Assessing Learners' Smartness Level in CMC: Teachers' Perspectives on AI-Enhanced Language Learning

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ABSTRACT

The Covid-19 pandemic period has formulated learners' familiarity and adaptation to computer-mediated communication in higher education as an alternative to traditional face-to-face classrooms, which also transforms the attitudes of stakeholders to acknowledge the significance of computer-mediated communication (CMC). The use of computers and technological applications has been encouraged for decades, but centre of the utilisation is on the autonomous learners to actively adopt those technologies in language learning. Smartness levels of learners demonstrate learners' ability to adopt and adapt to the technological devices in the smart learning environment (Uskov et al., 2015). However, the assessment of learners' smartness level of language learning to explore the degree of mastery among learners in CMC of language classrooms has not been much explored. The teachers' perceptions towards different levels of smartness among learners in AI-mediated world have been still a current gap. This chapter proposal attempts to explore teachers' perceptions towards assessing English-majored learners' smartness level in a smart learning environment (SLE) and their remedies to optimise the effectiveness of CMC utilisation in a language classroom. This study adopts Uskov's framework of Smartness Education (2015) as the holistic scale for assessment.

Keywords: Smartness level, CMC, Communication, Technology, Smart learning

Introduction

The context of globalization and innovation in language education has led to a transformation in higher education, especially in integrating technology into language learning. Because of this, the move from face-to-face interactions to online or hybrid models has made it necessary to use computer-mediated communication platforms and other tech tools to make language learning more effective.

Several studies have been conducted to integrate or apply technological tools. These tools have proven their effectiveness in fostering learners' academic performance, such as Padlet, Elsa

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Speak, and CapCut in classroom practices (Gacs et al., 2020; Rusmiyanto et al., 2023). However, the application of technological devices has mostly come from the teachers' sides, where teachers integrate technological options into the classroom to optimize their teaching effectiveness. This results in learners having passive access to these tools, rather than actively controlling them. Consequently, the learner's capacity to optimize these tools in their learning practices has not been investigated from multiple perspectives.

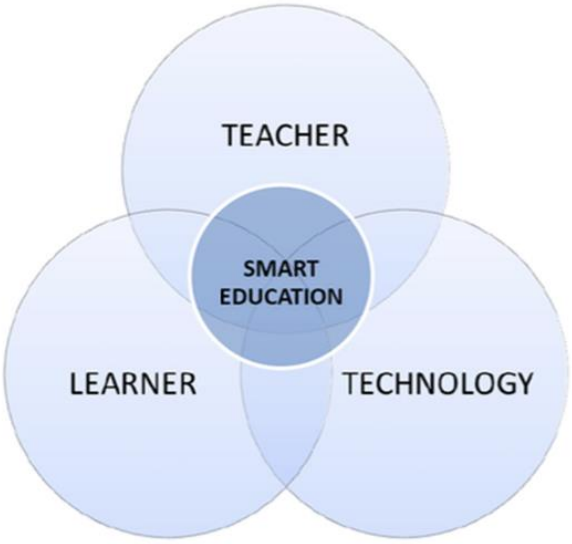
Thus, this study attempts to explore teachers' perspectives on assessing learners' smartness levels in a smart learning environment to identify their levels of mastery of technological devices in classroom activities. This study uses Uskov et al. (2015)'s Smart Education Framework, which defines smartness levels as a spectrum of mastering the use of technology.

Literature review

Background to Technology in Language Education

Technology has been integrated into language education for several decades, reducing the effort and pressure on teachers in designing and conducting classroom activities while also fostering student motivation and participation (Fig.1). Teachers can utilize various tools to enhance different aspects of teaching, such as Miro or Quizlet for lesson warm-ups, Padlet and Google Docs for group interaction, Canvas for slide design, and Kahoot or Quizizz for assessments.

Figure 1.
Zhu et al.'s smart education framework (Zhu et al., 2016)



The use of technology aligns with the ongoing innovation and transformation in education, shifting from computer-assisted language learning to more interactive, online, and accessible formats that enhance engagement and personalization (Huang et al., 2019; Kohnke et al., 2023). Technology allows teachers to adapt instruction to individual learners' needs and provide instant feedback, which can trigger students' curiosity and improve engagement (Temdee, 2020; Zhu et al., 2016).

Following the COVID-19 pandemic, language education has become more familiar with the integration of technology(Pellegrini et al., 2020). Before the pandemic, there were debates questioning the effectiveness of technology in education, with limited recognition of its

benefits. However, post-pandemic, online learning and digital interaction have been widely accepted as viable alternatives in education. Technology has helped reduce geographical barriers and strengthen the foundation for remote learning (Buehl, 2023). Various digital tools have been implemented and proven effective in supporting both teachers and students in optimizing learning interactions. Technology enables interactive, adaptive, and learner-centered educational experiences, as many digital tools are designed to accommodate learners' personal needs and diverse learning styles.

The Significance of Smart Learning in Language Education

Technology plays a pivotal role in language education, particularly in fostering learner autonomy. When learners take center stage in the classroom and are given the responsibility to direct their personal learning experiences, they become more engaged in the learning process (Wang et al., 2021). Research has indicated that higher levels of autonomy correlate with increased engagement (Gambo & Shakir, 2021; Gao et al., 2019). Therefore, when learners are exposed to technology, their sense of curiosity and motivation is enhanced, fostering greater independence in the digital era. By recognizing their role in learning and actively participating in the process, students develop a deeper connection to their studies.

Digital technology allows learners to explore new ideas beyond the boundaries of the classroom, as teachers alone cannot provide all the information or knowledge students need (Treem et al., 2020). Through multimodal approaches, technology enables learners to access diverse resources, expanding their learning experiences beyond traditional classroom settings (Huh & Lee, 2020). Additionally, technology fosters engagement by incorporating various interactive and immersive tools that simulate real-world contexts. Unlike traditional classrooms, which offer limited exposure to authentic language use and cultural interactions, smart learning environments provide learners with real-world simulations and interactive materials, helping them visualize and enhance language acquisition.

Theoretical Framework of Assessing Smartness Levels in Education

The concepts of smartness levels refer to learners' ability to access, adapt, and organise educational technology to innovate the learning process. It is beyond the normal competency to just use the channels. This construct demonstrates more active roles of learners to take control of the learning tools. The scale illustrates the continuum from basing tool recognition to high levels of integration.

Table 1 demonstrates the smartness levels of the smart learning environment, adapted from Uskov's Framework (2015). The framework consists of six levels, illustrating learners' ability to utilize online learning tools to optimize their learning experience, progressing from a lower to a higher level. This table also shows the value of the assessment. This serves as a holistic scale to understand learners' behavior and capacity to recognize the use of technological instruments, identify and apply their logical thinking, and leverage their learning performance. It also focuses on higher-order skills that enable learners to develop logical thinking and reasoning, allowing them to enhance the effectiveness of their learning experience.

Table 1.
Smartness levels of Smart Learning Environment (Adapted from Uskov et al., 2015)

No.	Smartness Level	Description
1	Adapt	Ability to alter one's appearance or behaviour to better adapt to or survive in a given environment.
2	Sense	Ability to recognise, identify, comprehend, and/or become conscious of a phenomenon, event, impact, object, etc.
3	Infer	Ability to draw logical conclusions from observations, data, rules, assumptions, logical reasoning, and processed and raw data.
4	Learn	Ability to acquire new or modify existing knowledge, experience, or behavior to improve performance, effectiveness, and skills.
5	Anticipate	Ability to use reasoning or thought to forecast future events or what should be done next.
6	Self-organize	Ability of a system to purposefully (non-randomly) change its internal structure (components), self-generate, and self-sustain without the help of an outside agent or entity under the right circumstances.

Previous studies

Researchers from all around the world have conducted several previous studies to investigate the effectiveness of online learning in language acquisition.

Effectiveness of Smart Learning Environment

The study conducted at Zhejiang Open University by Shu & Gu (2023) focused on enhancing learner-expected learning outcomes through the application of a smart education model enabled by the Edu-Metaverse. The research attempted to explore the integration of the Edu-Metaverse in teaching college English and sought to measure the effectiveness of this new application compared to traditional methods. The study applied a mixed-methods approach, incorporating both qualitative and quantitative methods, involving 60 students at the university to compare the experimental model and the traditional model. The results indicated that the experimental group significantly outperformed the control group in all assessments, particularly oral English and writing, demonstrating the effectiveness of the smart education model in fostering learner performance and interaction through collaborative tools.

Another empirical study conducted by Nguyen & Nguyen (2019) focuses on the integration of technology in education, particularly in the e-learning environment, to foster learners' intercultural communication competence. This study investigates the effects of employing technology in teaching culture among tertiary-level English students, as well as exploring teachers' and students' perceptions of using IT for cultural instruction in Vietnam. The findings reveal that the implementation of e-learning initiatives significantly enhances learner engagement and knowledge retention regarding cultural topics. The study also highlights the importance of training educators in using technology effectively to maximize the benefits of

the classroom environment. Additionally, it recommends IT-based pedagogical strategies for teaching culture. However, it also identifies classroom barriers, including time constraints and students' hesitation to collaborate and interact in classroom activities.

Teachers' and Students' Perceptions of AI/CMC Tools

In a study conducted in 2023 by Shu & Gu., researchers attempted to explore the preferences of teachers and students regarding smart learning environments in higher education at a central university in China. This case study aimed to provide insights from teachers and students to support decision-makers and educational managers in fostering educational experiences and outcomes. This empirical study involved a large sample of 1,937 undergraduate students and 807 teachers, using questionnaires designed based on the ecological model of smart learning environments. The results showed that both teachers and students had positive attitudes toward the use of smart education and smart learning. Students preferred physical learning spaces and teacher interactions, while teachers valued the presence of technology as a means to reduce workload and alleviate pressure. Both groups of participants demonstrated promising perspectives on the role of technology in fostering language education.

In a study conducted by Nguyen et al. (2024), the researchers examined the factors that influence the decision to adopt e-learning over traditional methods in the context of Vietnam. The study aimed to explore the motivation behind using e-learning and identify mechanisms through which e-learning can enhance the quality and accessibility of online education in Vietnam. The findings revealed that three core factors, including quality content, service delivery, and effective support are key determinants influencing the choice of e-learning. Learners are more satisfied when these elements are fulfilled and adequately supported, ensuring greater engagement with online education

Research Questions

1. What are teachers' perspectives on assessing learners' smartness levels in a smart learning environment?

Methods

Pedagogical Setting & Participants

The participants of this study are university lecturers, who were invited to participate in an online survey to provide their perspectives on the proposed assessment framework. The initial data were 157 collected from the survey; 21 items were removed as outliers and the total appropriate number for this study was 136. The participants are currently lecturers at universities in the south of Vietnam.

Table 2.
Demographic information of the participants

		N =136	
		F	%
Gender	Male		41.8
	Female		58.2
Age	Under 30		35.6
	30 - 90		25.3
	40 - 49		39.1
Highest qualification	Master's Degree		96.00
	Doctorate		4.0
Years of teaching experience in Higher Education	Less than 5 years		31.6
	5 - 9 years		12.0
	10 - 14 years		22.2
	15 years or more		34.2
Institution type	Public University		61.3
	Private University		38.7
Have taught online or hybrid courses before	Yes, frequently		30.7
	Yes, occasionally		68.9

Design of the Study

This study applies a quantitative research method to explore teachers' perspectives on assessing learners' smartness levels based on Framework of Assessing Learners' Smartness Levels by Uskov et al. (2015). The use of quantitative methods enables the researcher to gather general attitudes and perspectives from participants regarding this framework, following the approach suggested by Creswell & Creswell (2018) for examining new concepts in education.

Instrument

A questionnaire was used as the primary instrument in this study. The questionnaire was designed based on Framework of Assessing Learners' Smartness Levels (Uskov et al., 2015) and adapted to align with its key components. The scale was integrated through the question items in the questionnaires, which shape the responses. Groupings of questions were based on the levels of the scale with the integrations of CMC recognition.

The questionnaire consists of two main sections:

1. Demographic Information – Collects general background details about the participants.
2. Teachers' Perspectives – Gathers participants' views on the framework for assessing learners' smartness levels, structured according to the five levels of smart learning environments.

The reliability of the questionnaire was examined to reach 0.823 in Cronbach's Alpha, which demonstrated the applicability of the questionnaire.

Data collection & analysis

Data were collected through an online survey, where university lecturers were invited to complete the questionnaire. The collected responses were analyzed using SPSS 27.01.10.,

applying statistical methods to identify patterns, comparing variables, and interpret the general trends in teachers' perspectives on assessing smart learning environments.

Results

Recognizing and Accessing AI and CMC Tools

Table 3.
Students' Awareness and Access to AI and CMC Tools

No.	Item	Mean (M)	Standard Deviation (SD)
1	My students are familiar with basic CMC tools (e.g., Moodle, Zoom, Microsoft Teams).	3.96	0.902
2	My students are aware of AI-powered learning tools (e.g., ChatGPT, Grammarly, Elsa Speak).	4.30	0.692
3	I can easily identify students who struggle with accessing or navigating digital learning platforms.	3.54	0.677
4	Some students lack awareness of AI-driven learning strategies and only use traditional online resources.	3.67	1.004
5	I believe students should receive formal training on how to recognize and use AI-powered tools.	4.36	0.858

Table 3 describes teachers' perspective towards students' awareness of AI tools. Teachers agreed that students are familiar with basic CMC tools (M = 3.96, SD = 0.902) and AI-powered learning tools (M = 4.30, SD = 0.692). However, some teachers found it challenging to identify students struggling with digital navigation (M = 3.54, SD = 0.677). Additionally, a notable proportion of students still rely on traditional resources without exploring AI-driven strategies (M = 3.67, SD = 1.004), reinforcing the importance of structured guidance. The highest-rated item in this section was the need for formal AI training (M = 4.36, SD = 0.858), indicating strong teacher support for institutional AI literacy programs.

Applying AI and CMC Tools in Learning

Table 4 describes the teachers' perspectives toward the impact of AI use in a smart learning environment. In general, the majority of statements received the agreement. Although students use CMC tools for online discussions and academic collaboration, teachers reported moderate usage of these platforms (M = 3.48, SD = 0.902), indicating that there is still opportunity for improvement in promoting interactive online learning.

However, AI-powered tools were widely used to improve writing and comprehension (M = 4.17, SD = 0.857) and to finish assignments faster (M = 4.24, SD = 0.712). This suggests that students actively use AI to enhance their academic performance, especially in terms of productivity and writing.

Table 4.
The Impact of AI and CMC Tools on Learning Engagement

No.	Item	Mean (M)	Standard Deviation (SD)
6	My students regularly use CMC tools for online discussions and academic collaboration.	3.48	0.902
7	Many students use AI-powered tools to enhance writing and comprehension.	4.17	0.857
8	AI-powered learning tools help students complete assignments more efficiently.	4.24	0.712
9	I observe students relying on AI-generated content rather than critically engaging with materials.	4.06	0.707
10	I believe students' ability to apply AI and CMC tools effectively should be assessed.	4.15	1.029

The excessive dependence of students on AI-generated content without critical engagement, however, was a significant cause for concern (M = 4.06, SD = 0.707). Lastly, there was strong agreement on the need to assess students' ability to apply AI and CMC tools effectively (M = 4.15, SD = 1.029).

Modifying AI and CMC Tools for Personalized Learning

Table 5.
Students' Adaptation to AI-Generated Feedback

No.	Item	Mean (M)	Standard Deviation (SD)
11	My students integrate AI-generated feedback into their writing improvements.	3.88	0.780
12	Some students personalize AI-generated learning materials.	3.33	0.826
13	I can assess whether a student is critically engaging with AI-generated content.	3.73	0.873
14	Some students struggle to modify AI recommendations.	3.82	0.752
15	Students who adapt to AI tools demonstrate higher smartness levels.	3.85	0.797

Table 5 demonstrates the students' adaptation to AI. Teachers reported that students frequently integrate AI-generated feedback into their writing improvements (M = 3.88, SD = 0.780),

indicating that AI-assisted tools are actively used for refining academic work. However, fewer students personalize AI-generated learning materials (M = 3.33, SD = 0.826), suggesting that while AI is a helpful tool, it is not widely adapted to individual learning needs.

Teachers were rated as having a moderate ability to determine whether students critically engage with AI-generated content (M = 3.73, SD = 0.873). Furthermore, some students find it difficult to alter AI recommendations (M = 3.82, SD = 0.752), indicating the need for improved instruction on how to adapt AI-generated content to meet individual learning objectives.

The significance of AI literacy in academic settings was further supported by teachers' recognition that students who successfully adopt AI tools typically exhibit higher levels of intelligence (M = 3.85, SD = 0.797).

Efficient and Strategic Use of AI and CMC Tools

Table 6.
Optimization of AI Tools for Learning Efficiency

No.	Item	Mean (M)	Standard Deviation (SD)
16	My students use multiple AI tools in combination for strategic learning.	3.71	0.885
17	Students who optimize AI tools manage study time effectively.	3.75	0.823
18	I find it difficult to assess students' AI integration strategies.	3.80	0.749
19	Students who optimize AI tools demonstrate better academic performance.	3.89	0.948
20	Universities should provide training on optimizing AI and CMC tools.	4.43	0.696

Table 6 illustrates teachers' perspective toward optimisation of AI. While AI is being used, many students still do not fully integrate various tools to maximise learning outcomes, according to teachers who reported that students moderately use multiple AI tools in combination for strategic learning (M = 3.71, SD = 0.885). Similarly, students who optimize AI tools were seen as more effective in managing study time (M = 3.75, SD = 0.823), showing that AI can contribute to learning efficiency when used strategically. However, teachers found it somewhat difficult to assess students' AI integration strategies (M = 3.80, SD = 0.749), suggesting a need for clearer evaluation frameworks to determine how well students are using AI tools. Teachers also agreed that students who optimize AI tools tend to perform better academically (M = 3.89, SD = 0.948), reinforcing the idea that AI literacy can contribute to academic success. The highest-rated item in this section was the need for universities to provide training on optimizing AI and CMC tools (M = 4.43, SD = 0.696).

Innovation – Creating New Learning Strategies Using AI

Table 7.
AI-Driven Innovation in Student Learning

No.	Item	Mean (M)	Standard Deviation (SD)
21	Some students experiment with AI to create personalized learning materials.	2.99	0.793
22	A small number of students use AI to generate original educational content.	3.69	0.705
23	Students who innovate with AI-enhanced study tools should be recognized.	3.79	0.754
24	AI-driven learning solutions should be assessed.	3.95	0.889
25	Universities should encourage AI-driven innovations beyond passive usage.	4.17	0.839

Table 7 demonstrates teachers' perspectives towards online learning innovation. Although AI is used for learning support, it is not commonly used for content creation, according to teachers, who reported that only a small percentage of students experiment with it to create personalized learning materials (M = 2.99, SD = 0.793). Similarly, only a small number of students use AI to generate original educational content (M = 3.69, SD = 0.705), suggesting that AI innovation in academic settings remains limited.

Despite the low usage of AI for content creation, teachers agreed that students who innovate with AI-enhanced study tools should be recognized (M = 3.79, SD = 0.754) and that AI-driven learning solutions should be formally assessed (M = 3.95, SD = 0.889). The necessity for universities to support AI-driven innovations beyond passive usage received the highest rating in this section (M = 4.17, SD = 0.839). This research emphasises the significance of developing imaginative and creative uses of AI in education rather than merely focussing on basic AI-assisted learning.

Discussion

The findings of this study are aligned with the previous studies to a certain extent and contribute to new insights towards the general perspective of teachers' use of smart learning environment from the sense of Uskov's Framework for smart learning environment.

Teachers' Recognition of CMC Tools

At the identification level, the majority of items received agreement from teachers. Teachers acknowledged students' familiarity with basic CMC tools, as these tools are very common and fundamental. Many universities are currently integrating these tools into their teaching (Zhu et al., 2016). With the rise of AI-powered learning tools such as ChatGPT, Grammarly, and MS Speak, students can receive learning support both in and outside the classroom, fostering learner autonomy (Gao et al., 2019). However, when these tools are introduced in the classroom, some students struggle to apply them successfully because they are not yet familiar with their functions and structure. Additionally, only certain groups of students may be familiar with these

tools, rather than the entire class. As a result, some students are unable to use the tools effectively.

Although AI tools have been introduced into classrooms, students are often only using them at a basic level without fully understanding their functions or optimal strategies for maximizing their effectiveness. This is due to limited practice, as the use of these tools only occupies a small portion of classroom time, preventing students from fully mastering them (Nguyen et al., 2024). Therefore, students should receive proper training on how to use these tools, rather than just using them upon the teacher's request. In many cases, students are simply required to use a tool to complete tasks, but some do not fully understand how to operate or optimize its functions. For this reason, training sessions are crucial to ensure that all students are at the same level of proficiency in using these tools.

Impacts of CMC Tools in Language Pedagogy

The use of technology and online tools in language education has had a noticeable impact in the classroom from the perspective of teachers. Teachers recognize that their students regularly use CMC tools for online discussions and academic collaboration, which can foster interaction and constructive development in language learning (Nguyen & Nguyen, 2019). In particular, AI-powered tools allow students to enhance their writing performance and comprehension skills by generating ideas and serving as a reference source for information. In the current context, many students rely on online tools to help them complete assignments faster and with less effort by finding ideas, synthesizing materials, and generating content. However, certain issues need to be addressed. Students are becoming overly dependent on online tools rather than using their own critical thinking skills to assess the appropriateness of the generated content. In the past, students would use online tools to gather raw materials, compare and contrast information, and select relevant content (Guo et al., 2021). However, with modern AI-based filtering, these tools now pre-select information, reducing the effort required from students. As a result, many students rely on online tools excessively, rather than actively engaging with the learning process or developing problem-solving skills. This over-reliance on AI tools may ultimately diminish their level of autonomy in learning.

Washback on Learners' Progressive Development

For adaptation, many students use online tools and AI-generated feedback to improve their writing because they do not have to wait for the teacher to give them feedback. They can receive instant feedback, allowing them to recognize their mistakes and improve for future use. Online tools or AI-generated materials can be personalized, adapting to students' personal needs and styles, which reduces the amount of time needed to filter materials. Moreover, teachers still face certain limitations in assessing whether students are using AI-generated content appropriately because they cannot always distinguish between student-created content and AI-generated content. Some students struggle to determine whether AI-generated recommendations are appropriate or not. This presents a significant barrier because when students receive information from AI, they may not be able to identify whether it is correct or reliable enough to adapt and use effectively (Shu & Gu, 2023; Temdee, 2020). However, some students who use online tools strategically can actually demonstrate higher levels of smartness. When they become familiar with the tools, they can understand their functions, master their use, and optimize their effectiveness, rather than simply relying on them passively.

Teachers recognize that some students use different types of AI tools in combination for their learning. This reflects both sides of their learning behavior—they try to enhance their strategies by using multiple tools, but at the same time, it also indicates their inability to use one particular

tool effectively. As a result, they integrate various tools together to compensate for this limitation. With the increased use of AI tools, students can manage their time more effectively because they have greater control over their study schedule. AI tools help organize their workload and function as a system to support their learning (Rusmiyanto et al., 2023). However, the majority of AI tool usage occurs outside the classroom, making it difficult for teachers to assess students' ability and effectiveness in using these tools. Some students can optimize AI tools to improve their academic performance, but in some cases, this can be indistinguishable from simply relying on AI-generated content. Therefore, training sessions are crucial to ensure that students are using AI tools effectively rather than becoming overly dependent on them. It can be seen that the use of AI allows students to demonstrate higher levels of performance by providing personalized learning materials. However, very few students use AI tools to generate original educational content because they mostly copy ideas from AI and apply them in the classroom for submission to the teacher, which can reduce their level of critical thinking. Therefore, the effectiveness of AI usage should be re-evaluated. It is the responsibility of universities, teachers, and other stakeholders to regulate and guide AI usage among students, ensuring that they do not use AI passively or rely on it excessively but instead engage with it critically and effectively (Temdee, 2020).

Conclusion

This study has explored teachers' perspectives on assessing learners' smartness levels in computer-mediated communication within smart learning environments. The study applied Framework for Smart Learning Environments (Uskov et al., 2015) and investigated teachers' views on how students integrate and apply technological tools into their learning experiences. Traditional classrooms often focus on teachers integrating technological instruments to improve educational and academic performance. However, there is still a need to assess the effectiveness of using these tools rather than simply applying them in the classroom. The findings of this study revealed that, from the teachers' perspective, while students are familiar with digital learning platforms and AI-powered tools such as Padlet, quizzes, and Elsa Speak, there are variations in students' ability to apply and innovate with these technologies. Teachers recognized that students benefit significantly from AI-enhanced learning experiences, particularly in idea generation, group interaction, and task integration. However, students still face certain barriers, such as an inability to optimize technology usage and over-reliance on AI-generated content, which may hinder their critical thinking skills and engagement. This study also highlighted the need for formal training and institutional facilitation to enhance AI literacy.

The outcomes of this study provide valuable insights for educators, policymakers, and curriculum developers to recognize the importance of evaluating the effectiveness of students' technology use, rather than simply providing them with technological tools without proper guidance or assessment. This approach can improve the quality of technology integration and reduce inefficiencies in educational innovation. Policymakers can identify the current rationale of technological tools to make decisions on equipping more technological instruments into the classroom to elevate the educational outcomes. Moreover, curriculum developers can re-design the materials and the courses to integrate the online or digital sections in the curriculum to foster the active roles of learners to use online tools. Teachers are able to design more active tasks or interactional practices so that learners can adopt online tools effectively. However, this study is limited by several constraints. First, the limited sample size does not cover a large number of participants, which may affect the generalizability of the findings. Second, the study relies solely on quantitative data, meaning that teachers' deeper insights and experiences have not been fully explored.

This study paves the way for further research to investigate students' experiences with technology and gain insights from their perspectives. Future studies could also conduct comparative research to benchmark teachers' and learners' perspectives in order to further optimize smart learning environments. Further qualitative research should be conducted to apply for interviews or focus groups to deepen the insights of teachers and learners in the use of CMC tools to identify their experiences in technological integration.

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Biodata

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