timperley (2007) model is the "assumption that the purpose of feedback is to drive student achievement, thus supporting the learner in reaching their learning goal" (Mandouit and Hattie, 2023:np). Following the Hattie and Timperley (2007) framework, meaningful feedback begins with three critical questions:

- What are the goals?
- Am I on track?
- Where am I going next?

The first question addresses what the intended learning goals are and is referred to as feedup. The second question relates to how the student has managed thus far and is referred to as feedback. The third question looks to the next step in the journey and what needs to be done in order to achieve future goals. This is referred to as feedforward (Lipsch-Wijnen and Drikx, 2022; Sadler, Reimann and Sambell, 2023; Xerri Agius, 2020).

Feedup allows the student to understand what is expected of them, providing guidance and direction, while feedback should offer students a clear insight into their current level of performance and how it can be improved upon (Sadler, Reimann and Sambell, 2023). As the term suggests, feedforward is about looking ahead to the next task or assessment and how the lessons learnt from previous iterations of work can be leveraged for success (Sadler et al., 2023). According to Lipsch-Wijnen and Drikx, (2022:2), "feedforward is a positive aspect of the model because it focuses on growth or progress". To provide students with a clear sense of direction and purpose, feedup, feedback, and feedforward practices need to be used combination rather than in isolation (Lipsch-Wijnen and Drikx, 2022).

Four levels

The Hattie and Timperley (2007) model recognises four distinct feedback levels:

- Feedback on task
- Feedback on process
- Feedback on self-regulation
- Feedback on the person

Task feedback is concerned with how well a student has understood and/or performed the task, while feedback on process will address strategy, or perhaps whether the correct tools have been used to complete the task. This level of feedback, one that poses questions and raises the possibility of alternative solutions, is where "deep learning" has the potential to take place (Hattie and Timperley, 2007, cited in Lipsch-Wijnen and Dirkx, 2022:3). The third level of feedback relies on self-monitoring, or self-direction. As Lipsch-Wijnen and Dirkx (2022) explain, feedback on self-regulation looks at the choices students have made that have shaped their own learning, using their prior knowledge to inform how they have approached a learning task. Finally, feedback on the person is associated with a student's personal qualities and providing positive affirmations, such as complimenting them on their turn-of-phrase, or perhaps commending their attention to detail.

PURPOSE OF THE STUDY

The purpose of the study was thus to explore OF's understandings and perceptions about the nature of meaningful feedback. The aim of this study was, therefore, to explore any gaps that may exist between the participants' notion of what constitutes meaningful feedback and what the literature shares on the topic. By identifying these gaps, the researchers hope to use any gaps in understanding, and investigate and implement possible interventions to support the OFs with providing meaningful feedback to their students. This study sought to address the following key research questions:

1. What are OFs understanding of meaningful feedback?
2. How do OFs perceive meaningful feedback?
3. What gaps, if any, exist in OFs understanding of meaningful feedback?

METHOD

For this study, a qualitative exploaratory case study approach was adopted. This approach was selected because it is best suited to explore real-world subjects for the purpose of gaining in-depth insights into the phenomenon that is being investigated (Arghode, 2012). As the OFs affiliated to this PHEI are representative of a group that are bound by a specific context, space, and time (Hancock and Algozzine, 2017), using a case study approach was deemed most feasible, and because the researchers were interested in the process, meaning, and understanding that would be gained through engaging with these OFs, a socially constructed approach that was descriptive in nature was adopted (Creswell, 2021). By engaging with OFs affiliated to this PHEI, the researchers were able to gain insights into their perceptions regarding the notion of what constitutes meaningful feedback and how they provide same to their students.

To collect data for this study, an initial online qualitative survey was administerd to entire population of OFs. Using content analysis, the data from the surveys were reduced and analyzed. Thereafter the researchers used purposive sampling to identify paricipants for this study. In this way they were able to identify participants who possessed the required characteristics and exeperiences, such as age, gender and tenure to make them a fit for the study. The final group of OFs who participated in the study numbered 45 (which was 69% of the total population), with 34 female and 11 male participants. Tenure among the participants ranged from one to seven years. To gain in-depth insights into their experiences and perceptions of feedback, and to allow for interaction among the participants, they were invited to participate in any one of three focus groups. Both researchers were present at the focus groups but they were facilated by one researcher so as not to overwhelm the participants. All focus groups took place fully online using the Microsoft Teams platform; to accomodate the fact that the participants resided in different parts of the country. It also allowed for these sessions to be recorded for the purpose of transcription and analysis.

After transcribing the focus group recordings verbatim, content analysis was used to analyze the data (Braun and Clarke, 2012). Thus, data was reduced using codes and those codes were used to generate themes. Each researcher completed this analysis independently, and after meeting to discuss the themes that were generated, the analysis was conduting again independently to assist with clarification and defining and naming themes. In this way the validity of the study was enhanced through crystallization (Ellingson, 2017) before presenting the consolidated key findings (Gill, Steward, Treasure and Chadwick, 2008). Ethical clearance was obtained from the PHEI in question and informed consent was sought from each participant. Names of the participants were replaced with pseudonyms to ensure confidentiality.

FINDINGS AND DISCUSSION

During the focus groups, participants were asked to share how they approached the provision of feedback to their students and why they believed their practices resulted in feedback that was meaningful. From these engagements and the subsequent analysis of the data, the following themes emerged:

- Praise the process not the person
- Task and process take precedence

- Feedforward is understood but not practised
- Aligning with traditional views of providing feedback

Theme 1: Praise the Process Not the Person

According to Hattie and Timperley (2007), person level feedback is an opinion pertaining in some way to the characteristics of the student by the individual providing the feedback. An influential body of work conducted by Dweck and several of his colleagues during the late 1990s and early 2000's posits that feedback of a personal nature falls into two categories, namely praise of the person and praise of the process (Kamins and Dweck, 1999; Dweck, 2007), with Dweck (2006) suggesting that process praise has the potential to lead to a greater sense of mastery among students and encourage their ability to learn through application.

During the focus groups participants were asked to share whether they were in favour of including person level feedback to students. While a significant number did support including this level of feedback, most indicated that when they did so their comments were in relation to how the student had approached a task, rather than offering comment of a more personal nature. This can be seen in the two excerpts that follow:

> *Tenille: I don't believe that a comment like "awesome job" is of any real benefit. If I am going to get personal, I would rather refer to the strategy they have used, like "you have built an excellent argument here", or something like that.*

> *Noma: "I do offer personal comments sometimes, but I tend to focus on something they have done well, not about who they are as a person. I think you get into dangerous ground if you do that".*

These comments align with a recent study by Mardiah (2020:45), who suggested that when praise feedback focuses on a student's capabilities, rather than on their personal attributes, it can assist the student in identifying a link between "the effort that they invest in a task" and the potential to "improve their academic or behavioural performance". An earlier study by Skipper and Douglas (2012:np) found a similarly positive response to praise which was levelled at the process rather than the person, however, the study also found that feedback "worded in terms of effort" rather than in terms of personal evaluation was possibly just as effective in engendering a positive response in students. This reference to person praise of a more emotionally neutral, or objective, nature was also found in this study and is highlighted in the excerpt below:

> *Penny: I am a little wary of feedback of a personal nature, especially in this mode, because we never meet our students and don't really know them in the same way you would if they were in your [contact] classroom. So, I try to qualify any feedback like this by referring to the effort I can see they have put into their work.*

While many similar comments and sentiments were shared regarding person level feedback there was a clear emphasis on the importance of providing students with feedback that addressed the task itself, and / or the process that had been adopted to execute that task. This gave rise to the second theme.

Theme 2: Task and Process Take Precedence

Wisniewski, Zierer, and Hattie (2020) explain that while task level feedback revolves around surface information, such as the content or facts pertaining to the task, feedback at a process level addresses the strategies that have been deployed in completing that task. During the focus groups conducted in this study, most of the discussion revolved around the importance of providing students with detailed feedback on whether they had successfully completed the task, as well as using examples from the submitted work to illustrate why an approach or strategy was either successful or lacking, as three participants shared:

> *Michael: My students want to know what went right, and what went wrong. For me to do this I have to unpack the requirements of the task itself, where they met these requirements, or where they fell short. But they also want the 'why', … and that talks to how they went about doing things.*

> *Taylor: I really try and focus on making my feedback as specific to the [task] as possible. I want them to understand exactly why they did well, or where they went wrong.*

> *Thomas: I really believe that if they understand why an approach worked, or didn't work, then they can repeat that performance again next time.*

These and other comments from the participants suggested that they gave priority to feedback pertaining to the task at hand; whether it had been understood, how well it had been performed, and whether the tools used to undertake the task had been the most appropriate. While there was certainly reference to the importance of sometimes posing questions in the feedback, rather than simply providing students with the correct answer, these questions were also predominantly at a task and process level: "Why do you think providing more current examples would have improved your mark?", or "This question required you to apply the theory to a scenario, where do you think you fell short?"

What appeared to be missing from the anecdotal examples provided by the participants during the focus group sessions was any reference to feedforward practices, namely providing comments that would relate to future tasks and how a student can go about building on their previous experiences to improve (Dirkx et al., 2019). OFs in this study appeared to understand the mechanics of this level of feedback but had, for a range of reasons, elected to not to implement this approach in their practice. This led to our third theme.

Theme 3: Feedforward is Understood but Not Practiced

As explained by Lipsch-Wijnen and Dirkx (2022), feedforward encourages the student to look ahead, focusing on growth and progress. Feedforward "gives the student perspective, direction, and is motivating". A study conducted by Walker (2007) found that even when faculty had been specifically trained on feedforward practices, they found it challenging to implement. When discussing the notion of feedforward with the participants in this study, the majority seemed to be aware of the concept, but reluctant to implement it in practice:

> *Daniel: Oh, I understand the idea behind it, but it really just takes too much time. My students want feedback that pertains to 'right now', not 'tomorrow'.*

> *Penny: I love the idea, but I am not convinced it will work in our space. Maybe with my Post Grad students, but not with my first years.*

> *Kenneth: They don't even pay attention to the basic feedback I provide; it will take some convincing to get them to invest in this level of engagement, so I won't even waste my time.*

This dearth of feedforward is echoed in a study that Arts et al. (2021) conducted at a teacher training college in the Netherlands. Here they found feedforward practices to be totally absent, while the Dirkx et.al (2019) study only found feedforward comments being used in assessment rubrics, with almost none being recorded as in-text comments.

When compared with definitions such as those of Henderson, Molloy, Ajjawi, and Boud, (2019) and models such as that of Hattie and Timperley (2007) there is a definite misalignment between how the OFs in this study perceive meaningful feedback to be and what the literature suggests it ought to be.

Theme 4: Aligning with Traditional Views of Providing Feedback

Most OFs responded that they were cognizant of the importance of feedback. Words such as "meaningful", "effective", "positive" and "constructive" were used throughout the three focus groups. They also expressed the need to be mindful not to be too harsh or demotivate the students with negative feedback. However, when the process and method of feedback was delved into, it became apparent that they were using mostly the traditional methods. For instance, Thomas explained that he reads throught the entire submission first to get a sense of the student and then starts adding comments and uses a rubric during the second reading. At the end of that process, he provides feedback on the submission as a whole. Other participants indicated that they did similar with slight variations such as the omission of the initial reading of the submission, or not adding comments as the rubric had specific comments. Penny indicated that the process took a very long time, so she often only used the rubric and then sent a voicenote to the entire group to provide overall feedback. Apart from this, none of the other participants used any other platforms or methods to provide feedback.

As can be seen this is aligned with what the literature suggests about the challenge of time (Williams, 2024) and unfamiliarity with using alternate feedback methods and platforms (Ajjawi and Boud, 2018; Brookhart, 2017) to suit Gen Z students and online learning environments. The participants' feedback was more aligned with traditional monologic feedback using an online platform. This could be attributed to the lack of understanding and knowledge of alternative feedback methods and platforms to provide meaningful feedback to their students.

Discussion

The findings from this study provide valuable insights into the current practices of online facilitators (OFs) regarding feedback provision to their students. Four key themes emerged from the focus group discussions: praising the process rather than the person, prioritizing task and process feedback, the understanding but lack of implementation of feedforward practices and aligning with traditional views of providing feedback.

The first theme aligns with the theoretical framework proposed by Dweck and colleagues (1999, 2007), who emphasize the importance of process praise over person praise. The participants in this study echoed this sentiment, highlighting a preference for feedback that focused on students' approaches and strategies rather than personal attributes. This is in line with Hattie and Timperley's (2007) distinction between person-level feedback and process feedback, with the latter being more conducive to fostering a growth mindset among students.

Tenille's and Noma's comments underscore the preference for process-oriented feedback, reflecting a belief that such feedback is more beneficial in helping students understand their learning processes and improve their academic performance. This is supported by Mardiah's (2020) findings, which indicate that feedback emphasizing student capabilities and effort can help them draw connections between their efforts and academic outcomes. Skipper and Douglas (2012) also highlight the effectiveness of feedback focused on effort and strategy, further corroborating the preference for process praise observed in this study.

The second theme emphasizes the importance of task and process feedback. Participants highlighted the necessity of providing detailed, specific feedback on students' performance related to the task requirements and the strategies employed. This approach is consistent with Wisniewski, Zierer, and Hattie's (2020) differentiation between task-level feedback, which addresses content and factual information, and process-level feedback, which focuses on the methods and strategies used to complete the task.

The emphasis on specificity and clarity in feedback, as articulated by Michael, Taylor, and Thomas, is crucial in helping students understand both their successes and areas for improvement. This focus on task and process feedback ensures that students receive actionable insights that can guide their future efforts, thereby enhancing their learning outcomes. However, the participants' feedback examples revealed a gap in feedforward practices, which leads to the third theme.

Despite an understanding of the concept of feedforward, participants in this study rarely implemented it in their feedback practices. Feedforward, as described by Lipsch-Wijnen and Dirkx (2022), is intended to

provide students with forward-looking guidance that can help them improve future performance. However, the reluctance to adopt feedforward practices, as expressed by Daniel, Penny, and Kenneth, suggests several barriers, including time constraints and doubts about its effectiveness for certain student groups.

The challenges associated with implementing feedforward are not unique to this study. Walker (2007) found that even with specific training, faculty members struggled to incorporate feedforward into their feedback routines. Similar findings were reported by Arts et al. (2021) and Dirkx et al. (2019), indicating a broader issue within educational practices.

This reluctance and the resulting misalignment between current practices and the theoretical models of effective feedback, such as those proposed by Henderson et al. (2019) and Hattie and Timperley (2007), highlight a significant area for development. Addressing these barriers and finding practical ways to integrate feedforward into feedback practices using different platform and methods could enhance the overall quality and effectiveness of feedback provided to students.

CONCLUSION

In a time where online learning has become an integral component of higher education learning and teaching, and considering the pivotol role that feedback plays, especially in online learning environment, in improving student performance, there exists a necessary focus on providing students with feedback that is truly effective. As stated by Hattie and Timperly (2007), there is a greater chance of feedback being considered meaningful when it not only addresses the task that was undertaken and the tools or strategies used to undertake that task, but also provides the student with logical connections for the improvement of future tasks.

All the participants in this study communicated a confidence in their ability to provide their students with meaningful feedback. While their commitment to the feedback process may be commendable it can be concluded that there was nonetheless a clear disconnect between their intentions and the benchmark criteria as set out in the framework which guided this study. As with the Lipschen-Wijnen and Drikx (2021) study, this study evidenced an unclear understanding of feedback as needing to be a combination of feedup, feedback, and feedforward practices. Instead, these levels of feedback, when implemented, were approached as stand-alone options. These findings provide the perfect opportunity for training and to conduct further research into strategies regarding the use of the Hattie and Timperley (2007) framework as the foundation for modelling best practice in an ODL setting.

What are OFs' Understanding of Meaningful Feedback?

They understand meaningful feedback as feedback that emphasizes students' processes and strategies rather than personal attributes. They understand meaningful feedback to be comments, rubrics and overall feedback provided by the OF. A shift in understanding is needed so that feedback is better suited to Gen Z students and online teaching and leaning.

How do OFs' Perceive Meaningful Feedback?

Meaningul feedback is perceived as detailed, specific, and focused on task requirements and strategies, ensuring that students understand their successes and areas for improvement. They use the correct terminology when describing what feedback should entail but due to time and other constraints their practice does not always align with their beliefs about their practice.

What Gaps, If Any, Exist in OFs' Understanding of Meaningful Feedback?

A significant gap exists in the implementation of feedforward practices, despite an understanding of its importance. Barriers such as time constraints and doubts about its effectiveness hinder its adoption. A further gap that exists is in relation to how shift from monologic to dialogic feedback and to providing feedback using different platforms and methods.

SUGGESTIONS FOR FURTHER PRACTICE AND RESEARCH

Motivated by the findings of this study and the assertion of Lipsch-Wijnen and Dirks (2021) that, particularly within an ODL context, there exists a need to conduct further research that interrogates how a model like that of Hattie and Timperley (2007) can be applied in practice. Adding to this, this study foregrounded the urgent need to design and implement training and support for the OFs. As such, the researchers will embark on a follow-up study wherein interventions will be explored and implemented and OFs will be invited to share their thoughts and experiences of these interventions intended to support them in the provision of meaningful feedback. Another consideration for further study is to give voice to the students to gain insight into their perspectives and experiences about feedback. Inviting students to participate in such studies could allow them to comment on how they experience the feedback that their OFs provide. This student input will enrich the discussion and serve to illuminate the way forward regarding the nature and type of feedback that ODL students find most meaningful in their context. A further area of study could be the exploration of how the advancement of ChatGPT and AI tools can be effectively leveraged to make the feedback process more effective in terms of quality and time.

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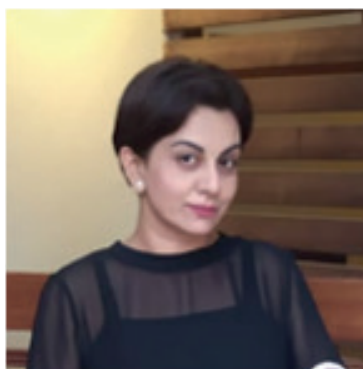
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IMPACT OF E-LEARNING ON ENGINEERING EDUCATION DURING THE COVID-19 PANDEMIC: A STUDY IN THE NORTHEASTERN REGION OF INDIA

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ABSTRACT

The COVID-19 pandemic has put the entire world in a very challenging situation, and similar to other sectors, education has also been severely affected. The teaching-learning process during that period was carried out only online. As none of the stakeholders expected such an unprecedented situation, all the institutions had to switch to an online mode with almost zero preparation, abruptly putting the entire process in a very challenging position. This survey article aims to assess the impact of e-learning on engineering education during the pandemic in the Northeastern region of India. A carefully designed questionnaire divided into six major groups was circulated among the learners. The study addresses several research questions, including the improvement of IT skills among students, the e-learning exposure level before the pandemic, and the comparison between e-learning and face-to-face learning in terms of knowledge improvement, technical skills, and social competency. Additionally, the interest level of students in attending theoretical and lab classes in online and offline modes, students' assessment of the merits and challenges of e-learning, major obstacles faced during online learning, the overall experience of learners with e-learning during the pandemic, and students' excitement to return to college for physical learning after COVID-19 are examined. The findings highlight the need to address technological challenges, enhance online instructional design, and consider individual preferences and needs in shaping the future of engineering education. Unreliable internet connectivity and the higher cost of internet data are identified as the two major bottlenecks of e-learning in the specified region. Proper teacher training, time-efficient schedules for online classes, and selection of the most relevant e-content are some of the most important issues to be addressed for enhancing the effectiveness of e-learning.

Keywords: e-Learning, face-to-face learning, engineering students, survey, COVID-19.

INTRODUCTION

The COVID-19 pandemic has severely impacted the global education sector. The learners and educators were forced to remain stranded in their houses (Crawford, et al., 2020). The conventional methods of the teaching-learning process became almost impossible to implement. To ensure learning continuity, educational institutions

around the world have been compelled to quickly switch from physical to virtual learning environments (Gupta, Kumar, & Tekchandani, 2023). To minimize the loss of learners, the academic community considers online learning or e-learning to be the most viable alternative solution under the given circumstances. Online learning and virtual classes are now the foundation of all educational institutions worldwide.

From a user's point of view, e-learning can be accessed using a laptop, a desktop, or a smartphone with suitable communication software and a reliable internet connection (Pal, Pramanik, & Choudhury, 2019). In response to the changing requirements, teachers could transform their teaching-learning process from conventional to virtual, with minimum training or even with no training, in some cases. The students' community, too, enthusiastically embraces the changing environment of the teaching-learning process.

E-learning or electronic learning, also called technology-enhanced learning (Wheeler, 2012), can be defined as acquiring knowledge with the help of electronic resources (Tamm, 2020). It has merits as well as demerits (Bezhovski & Poorani, 2016) (Alqudah, et al., 2020). It saves time and money, as it can be scheduled around the clock and attended from anywhere (Almahasees, Mohsen, & Amin, 2021). As physical infrastructures such as classrooms, desk benches, audio-video systems, etc., are not needed, many learners can be addressed simultaneously, provided that the communication software is the same. The live classes can be recorded and used as resource material for later use if made available online. On the other hand, one of the prerequisites is access to good internet connectivity, without which learning is a disaster. The availability of a computing device is a must, and it may sometimes burden parents in very low-income groups. Security is an issue; anyone with a joining link can access the class. The assessment of learning outcomes is very challenging because students' activities cannot be monitored until they are proctored. Hands-on learning is almost impossible to implement in a virtual classroom. Social isolation is one of the side effects of e-learning.

In this paper, we developed a questionnaire encompassing the above merits and demerits to assess the e-learning experience of engineering students in India's northeastern region (NER), during the COVID-19 pandemic. The northeast part of the country has geographically difficult terrain with a sparse population density. This region is relatively less developed than the rest of the country regarding infrastructure supporting online education. Although e-learning was relatively popular in other parts of the country compared to the region of study, COVID-19 has forced the entire world, including this region, to use the completely online mode. The study aims to assess the region's learners' preparedness and motivation to embrace the e-learning mode of study. This study aimed to discover the e-learning experiences and challenges faced by young learners of engineering courses from the region during the pandemic. In particular, we sought to find answers to the following research questions through this study.

The paper's motivation is to study and assess learners' IT skills, e-learning exposure before and after the pandemic, and experience with e-learning compared to conventional forms of learning with respect to multiple parameters. More specifically, this study addresses the following research questions to assess the experience and impact of e-learning gathered by engineering students in the NER of India during the COVID-19 pandemic. Through this study, the authors also assessed the preparedness of stakeholders to address future COVID-19-like situations.

RQ1: Has there been an improvement in IT skills among students since COVID-19?

RQ2: What is the e-learning exposure level of learners before the pandemic?

RQ3: How does student experience with e-learning compare to face-to-face learning in terms of improving overall knowledge, technical skills, and social competency?

RQ4: What is the interest level of students in attending theoretical and laboratorial classes in online and offline modes?

RQ5: How do the students assess the overall merits and challenges of e-learning?

RQ6: What major obstacles did students face while pursuing online learning during the COVID-19 pandemic?

RQ7: How was the overall experience of the learners regarding e-learning gathered during the pandemic?

RQ8: Are students excited to return to college for the physical mode of learning after COVID-19, leaving the habit of online education?

With respect to the above-mentioned objectives, the major contributions of this paper are as follows:

- This study is the first to involve NER in India to assess the e-learning experience of three levels of engineering students, diploma, degree, and postgraduate engineers, during the COVID-19 pandemic.
- The survey uses a large sample size to obtain more accurate and reliable results. Of the 1425 respondents, 601, 721, and 103 were diploma, degree, and postgraduate engineering students, respectively.
- A moderate-sized questionnaire, divided into six major groups, was used. It was especially focused on assessing the learning experience, enhancement in skills, merits and challenges of e-learning, suggestions to improve, etc.
- An in-depth analysis of the survey data is presented in pictorial and tabular form for better readability.
- The study's findings are presented in the final section, along with explicit recommendations to guide policymakers and educational administrators in making e-learning more effective.

LITERATURE SURVEY

Few studies assessing the e-learning experiences of engineering students worldwide during the COVID-19 pandemic have been reported in the literature. A study to identify Indian engineering students' perceptions of currently available e-learning platforms was reported by Thakker et al. (Thakker, Parab, & Kaisare, 2020). Although Google Meet was the most preferable among all other platforms, such as Zoom, Microsoft Teams, GoToMeeting, Zoho Meeting, GoToWebinar, and Adobe Connect, all these platforms lack integration with others, for instance, conducting proctored examinations. Including new features such as annotations, split screens, live polling, and the ability to rewind would have helped make the classes more interesting for teachers and students. The survey was completed by 364 engineering students from 49 colleges in India.

Bolu et al. (Bolu, et al., 2020) investigated the problems faced by engineering students in Nigeria during the COVID-19 pandemic and suggested cost-effective and sustainable solutions for virtual learning. Power cuts and poor internet connectivity have been identified as the major bottlenecks of e-learning in Nigeria. Most respondents preferred a combined solution to the problem of power and the internet cost-effectively. 5,166 participants across the country completed the survey. A group of researchers (Alexa, et al., 2022) from the "Gheorghe Asachi" Technical University of Iasi, Romania, conducted a two-phased survey among engineering students. The first phase, in which 134 students participated, focused on learning about the online learning system offered by the university as an emergency learning mechanism. In contrast, the second phase was categorically focused on identifying the major advantages and challenges faced by the learners after they became accustomed to e-learning for almost a year. The study revealed that many students already have the necessary skills and resources to attend e-learning classes. However, the motivation level and focus gradually decreased as learning progressed in virtual form over almost a year. The know-how to handle the virtual classes was not translated into acquiring new skills and knowledge as effectively as in the conventional mode.

Asgari et al. (Asgari, et al., 2021) carried out an observational study among 627 engineering students, including 110 faculty members, at California State University, Long Beach. Logical/technical issues, teaching/learning challenges, security and privacy concerns, and insufficient hands-on training opportunities were the few factors negatively influencing online engineering education during the COVID-19 pandemic. A similar study was performed by Alkhalil et al. (Alkhalil, et al., 2021) at Al-Zaytoonah University of Jordan with the participation of 470 engineering students. The study focused on identifying the types of devices/software used, the level of engagement with teachers and student satisfaction, internet speed issues, the performance of e-learning websites, and so on. Ilangarathna et al. (Ilangarathna, et al., 2022) highlighted the e-learning experiences of Sri Lankan undergraduate engineering students during three distinct phases of the COVID-19 pandemic. The study revealed a gradual increase in students' participation in e-learning as the learners' expertise in handling e-learning resources and devices increased with time. The study involving 367 participants in connection with e-learning during the pandemic phases identified several issues. Theseincluded internet reliability, the affordability of internet bandwidth, power outages, the nonavailability of devices due to sharing among family members, missing peers, and the absence of extracurricular activities. Alkabaa (Alkabaa, 2022) conducted a study to analyze and investigate engineering students' perceptions of an online learning platform, Blackboard, at a Saudi Arabian university during the

COVID-19 pandemic. The perceptions of male and female students toward e-learning are quite different. The study recommended improving the infrastructure for e-learning and imparting necessary training to the instructors to enhance the e-learning experience of engineering students. A study to assess the impact of the online learning experience on the emotions of undergraduate engineering students in two phases was conducted by Salvador et al. (Salvador, Torre, & Pena, 2021) with a sample size of 254 at the Polytechnic University of Catalonia, Spain. The participants were not satisfied with the quality of e-learning, which degraded their academic performance. On the emotional side, the students felt discouraged, confused, bored, and worried to a greater extent. As the pandemic continued, factors other than boredom improved as people became more accustomed to handling the situation.

METHODOLOGY

This study was conducted in the NER of India. The region consists of eight states, as shown in Figure 1, with a geographical area of 2,69,179 sq. km. and a total population of 45,590,864 as per the 2011 census (Ministry of Development of North Eastern Region, Govt. of India, 2024). The region is mostly hilly and sparsely populated, with an average population density of 169.37 people/sq. Km. against the country's national average of 382 per sq. km (National Informatics Centre, Govt. of India, 2020). Regarding internet and mobile connectivity, NER (approximately 35%) lags behind the country's average (approximately 42%). The e-learners from this part of the country face more serious internet connectivity issues than those in other regions (Karmakar, 2021). The NER consists of several National Institutes of Technology (NITs), central universities, state universities and institutions, self-financed universities and institutions, and government-run and self-financed polytechnic institutions offering master's, undergraduate, and diploma-level engineering programs with durations of 2, 4, and 3 years, respectively.
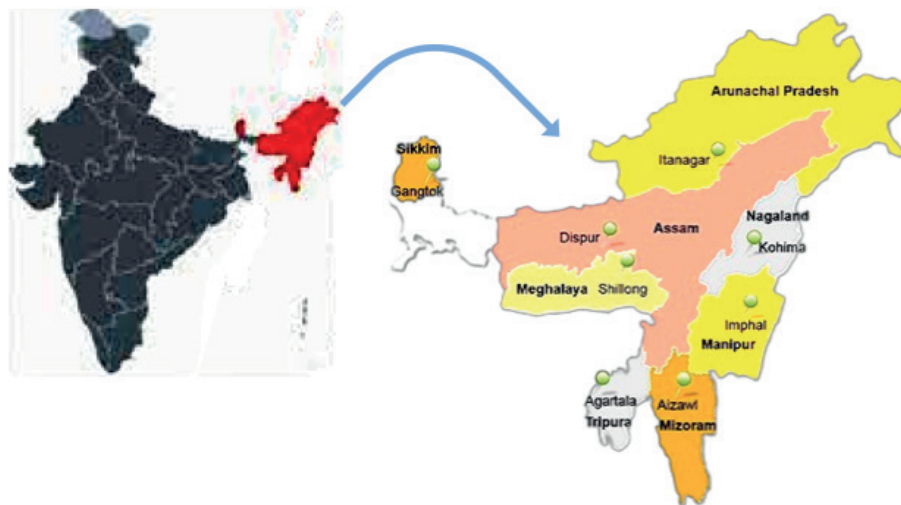
Figure 1. Location of the e-learning study region in India

Research Design

Research Method

For this study to investigate the multifaceted impact of e-learning on engineering education during the pandemic, we adopted the Mixed-Methods Research Design with a Concurrent Triangulation Design. The key reasons for this are:

- It incorporates both quantitative and qualitative data collection methods. By combining both data types, a more complete understanding of the impact of e-learning could be achieved, addressing both measurable trends and subjective experiences.

- Quantitative data: The survey includes structured questions such as multiple-choice and Likert scale, which were analyzed using descriptive and inferential statistics. This aspect aligns with the quantitative research design.
- Qualitative data: Open-ended questions are included to gather detailed insights and personal experiences, which were analyzed using thematic analysis. This part corresponds to the qualitative research design.
- The quantitative and qualitative data were collected concurrently rather than sequentially.
- The goal was to obtain different but complementary data on the same topic to understand better the research problem (impact of e-learning) rather than one method being dependent on the other.
- The results from both methods were analyzed separately, but results were merged to draw conclusions, as is done in a concurrent triangulation design to validate and corroborate findings, providing a comprehensive perspective on the research problem.

Population and Sampling

To finalize the selection of the survey respondents, the following factors were considered:

Target population: Engineering students in the Northeastern region of India.

Sampling technique: Stratified random sampling to ensure representation from various levels of engineering courses and also various engineering colleges across different states in the Northeastern region.

Sample size: Approximately 2000 students were approached to ensure statistical significance and diversity in responses.

Data Collection Methods

To conduct the survey and collect the responses from the respondents, the following approach was exercised:

Online questionnaire: Given the ongoing relevance of digital methods, an online questionnaire was administered using Google Forms. A deadline of two weeks was set for responses.

Questionnaire design: To find the answers to the RQs, we framed a suitable questionnaire, as mentioned in Section 1, that spanned eight sections.

- Section A: Demographic information (age, gender, year of study, institution).
- Section B: E-learning exposure and IT skills improvement (related to RQ1 and RQ2).
- Section C: Comparison of learning modes (related to RQ3).
- Section D: Interest levels in various learning modes (related to RQ4).
- Section E: Merits and challenges of e-learning (related to RQ5).
- Section F: Obstacles faced during online learning (related to RQ6).
- Section G: Overall e-learning experience (related to RQ7).
- Section H: Preference for returning to physical learning (related to RQ8).

Question types: Mix of multiple-choice questions, Likert scale questions, and open-ended questions to gather both quantitative and qualitative data.

Data Analysis Methods

The responses were stored in a spreadsheet (MS Excel) and plotted using suitable graphs for visualization, analysis, and inference.

Ethical Considerations

We ensured that the ethical factors generally involved in a survey study involving human participants were followed during this survey.

Informed consent: Participants were informed about the study's purpose and obtained consent before participation.

Confidentiality: The confidentiality of the participants' information and responses was ensured.

Voluntary participation: Participation in the survey was voluntary, and participants could withdraw at any time.

Timeline

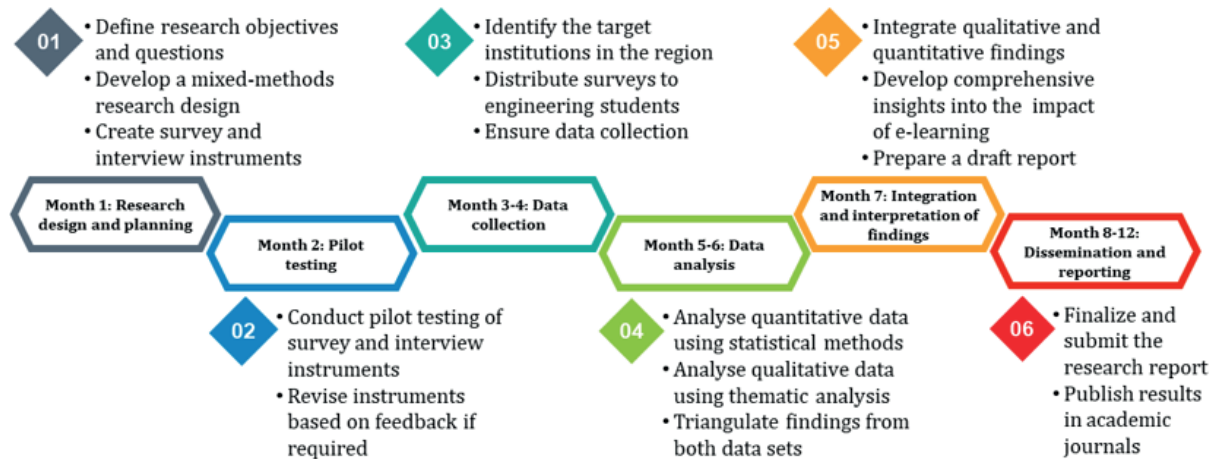We planned to complete the study in 12 months**.** The timeline of various stages is detailed in Figure 2.

Figure 2. Graphical representation of timeline and steps involved in the study

Data Collection Tool and Distribution Mechanism

A questionnaire was designed using Google Forms and was circulated through e-mails and WhatsApp groups among the target group of students with the help of institutional authorities and faculty members in March 2022. The questionnaire included both closed- and open-ended questions based on an extensive literature survey. By this time, the students had gone through three waves of the COVID-19 pandemic, and the e-learning experience they shared can be considered the consolidated views of the learners residing in India's NER. A total of 1425 students participated in the survey, with internal breaks of 42.2%, 50.6%, and 7.2% from diplomas, degrees, and postgraduate engineers, respectively.

Survey Questionnaire

To find the answers to the research questions mentioned in Section 1, we framed a number of suitable and targeted questions for the participants. The questionnaire comprised six general questions and 17 research questions, which can be grouped as presented in Table 1. To determine the internal consistency of the survey questionnaire, Cronbach's alpha (Tavakol M, 2011) was calculated. For this purpose, feedback from 20 students was collected. The eight questions for which responses were collected at the point of scale five were used to calculate Cronbach's alpha by the following equation:

$$\alpha = \frac{k}{k-1}\left(1 - \frac{V_i}{V_t}\right) \tag{1}$$

where k = the number of questions and $\frac{\sum V_i}{V_t}$ gives us information on how much of the total variance is attributed to the sum of individual variances.

After calculation, the Cronbach's alpha was found to be 0.84.

Table 1. Questionnaire description for this study

Group title	Questions	Scale
General information	Study level, branch and year of study, age, gender, institute name (optional)	Mixed type (multiple choice, textual type and numerical type)
Skill assessment	IT skills before and after COVID-19 pandemic	4-point
	E-learning experience before the pandemic	2-point
Comparison between e-learning and face-to-face learning	Effectiveness of e-learning in comparison with face-to-face learning to enhance	5-point
	Overall knowledge	
	Technical skill	
	Social competency	
	The choice between online and physical mode in attending the theoretical subjects and the practical subjects	2-point
Merits and challenges of e-learning	Advantages and disadvantages of e-learning	Multiple answers with seven choices (including 'others')
Learner's experience	Major obstacles experienced in online education during pandemic	Multiple answers with six choices (including 'others')
	Overall e-learning experience during COVID-19 pandemic	5-point
	Excitement to attend physical classes after the pandemic is over	5-point
Suggestions	Suggestions to improve the e-learning (optional)	Textual type

RESULTS ANALYSIS

This section provides an in-depth analysis of the data received from the online survey conducted among the engineering students of the NER of India studying in various branches of engineering/technology programs such as civil, mechanical, electrical, computer science, electronics, information technology, instrumentation, automobile, medical lab, textile, VLSI, thermal, data science, etc. Pictorial representations in the form of bar charts, pie charts, etc., have been presented to provide a quick understanding for the readers.

Participant Profile Analysis

Students from three levels of engineering courses participated in the survey. Diploma engineering is a 3-year course divided into six semesters, and students, after passing class 10 (16 years and above), can take admission to this course. Similarly, the degree of engineering is a 4-year course with eight semesters, and students can take admission after passing class 12 (18 years and above). After completing a degree in engineering courses (22 years and above), students can undergo 2 years of postgraduate engineering with four semesters. The survey was administered to students every year of study. A summary of the participants' profiles is presented in Figure 3. Figure 3(a) shows the level-wise average age and the standard deviation of the participants, and Figure 3(b) shows the gender-wise break-up of participants at each level of engineering courses.
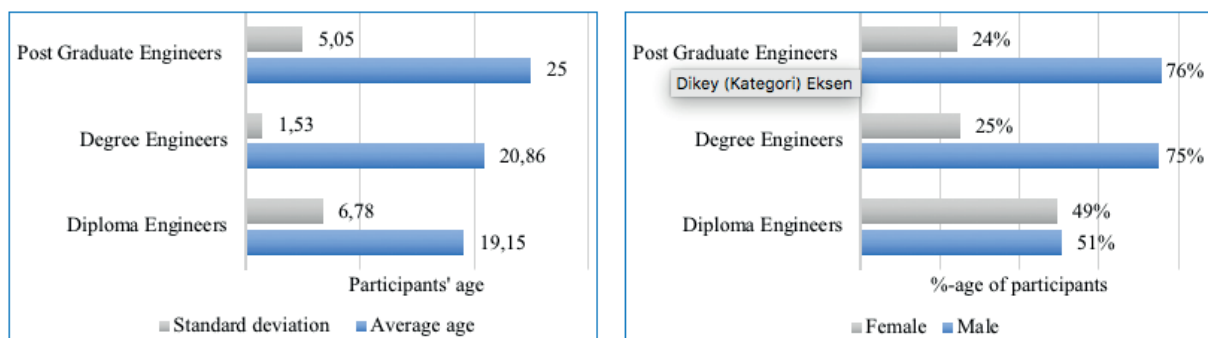

Figure 3. a) Average age and standard deviation of participants and b) Gender-wise break-up of participants

Skill Assessment

The study asked self-assessment questions on a scale ranging from excellent to poor among the participants related to enhancing their IT skills by attending online classes during the pandemic. In addition, a query related to assessing exposure to e-learning before the pandemic was also asked. The responses are pictorially presented in Figure 4 and Figure 5.

IT Skills of Participants Before and After the COVID-19

The study revealed a marginal improvement in the IT skills of the participants after they attended online classes during the pandemic period, as shown in Figure 4. Such an outcome may be expected, as the survey was conducted among engineering students, who usually have better IT skills than students studying in other disciplines.

E-learning Experience Before and After the Pandemic

The survey produced very interesting and positive results, as 44.5% of the participants in NER India had already participated in e-learning practices even before the pandemic, as shown in Figure 5. There have been efforts to popularize Swayam (https://swayam.gov.in/) courses, the Indian initiative of MOOC courses, to instill self-learning and lifelong learning. In addition, there are various opportunities for enrolling and using e-learning platforms, such as spoken tutorials, e-Yantra labs, virtual labs, Swayam Prabha, and national digital libraries, under the National Mission on Education through Information and Communication Technology (NMEICT) project of the Govt. of India have been popularized among engineering students.
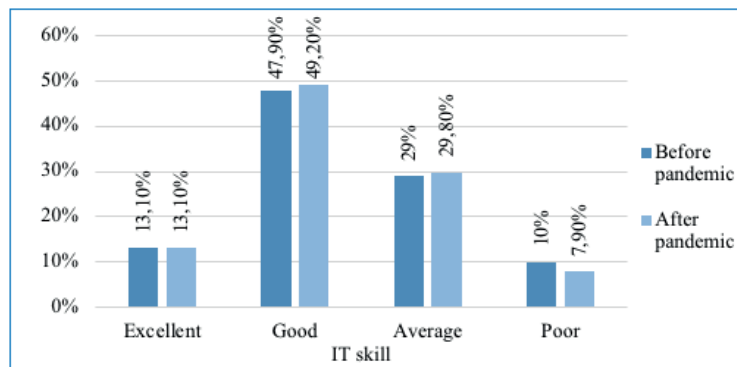
Figure 4. Levels of IT skills of participants before and after the pandemic
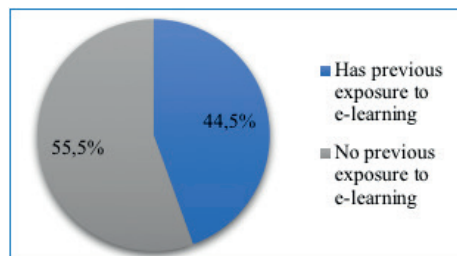
Figure 5. Number of participants with and without previous e-learning exposure

Comparison between e-Learning and Face-to-Face Learning

This study aimed to assess students' e-learning experience in comparison with face-to-face learning. Accordingly, survey questions were used to rate the effectiveness of e-learning and face-to-face learning in terms of overall knowledge, technical skills, and social competency on a five-point scale, and their responses are analyzed in the following subsections. In addition, participants' choices between online and physical modes of attending to theoretical and practical subjects were also analyzed.

Effectiveness of e-Learning and Face-to-Face Learning in Terms of Increasing Overall Knowledge, Technical Skills, and Social Competency

The participants were asked to rate the effectiveness of e-learning and face-to-face learning on a 5-point scale where 1 indicates least effective and 5 indicates highly effective. The rating statistics are shown in Figure 6. Figure 7 shows the percentage of each rating received against overall knowledge, technical skills, and social competency for e-learning and face-to-face learning, whereas Figure 8 shows the average ratings of the effectiveness of e-learning and face-to-face learning for each category.

A greater percentage of students favored face-to-face learning for all three cases, whereas a significant percentage of learners believe that a hybrid mode of learning (online and offline together) can enhance overall knowledge, technical skills, and social competency.
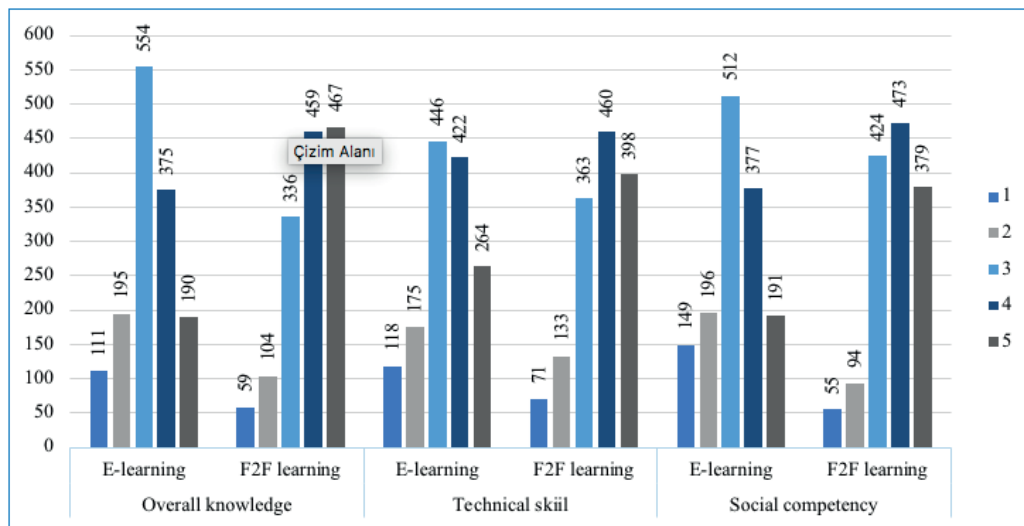
Figure 6. Participants' ratings of the effectiveness of e-learning and face-to-face learning for enhancing overall knowledge, technical skills and social competency
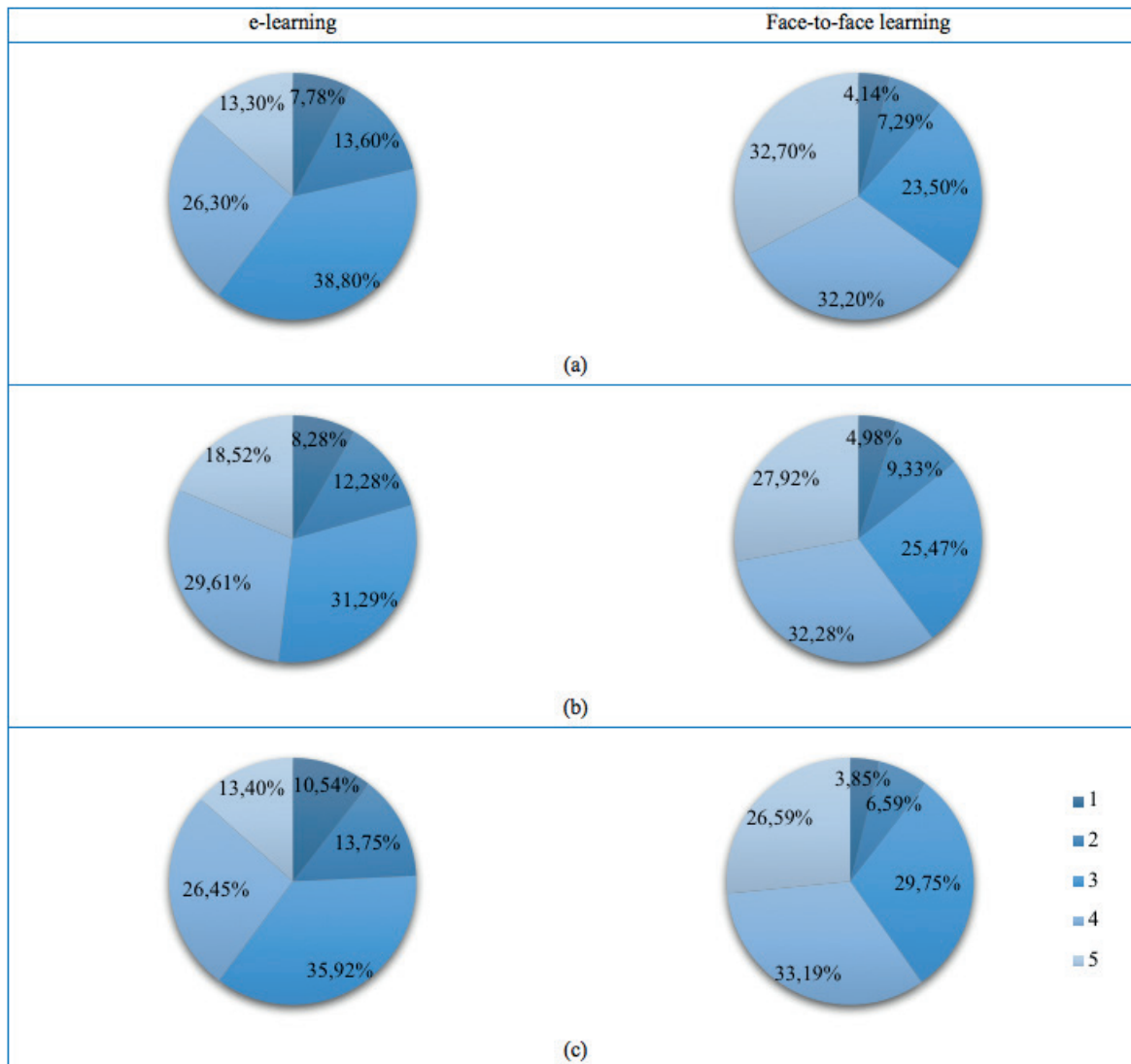
Figure 7. Participants' responses in enhancing a) overall knowledge, b) technical skills and c) social competencies through e-learning and face-to-face learning methods
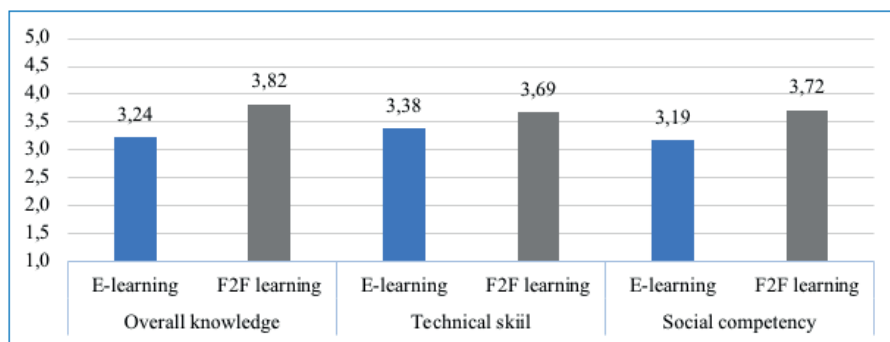

Figure 8. The weighted average of participants' endorsement of the effectiveness of e-learning and face-to-face learning on a 1 to 5 scale

Students' Interest in Theory and Laboratory Classes in Online and Offline Modes

We surveyed the students' interest in attending online or face-to-face classes for both theory and practical papers. 76.4% of students prefer the face-to-face learning mode for theory classes, whereas 90.3% prefer laboratory classes in the traditional offline mode for practical classes, as shown in Figure 9.

Merits and Challenges of e-Learning

Due to technological advancements, e-learning is gaining popularity among educators and learners. It offers many advantages but also has several disadvantages. This section analyses learners' opinions about the merits and demerits of e-learning against a few pre-established points collected from the available literature. The questionnaire provided the opportunity to agree with more than one option, and participants could also specify their points in the "others" category.
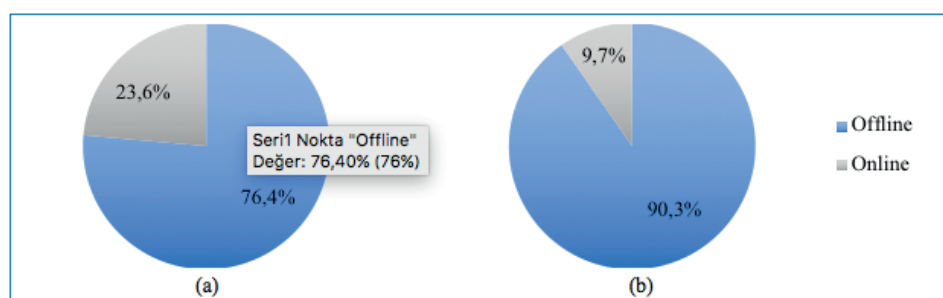
Figure 9. Participants' interest in attending (a) theoretical subjects and (b) practical subjects in the online and offline modes

Advantages of e-Learning

A list of six advantages of e-learning was offered for participant selection. The results of the students' opinions are presented in Figure 10, wherein "access to online material", "learning at your own pace", and "ability to stay at home" are the greatest advantages of e-learning. Some prominent opinions received in the "others" category are listed in Table 2.
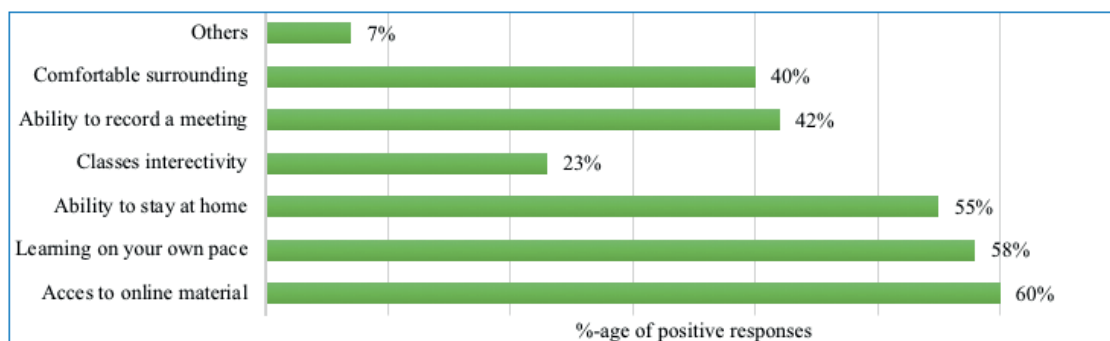
Figure 10. Participants' responses about the advantages of e-learning

Table 2. Students' opinions about the advantages and disadvantages of e-learning in the "others" category

e-learning advantages	e-learning disadvantages
More time is available to the learner for self-study and self-development	Mantle fatigue and eye-related health issues arose out of long-duration online classes
Provides safety during the COVID-19 pandemic	Lack of motivation to attend classes due to lack of an engaging environment
Scope to learn about the new teaching-learning method	Understanding classes are relatively difficult
Opportunity to access quality education without loss of time and money	Improper scheduling of classes

Disadvantages of e-Learning

As in the previous subsection, six pre-established drawbacks and the "other" category were selected by the participants in connection with the disadvantages of e-learning, as shown in Figure 11. "Technical problems" have been identified as the single major bottleneck in e-learning during the pandemic. Among others, "reduced interaction with teachers" and "lack of interaction with other learners" were considered significant drawbacks of e-learning. In the "others" category, learners identified a few issues beyond the prescribed disadvantages, as listed in Table 2.
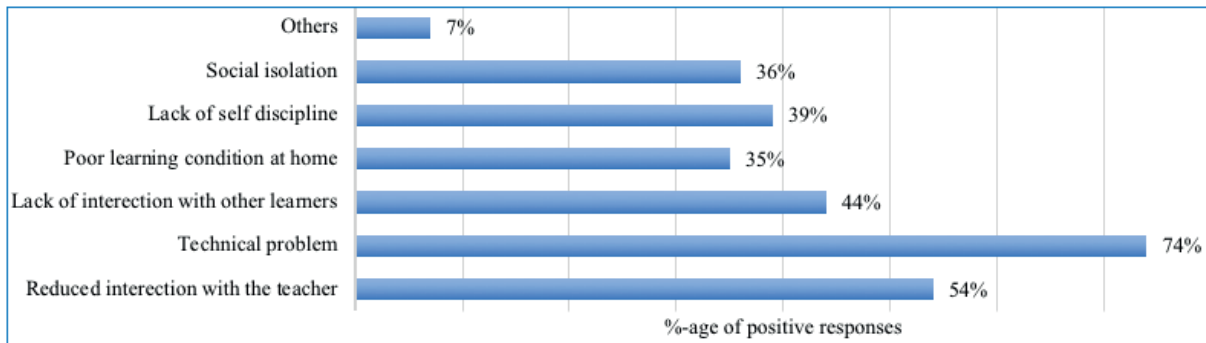
Figure 11. Participants' responses about the disadvantages of e-learning

Learners' Experience during the COVID-19

To identify the learners' experience during the COVID-19 pandemic, three different types of queries were presented to the aspiring engineers: "major obstacles experienced in online education during a pandemic," "overall e-learning experience during the COVID-19 pandemic," and "excitement to attend physical classes after the pandemic is over." The responses received are analyzed at length and presented in the following subsections.

Major Obstacles in Online Education Faced by Students during the COVID-19

This study aimed to determine the major obstacles students faced in the e-learning process during the pandemic using a multiple-answer query with five predetermined options and "others". All such options, along with participants' opinions, are depicted in Figure 12. "Unreliable internet connection" and "high cost of data" have been identified as the major hindrances to online education in this part of the world. The students highlighted issues such as the "requirement of proper training for teachers to handle online classes" and "difficulty in understanding some of the e-content" in the "others" category.
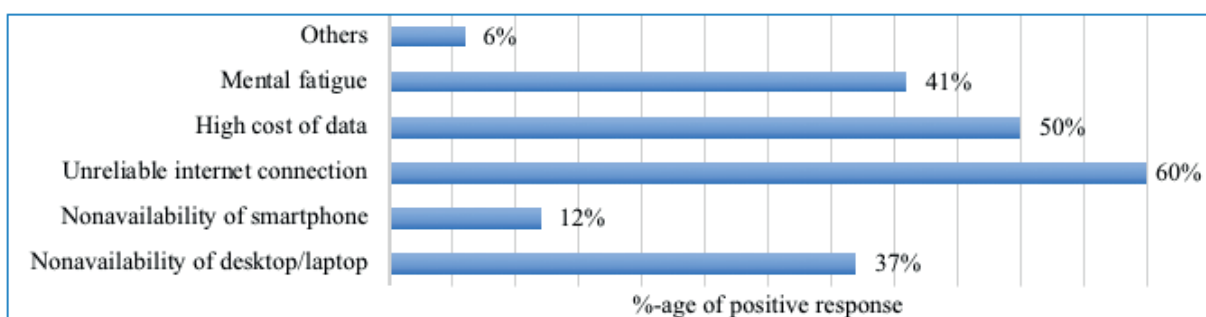

Figure 12. Participants' responses about obstacles to online education

Overall e-Learning Experience during the COVID-19 Pandemic

Another query to gather data related to the overall learning experience of budding engineers using a five-point scale (where 1 is extremely ineffective and 5 is extremely effective) has been presented in Google. Figure 13 shows that 58% of the students enjoyed the online classes, but 42% were not happy with such classes.
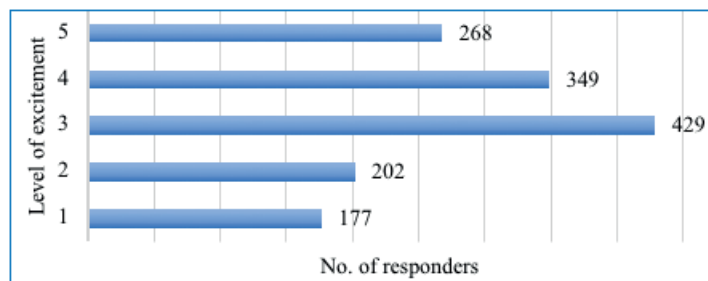

Figure 13. Participants' opinions about the overall online learning experience during the pandemic

Students' Excitement of College Reopening after the COVID-19 Pandemic

We assessed the participants' excitement to join face-to-face classes after the pandemic using a five-point scale (1 - not excited and 5 - extremely excited). The results are shown in Figure 14, which suggests that 77% of students are excited to attend classes in physical mode. On the other hand, 23% of the participants were not excited to attend their classes before the pandemic broke out. This may be due to insecurity about COVID-19 infection, dissatisfaction with the physical mode of education, or other similar reasons.
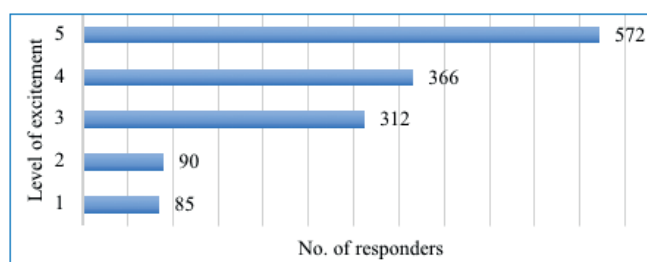

Figure 14. Summary of learners' excitement about the reopening of colleges

Suggestions

One of the important components of the survey is the ability to provide suggestions (optional) by e-learners, who can write with an open mind about their experiences and concerns. The suggestions and recommendations are classified into the following seven categories and are presented in Table 3.

245

Table 3. Category-wise suggestions to improve e-learning adoption and experience

Suggestion category	Summary of suggestions
Device related	• Teachers to use improved quality hardware for better clarity.
	• Financial assistance for procuring the laptops, smartphones, tablets, etc., is suggested.
Internet service and data pricing	• Consistency in internet service is very important—service to be improved. Rural areas' internet connectivity needs improvement.
	• Financial support for purchasing internet data plans for students with weaker financial status is recommended.
	• A cheap data plan for students is suggested.
Teachers' skill	• Teachers' skills in online teaching need to be improved.
	• The use of online writing boards is to enhance and improve students' learning outcomes.
	• Enhance interaction with students and support academically weaker students more.
E-content	• Proper design and judicious use of e-content are to be made for the classes.
	• Only using YouTube content is not satisfactory.
	• Sharing prerecorded videos followed by interactive sessions to clear doubts has been preferred.
	• E-content to be shared with students immediately after the class.
Class timing, duration, and class size	• A proper class schedule rather than casual timing is suggested.
	• A suitable gap between consecutive classes is desired.
	• Class duration should be shorter, and innovation in the class delivery mechanism is recommended.
	• Smaller class sizes are preferred for better interaction opportunities.
Software/app	• The software/Apps used should be bandwidth efficient.
	• Learning management system-based software/apps are preferred.
	• Other options to deliver e-resources are to be explored.
Others	• A more effective learning assessment mechanism is expected.
	• Provide an opportunity to work in a team.
	• The scope is to be provided for other social activities, too.
	• Hands-on learning is not sufficient.
	• E-learning is to be improved for mathematical subjects as well.

RECOMMENDATIONS AND CONCLUSION

The unprecedented challenge that has deeply affected the education system during the COVID-19 pandemic worldwide must be addressed and analyzed rigorously. Although the challenge of this pandemic has had some common impact worldwide, it may vary based on regional and geographical differences. This study aimed to assess, identify, and highlight the challenges faced by technical/engineering students in the NER of India in terms of e-learning during the pandemic. However, during a pandemic of this scale, learning can only be possible through a virtual mode; considering the future perspective, a blended mode of education is under consideration worldwide.

Through the study, the following key findings emerged:

- Firstly, there has been a marginal improvement in IT skills among students since the onset of COVID-19. A decent number of learners, including engineering students, had an opportunity to attend online classes before the pandemic.

- Secondly, almost half of the respondents were exposed to e-learning platforms and tools before the pandemic, but it was new exposure for the rest of the participants.

- Regarding the comparison between e-learning and face-to-face learning, the study revealed that students perceived face-to-face learning to be effective in improving overall knowledge, technical skills, and social competency. However, the specific benefits and challenges varied among students.

- The interest level of students in attending theoretical and lab classes differed between online and offline modes. Further investigation is needed to understand the factors influencing these preferences.
- The overall assessment of e-learning by students was mixed, with both merits and challenges identified. The study highlighted the need for continuous improvement in online instructional design, engagement strategies, and technical support to enhance the learning experience.
- Major obstacles faced by students during online learning included challenges related to access to technology, internet connectivity, and the lack of face-to-face interaction with peers and instructors.
- Overall, the learners' experience with e-learning during the pandemic was varied. While some students adapted well to the online mode of education, others faced difficulties adjusting to the new learning environment. The study emphasized the importance of considering individual needs and providing adequate support to ensure a positive learning experience.
- Lastly, the survey indicated that students had mixed feelings about returning to physical modes of learning after the pandemic. While some expressed excitement about the prospect of resuming face-to-face education, others had become accustomed to online learning and may not readily abandon the habit.

This study identified many areas to be improved, mostly in the online education system, along with a few issues in the offline education systems and in the geographical domain of the survey. This has shown that the online education system promulgated during the last pandemic could not impart enough technical skills to the students. The issue of reliable internet connectivity and the high cost of data are the greatest barriers to the online mode of education in this part of India. Efforts are to be made to provide reliable internet connectivity, low-cost internet data packages, and financial support for the purchase of laptops, tablets, smartphones, etc., at least for students belonging to economically backward classes, if not for all. Special attention is desired for the learners from rural areas, who find it very difficult to attend virtual classes due to poor internet coverage. All stakeholders should take the virtual learning mode more seriously, considering any future pandemic such as COVID-19. Educators/teachers should also be trained to make online teaching more effective. Learners have emphasized the need for carefully designed and effective e-content to make virtual classes more effective. The institution's management must develop an appropriate plan to handle the situation more effectively. The integration of an online platform with a learning management system is expected to enhance the performance of the e-learning system. Additionally, online platforms should be designed especially for effective practical classes. A common approach among educators/teachers would minimize the uncertainty and confusion among the students. A well-designed scientific approach to online education is required to help students reduce mental fatigue from long-duration online classes and address students' psychological issues. Although e-learning classes can be scheduled clockwise, this study recommends adopting a well-defined schedule to motivate learners. Efforts are also to be made to make the classes more engaging by providing group work or otherwise to break the monotony. On the other hand, this study also suggested that e-learning is already a popular choice among participants because learning can occur in a comfortable home environment and provides access to online material, and the learning pace may vary as session recordings are feasible. Learning during a pandemic by maintaining social distance has been identified as one of the most important advantages of e-learning.

Although, as per the study, participants showed more interest in face-to-face learning than in online learning, a few concerns are also raised by the study, indicating that some improvements are required in the conventional teaching-learning process. Our approach to data analysis has shown an agreement of 41%, 36.2%, and 42.2% in increasing overall knowledge, technical skills, and social competencies, respectively, in favour of the effectiveness of the conventional face-to-face learning process, which does not give a clear mandate toward its acceptability. This suggests that improvement is also required in face-to-face learning, which would be more engaging and could provide experiential learning, at least for engineering education in the focused region.

This study also indicates that face-to-face learning and the virtual mode of education complement each other rather than being exclusive in imparting quality technical education. This aligns with the recommendations made by other researchers in the literature.

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