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Managing Student Engagement in AI-supported English Learning: A CIPO Analysis at a Vietnamese University

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ABSTRACT: *The rapid expansion of artificial intelligence (AI) in higher education has created new opportunities for personalized learning, while also raising questions about how to effectively manage student engagement in AI-enabled environments. This study employs the Context-Input-Process-Output (CIPO) model to examine how organizational context, learner input, and instructional processes shape student engagement in an AI-integrated English course at a university in Vietnam. A mixed-methods design was used by combining survey data from 288 undergraduate students with semi-structured interviews with seven students. Quantitative results show that the model explains 78.2% of the variance in engagement, with Process factors, including instructor support and motivation to learn, being the strongest predictors, followed by contextual conditions such as policy clarity and digital infrastructure. Input factors, including attitudes towards AI and digital competence, are no longer statistically significant after controlling for the effects of context and teaching process. Qualitative results reinforce the above findings, suggesting that learning engagement depends less on students' individual AI competences than on how instructors design AI-enabled tasks and the consistency of organizational regulations in guiding AI use. The study contributes to existing scholarship by showing that student engagement in AI-enabled English learning is a systemic outcome, determined primarily by pedagogical and contextual mechanisms. At the same time, the study proposes managerial recommendations to strengthen AI governance, enhance instructor capacity, and support learners in higher education in the Asia-Pacific region.*

KEYWORDS: **Artificial intelligence in education, student engagement, English language learning, educational management, CIPO framework**

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1. Introduction

The integration of artificial intelligence (AI) into education is transforming the way teachers and learners interact with content, feedback, and learning processes. In higher education, institutions are increasingly using AI tools such as ChatGPT, Grammarly, and ELSA in language teaching and assessment to enhance personalization and improve learning outcomes (Bond *et al.,* 2024; Zawacki-Richter *et al*., 2019). These tools have the potential to enhance efficiency and promote learner autonomy, but they also pose new challenges related to maintaining student engagement, ensuring academic integrity, and maintaining pedagogical coherence, especially in the context of uneven development of digital infrastructure and institutional capacity (UNESCO, 2023).

Student engagement is considered a key determinant of learning quality and retention in higher education (Fredricks *et al*., 2004). In AI-enabled learning environments, student engagement depends not only on learners' motivation and digital competence, but is also influenced by institutional policies and instructional processes that govern the use of technology (Bond *et al*., 2024; Huang *et al.,* 2024). Managing these factors requires a systemic approach that considers the interactions between context, pedagogical processes, and learner characteristics. The Context-Input-Process-Output (CIPO) model provides such a perspective, viewing education as a managed system in which context and inputs interact through processes to

produce measurable outcomes (Scheerens, 1990; Tran, 2009; UNESCO, 2017).

In Vietnam, as in many countries in the Asia-Pacific region, digital transformation in education is making significant progress. National policies encourage universities to integrate digital technology and AI to improve the quality of teaching and learning, including English language education (Pham, 2024; UNESCO, 2017). However, empirical studies in Vietnam have mainly focused on the technological potential of AI or the perceptions of individual groups (e.g., lecturers or students), rather than on management mechanisms that help maintain student engagement in AI-enabled learning environments over time (Bui & Nguyen, 2024; Cung *et al*., 2025; T. T. H. Nguyen, 2023). Therefore, there is still a lack of evidence on how universities can manage AI-enabled learning environments so that student engagement is not only initiated but also effectively maintained and monitored.

In this context, this study applies the CIPO model to analyse how student engagement is managed in an AI-enabled English learning environment at a technology-oriented university in Vietnam. By examining the relationship between organizational context, learner inputs, and instructional processes on learning engagement, the study aims to provide a more systematic understanding of engagement management in AI-mediated environments. At the same time, the study also responds to regional recommendations for developing evidence-based strategies to connect digital innovation with governance and quality assurance in education in the Asia-Pacific region (APEC, 2023; Bond *et al.,* 2024; UNESCO, 2023).

The study pursues three main objectives:

(1) To analyse the relationship between contextual, input, and process factors that influence learning engagement in AI-enabled English learning environments;

(2) To identify the components of the CIPO model that have the strongest influence on learning engagement;

(3) To propose management recommendations to enhance sustainable learning engagement in AI-integrated education in the Asia-Pacific region.

The research results contribute to theory and practice by expanding the scope of application of the CIPO model in managing AI-integrated foreign language teaching activities, and at the same time provide suggestions for education managers in balancing technological innovation, pedagogy, and policy in the digital transformation process.

To achieve these objectives, the study addresses the following research questions:

RQ1: How are contextual, input, and process factors related to student engagement in AI-enabled English learning environments?

RQ2: Which component of the CIPO model (Context, Input, or Process) serves as the strongest predictor of learning engagement?

RQ3: What management strategies can be proposed to enhance sustainable learning engagement based on the systemic analysis?

2. Literature Review

2.1. CIPO Framework in Education Management

The Context-Input-Process-Output (CIPO) model was originally proposed to conceptualize education as a dynamic system in which learning outcomes depend on how contextual conditions, inputs, and processes are organized and managed (Scheerens, 1990; Tran, 2009). Unlike linear models that primarily focus on internal efficiency, CIPO emphasizes feedback and continuous improvement, and has been widely used in research on educational effectiveness and quality management (Scheerens, 2016; Scheerens & Glas, 2006; UNESCO, 2017).

In this framework, context refers to the external and internal environment in which educational activities take place. This includes governance structures, school policies, organizational culture, and the availability of resources and infrastructure. Inputs refer to learners, teachers, curricula, learning materials, and technology that are incorporated into the educational process. Processes include teaching, learning, interaction, and assessment activities that directly influence student experience and the quality of learning. Outputs typically refer to measurable outcomes

such as academic achievement, satisfaction, progress, or employability (Scheerens, 1990; UNESCO, 2017).

In Vietnam, the CIPO model has been used to analyse and improve the management of training programs and ensure educational quality. For example, N. T. Nguyen (2018) and D. T. Nguyen (2017) applied CIPO to evaluate vocational and university programs, arguing that a close link between context, inputs, and processes is essential to improve educational outcomes. These studies suggest that CIPO is particularly suitable for digital transformation contexts where multiple factors interact in a complex way and together shape the quality of teaching.

In this study, the output is understood as the level of student engagement in an AI-enabled English learning environment. The context is defined as the institutional policies and digital infrastructure related to the application of AI in teaching and learning. The input includes student attitudes towards AI and their digital competence, while the process focuses on teacher support and learning motivation.

2.2. AI in Higher Education and The Need for Systemic Management

AI is playing an increasingly important role in higher education, supporting functions such as adaptive learning, automated feedback, virtual tutoring systems, and learning analytics. Systematic reviews point to both opportunities and challenges: while AI can increase personalization and efficiency, issues related to ethics, transparency, equity, and institutional readiness are still underdeveloped (Bond *et al.,* 2024; UNESCO, 2023; Zawacki-Richter *et al.,* 2019). International policy organizations such as UNESCO (2017, 2023) and APEC (2023) emphasize that the integration of AI needs to be placed within broader educational digital transformation and quality assurance strategies.

In the field of English language teaching, AI tools are increasingly used for personalized language training, automated writing assessment, and pronunciation coaching. Huang *et al.* (2024) argue that when AI tools are integrated into pedagogically meaningful tasks, students can increase their engagement and receive more effective feedback loops. However, without clear instructional design, task objectives, or assessment criteria, AI can lead to superficial engagement or overdependence (Bui & Nguyen, 2024; Cung *et al.,* 2025; Holmes, Bialik, & Fadel, 2019; T. T. H. Nguyen, 2023). These models reinforce a core proposition of the CIPO model: technological innovations cannot be understood as discrete tools but as components whose effectiveness depends on contextual and pedagogical conditions.

2.3. Digital Competence in AI-enabled Learning

Digital competence has become a fundamental requirement for students in AI-mediated learning environments. The DigComp 2.2 framework defines digital competence as a combination of knowledge, skills, and attitudes across five domains: information and data literacy, communication and collaboration, digital content creation, safety, and problem solving (Vuorikari, Punie, Carretero, & Van den Brande, 2022). Complementing this vision, the DigCompEdu framework extends digital competence into the educational context by emphasizing how digital competence interacts with organizational systems and pedagogical practices (Redecker, 2017).

In AI-assisted English learning, digital competence helps students interpret AI-generated feedback, evaluate content quality, integrate automated suggestions into learning strategies, and use AI tools ethically. However, studies show that high digital competence does not automatically lead to meaningful learning engagement. Bond *et al.*'s (2020) overview suggests that digital skills are necessary but not sufficient without appropriate instructional support and clear task design. Similarly, studies on AI applications in English language teaching show that without specific modelling and guidance, even learners with good digital skills can engage superficially (Holmes *et al*., 2019; Huang *et al*., 2024).

In this study's CIPO model, digital competence is viewed as an Input condition that supports learner readiness, but its influence is enabled or constrained by the clarity of context

and process-oriented pedagogical mechanisms. This systems perspective explains why students with similar levels of digital competence can still demonstrate different levels of engagement depending on institutional expectations and instructor guidance.

2.4. Student Engagement Theory in Technology-mediated Learning

Student engagement is a central construct in higher education research and is widely recognized as a predictor of learning outcomes, retention, and learning quality. Fredricks *et al.* (2004) conceptualize engagement as having three components: behavioral, emotional, and cognitive. Behavioral engagement reflects levels of involvement and effort; emotional engagement relates to interest, enjoyment, and a sense of belonging; cognitive engagement refers to intellectual investment, self-regulation, and the use of deep learning strategies. Schaufeli *et al.* (2002) describe engagement in terms of enthusiasm, commitment, and immersion, which represent the depth of a learner's motivation.

In digital environments and AI-mediated learning environments, engagement becomes more complex. Research shows that engagement depends not only on learner motivation and competence, but also on how the task is designed, how feedback is incorporated, and how much autonomy is supported. Self-Determination Theory (Ryan & Deci, 2000) suggests that engagement is enhanced when learners feel autonomous, competent, and socially connected. Evidence from studies of AI-enabled ELT suggests that teacher modelling, clear language goals, and reflective task design play a crucial role in promoting engagement; conversely, unstructured use of AI often leads to passive or superficial engagement (Huang *et al.,* 2024; Reeve, 2006).

Positioning learning engagement as an Output in the CIPO model allows for a systems-oriented interpretation: engagement is shaped by the interaction between organizational expectations, learner readiness, and pedagogical processes. This approach fits with the research goal of explaining not only individual levels of participation but also the underlying governance mechanisms that shape that participation.

2.5. Research Gaps and Conceptual Framework

Despite the growing interest in AI in higher education, there are still significant gaps in research. International studies often focus on AI tools or user perceptions without fully considering the broader management system that shapes learning engagement (Bond *et al.,* 2024; Holmes *et al*., 2019; Zawacki-Richter *et al.,* 2019). In Vietnam, studies have examined lecturers and students' attitudes towards AI (Bui & Nguyen, 2024; Cung *et al.,* 2025; T. T. H. Nguyen, 2023) and applied the CIPO model to curriculum management (D. T. Nguyen, 2017; N. T. Nguyen, 2018; Tran, 2009). However, these research directions are generally separate. Very little work integrates AI pedagogy, digital competencies, and engagement theory into a systemic framework that explains how engagement is generated and sustained in AI-enabled learning environments.

Another gap is theoretical integration. While digital competency frameworks such as DigComp 2.2 and DigCompEdu describe essential competencies for learners and educators (Redecker, 2017; Vuorikari *et al.,* 2022), empirical research rarely considers how these competencies interact with organizational policies or instructional processes to influence engagement. Similarly, while engagement theory provides a solid foundation for analysing learner motivation and engagement (Bond *et al.,* 2020; Fredricks *et al.,* 2004), there is little research exploring how engagement occurs in AI-enabled English learning environments, where policy clarity, assessment design, and teacher mediation can vary significantly.

To address these gaps, this study proposes an integrated conceptual framework that combines the CIPO model with components from digital literacy theory and engagement theory. In this framework, Context includes organizational policies, digital infrastructure, and governance mechanisms for AI use; Input includes learner

attitudes toward AI and digital literacy; Process includes teacher support and learning motivation; and Output is understood as students' multidimensional levels of learning engagement. This framework guides the development of survey instruments, data analysis, and results interpretation, and provides a foundation for management recommendations that link technological innovation with pedagogical quality and organizational accountability.

3. Methodology

3.1. Research Design

This study used a mixed-methods design to provide a comprehensive view of how contextual, input, and process factors influence student engagement in an AI-assisted English learning environment. The quantitative component helps identify statistical relationships between variables in the CIPO model, while the qualitative component provides deeper insights into how students interpret and experience AI-assisted learning. Integrating the two methods allows the strengths of one method to compensate for the limitations of the other, thereby enhancing the reliability and interpretability of the research results. The CIPO (Context – Input – Process – Output) model serves as an analytical framework to guide the development of the survey instrument, data collection, and interpretation of the results.

3.2. Research Context and Participants

The study was conducted at University A (anonymized), a technology-oriented institution in Vietnam, where AI tools such as ChatGPT, Grammarly, QuillBot, and ELSA have been integrated into compulsory English courses. These courses, typically implemented in the first two years, focus on developing academic reading and writing skills.

A total of 288 university students completed the survey. They were recruited from a variety of English classes across different majors and years. The majority of students were at CEFR B1–B2 levels, with some at A2 or approaching C1. Most students reported using digital devices frequently and had experience with AI tools, indicating average to high levels of digital competence overall (Vuorikari *et al.,* 2022). The sample size exceeded the recommended threshold for regression analysis with three predictors and was adequate to ensure stable statistical estimates (Hair *et al.,* 2019).

For the qualitative part, seven students were selected using a purposive sampling method to reflect diversity in terms of gender, field of study, year of study, frequency of AI use, and self-rated English and digital competence. This diversity allowed the interview set to cover a wide range of AI-related learning experiences. Although small in size, the sample is consistent with qualitative research practice, where depth is prioritized and thematic saturation is used as a guiding criterion (Braun & Clarke, 2006). In this study, saturation was achieved when subsequent interviews no longer yielded meaningful new information. The interviews were conducted in Vietnamese, lasted approximately 30 minutes, and code names were used to protect participant anonymity.

3.3. Instruments

3.3.1. Survey Questionnaire

The 30-item Likert-scale questionnaire was designed to operationalize six constructs consistent with the CIPO model, with five items for each construct: Attitudes towards AI (Q1–Q5), Digital Competence (Q6–Q10), Faculty Support (Q11–Q15), Motivation to Learn (Q16–Q20), Contextual Conditions (Q21–Q25), and Student Engagement (Q26–Q30). All items were rated on a five-point scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

The questionnaire was originally developed in English and then translated into Vietnamese by a bilingual lecturer familiar with ELT terminology. To ensure linguistic and conceptual equivalence, a second bilingual colleague, who did not participate in the initial translation, independently back-translated the Vietnamese version into English. The research team compared the back-translated version with the original English items to identify discrepancies in meaning and adjusted the Vietnamese wording where necessary. Only minor wording revisions were required after this step.

Table 1. Operationalization of Variables Based on the CIPO Framework

Dimension	Constructs	Item range	Key references
Context	Institutional environment and policy	Q21–Q25	UNESCO (2023); Zawacki-Richter et al. (2019)
Input	Attitudes toward AI; Digital literacy	Q1–Q10	Davis (1989); Vuorikari et al. (2022)
Process	Instructor support; Learning motivation	Q11–Q20	Reeve (2006)
Output	Student engagement	Q26–Q30	Fredricks et al. (2004); Schaufeli et al. (2002)

Content validity was examined through a peer-review process involving three experts in educational management and English language pedagogy from FPT University. These reviewers evaluated the questionnaire items in terms of clarity, relevance, and alignment with the CIPO framework. Based on their feedback, several items were refined to improve wording clarity and conceptual consistency.

A pilot study with 30 students was then conducted to assess the clarity and appropriateness of the questionnaire items. Feedback from the pilot participants confirmed that the items were understandable and relevant to their learning experiences. Internal consistency reliability was assessed during the main analysis phase and is reported in Section 4.2. The dimensions and their theoretical underpinnings are summarized in Table 1.

3.3.2. Interview Questionnaire

Semi-structured interviews were conducted to further explore students' experiences of learning engagement when using AI tools. The interview questionnaire focused on four main content areas: (1) factors that promote or hinder learning engagement; (2) students' experiences with AI-based learning tasks; (3) the role of instructors in orientation and support; and (4) perceptions of institutional support, policy clarity, and ethical issues. Although based on a general orientation framework, the open-ended question format allowed participants to share freely, thereby generating rich qualitative data that accurately reflected real-life experiences. All interviews were audio-recorded (with consent) and transcribed verbatim.

3.4. Data Collection and Analysis

a. Quantitative Analysis and Validity

Quantitative data were collected online through Google Forms. After data processing and cleaning, a total of 288 valid responses were included in the analysis. SPSS version 26.0 software was used to calculate descriptive statistics, test reliability, and perform multiple regression analysis.

Since the scales were adapted from widely validated tools, the study did not conduct exploratory factor analysis. Instead, validity was ensured through several strategies, including:

- *Content validity:* building questionnaire items based on underlying theories.

- *Translation validity:* through the translation-back translation process.

- *Internal construct validity*: high Cronbach's alpha coefficient.

- *Construct validity*: demonstrated through consistent correlations between CIPO model components and their conformity with theoretical expectations.

The composite score was calculated as the average of the five items in each construct. The regression assumptions of normal distribution, linearity, homoscedasticity, and absence of multicollinearity were checked and met.

b. Qualitative Analysis and Reliability

The interview transcripts were analysed using Braun and Clarke's (2006) six steps of thematic

analysis. First, two coders read the data carefully several times to familiarize themselves. Next, each coder generated initial codes line by line. The codes were then compared, discussed, and refined, and grouped into preliminary themes. The themes were then reviewed with the code snippets and the entire data set to ensure logic. Next, the themes were identified and named. Finally, illustrative quotes were selected and the thematic structure was aligned with the CIPO model.

Several measures were taken to enhance trustworthiness. Validity was reinforced by cross-referencing qualitative themes with quantitative results and comparing codes between the two coders. Member validation was conducted informally through discussions to clarify meanings during the interview. Dependability was supported by a research journal that recorded coding decisions, theme adjustments, and editing processes. Confirmability was ensured by comparing all paraphrases with verbatim quotes and maintaining reflective notes. Transferability was supported by detailed descriptions of the organizational context and learning environment in relation to AI.

To enhance internal reliability, the analysis process involved repeated reading, coding, and continuous comparison between codes, themes, and raw data. Codes were grouped according to Braun and Clarke's six-step process, and independent coding by two coders combined with a consensus process helped ensure that the final themes accurately reflected the participants' experiences.

3.5. Ethical Issues

The study fully complied with ethical standards for research involving human subjects. Students were informed of the purpose of the study, their rights, and participation was completely voluntary. Written informed consent was obtained before the survey and interview. All data were anonymized and any identifying information about the institution was removed to ensure confidentiality. The name of the university was replaced with "University A" to maintain the privacy of the participating unit.

4. Results

4.1. Descriptive Statistics

Descriptive results show consistently positive perceptions across all components of the CIPO model. All mean scores were above the midpoint of the five-point Likert scale, suggesting that students generally had favourable attitudes toward AI-assisted English learning. Learning motivation had the highest mean score (M = 3.77, SD = 0.92), reflecting a strong level of excitement and willingness to engage in AI-mediated tasks. Instructor support (M = 3.71, SD = 0.93) and context (M = 3.71, SD = 0.91) were also high, indicating that students positively evaluated the pedagogical orientation and readiness of the institution. Digital competence had the lowest mean score (M = 3.60, SD = 0.90), suggesting that although students were motivated, their confidence in using AI tools effectively varied. Student engagement in learning remained strong overall (M = 3.70, SD = 0.91). Table 2 presents the descriptive statistics of all composite variables.

Table 2. Descriptive Statistics of CIPO-related Variables and Engagement

Variable	Mean (M)	Standard Deviation (SD)
Attitude toward AI	3.75	0.93
Digital literacy	3.60	0.90
Input (Attitude + Literacy)	3.67	0.86
Instructor support	3.71	0.93
Learning motivation	3.77	0.92
Process (Support + Motivation)	3.74	0.89
Context	3.71	0.91
Student engagement	3.70	0.91

4.2. Reliability Analysis

Reliability analysis showed that all six scales had high internal consistency. Cronbach's alpha coefficients ranged from .888 to .952, indicating that each set of items reliably measured the constructs targeted within the CIPO framework. These consistently high

alpha values reflect strong correlations between items and reinforce the instrument's suitability for examining multidimensional constructs such as learning engagement and process-related factors. Table 3 details the reliability coefficients for each scale.

4.3. Regression Analysis

To address RQ2, which examines the components of the CIPO model that most strongly predict student engagement, a multiple regression analysis was conducted. The analysis examined the extent to which the Context, Input, and Process components predicted student engagement in an AI-assisted English learning environment. The overall model was statistically significant, $F(3, 284) = 339.81$, $p < .001$, explaining 78.2% of the variance in engagement (Adjusted $R^2 = .780$). These results indicate that the model had strong explanatory power.

Analysis of standardized coefficients showed that the Process component had the strongest influence on learning engagement ($\beta = .477$, $t = 5.87$, $p < .001$), followed by the Context component ($\beta = .452$, $t = 7.27$, $p < .001$). In contrast, the Input component did not significantly predict engagement ($\beta = -.024$, $t = -0.43$, $p = .671$), suggesting that students' attitudes and digital competencies do not automatically translate into higher engagement when contextual and pedagogical support factors are taken into account.

Table 3. Internal Consistency of Measurement Scales

Scale	Number of items	Cronbach's α
Attitude toward AI	5	.888
Digital literacy	5	.912
Instructor support	5	.939
Learning motivation	5	.952
Context	5	.941
Student engagement	5	.937

4.4. Qualitative Findings

Qualitative interviews helped to further interpret the quantitative results and clarify why the two components, Process and Context, emerged as the strongest predictors of learning engagement. The thematic analysis yielded three themes that were closely linked to the CIPO model, revealing the mechanisms that facilitate or hinder engagement in AI-enabled English learning environments.

a. Instructor Mediation and Task Design

Students repeatedly emphasized that engagement depended not on the AI tool itself but on how instructors introduced, guided, and structured AI-enabled learning activities. Clear objectives, concrete modelling, and supported practice were described as essential elements for meaningful engagement. As one student shared: *"If teachers just give us tools without guidance, we get lost. But if they give us clear guidance, learning becomes purposeful"* (S1). Another student highlighted the importance of language objectives: *"I participate more when teachers clearly state the language objectives rather than just saying 'use AI'"* (S2). Live simulations in class also have a significant impact. A communication design student said: *"When I use AI directly in class and discuss the results, I develop my language skills and practice critical thinking at the same time"* (S4).

Table 5. Multiple Regression Predicting Student Engagement (standardized coefficients)

Predictor	β	Std. Error	t	p
Input	−.024	.059	−0.43	.671
Process	.477	.082	5.87	< .001
Context	.452	.062	7.27	< .001

Table 4. Model Summary for Regression Predicting Student Engagement

R	R^2	Adjusted R^2	F	df1	df2	Sig.
.884	.782	.780	339.81	3	284	< .001

Task design also shapes willingness to participate. Collaborative and practical tasks are seen as particularly motivating. S1 shared: *"Working in groups with AI, like creating a dialogue or editing a paper, helps me learn more through discussion."* Some students appreciated formative assessment. As S2 said: *"Teachers should assess how we use AI, not just the end product; that would motivate real effort."*

These findings reinforce the quantitative findings that Process factors, particularly instructor support and a motivating learning environment, are the strongest predictors of learning engagement.

b. Institutional Clarity and Supportive Learning Environment

The second theme relates to the important role of institutional context. Many students reported that unclear or inconsistent regulations on AI use led to a lack of confidence and limited participation. One student said: *"If one teacher allows AI, another prohibits it without explanation, we are afraid to use it for fear of making mistakes"* (S4).

Many students wanted systematic support from the institution, beyond individual modules. S1 suggested skill-based workshops to improve AI use. S5 suggested building *"an AI learning community for students to share tips and good practices"* to enhance collaborative learning. Ethical issues in the use of AI were also raised; S3 observed that *"many students confuse support with copying"* and called for clearer guidance from the institution.

Some students wanted AI capabilities to be incorporated into formal training programs. S5 suggested that *"AI competency should be a course that teaches how to use, evaluate, and cite AI appropriately."* Students also suggested organizing competitions, application projects, and business networking activities (S2, S7), seeing these as opportunities to create deeper engagement and send a clear message about the value of AI.

These comments help explain why the Context component had a significant impact on the quantitative results; students were more engaged when policies, resources, and organizational norms created a transparent and supportive environment for AI-enhanced learning.

c. Motivation, Autonomy, and Perception of Progress

The third theme related to students' motivational orientations and perceptions of autonomy and progress. Many students described intrinsic motivation as central to their engagement. As S2 said: *"I participate more when I am genuinely curious or feel like I am making progress; when it is mandatory, I engage less."* Clear goals also play a decisive role. S5 explained: *"Clear goals make AI tasks meaningful; without goals, motivation drops very quickly."*

Autonomy is both an opportunity and a challenge. S4 commented: *"AI helps self-learning, but without self-management, it is easy to get distracted."* S6 emphasized the importance of trust in the tool: *"When I believe the tool is helpful, I am more proactive in exploring."* Immediate feedback and a clear sense of progress also increase engagement. For example, S1 shared: *"AI corrects my grammar immediately, which makes me want to try again,"* while S5 appreciated that AI helps generate ideas quickly and reduces anxiety at the beginning of the task.

These findings reinforce the quantitative results that motivational factors in the Process component have a strong influence on engagement.

d. Additional Enabling and Constraining Factors

Although mentioned less frequently, some additional factors were found to influence how students engaged with AI. User experience determined their willingness to use certain tools; as S4 explained: *"A friendly interface makes me want to use it, but a complex platform discourages me."* Time pressure and workload also affected engagement, as S3 noted: *"When I have a lot of work, I use AI less because I can't process all the feedback."* Finally, tool-task fit was also important; S3 noted that *"using the wrong AI tool wastes time and reduces efficiency."*

These factors did not emerge as primary predictors but acted as background conditions that influenced how the Process and Context mechanisms operated in practice.

Taken together, the qualitative findings reinforce and extend the quantitative results by showing that learning engagement in AI-enabled English environments is most strongly influenced by pedagogical factors in the Process component—particularly instructor guidance, goal clarity, and learning motivation—as well as organizational mechanisms in the Context component, including policy, training, and ethical guidelines. Individual attitudes and digital competencies play a supporting rather than decisive role, consistent with their lack of statistically significant effects. The convergence of the two data sources enhances the explanatory power of the CIPO model and suggests that learning engagement emerges from a well-supported pedagogical and organizational ecosystem, rather than solely from individual learner characteristics.

5. Discussions

This section discusses the research findings related to the three research questions and places them in the context of a review of the literature on AI-enhanced learning and educational management. The integration of quantitative and qualitative evidence shows that student engagement in AI-enhanced English learning environments is shaped by the systemic interactions between the components of the CIPO model. This both reinforces previous studies and brings new insights from the Vietnamese higher education context.

5.1. Research Question 1: How are contextual, input, and process factors related to student engagement in AI-enabled English learning environments?

The study found that all three components of the CIPO model were associated with engagement, albeit to varying degrees. This is consistent with the argument by Scheerens (1990) and Scheerens and Glas (2006) that educational outcomes emerge from the interaction of systemic conditions, rather than from individual factors.

Similar to international reviews (Bond *et al.,* 2024; Zawacki-Richter *et al*., 2019), students in this study expressed positive perceptions of AI and digital learning environments. However, the relationship between these perceptions (Inputs) and learning engagement becomes weaker when contextual and pedagogical factors are taken into account. This reinforces the view that attitudes towards technology and basic digital skills play a supporting role but do not determine learning behaviour by themselves (Holmes *et al.,* 2019).

Qualitative findings support this systemic interpretation. Students reported that their engagement depended on the clarity of school rules, the structure of learning tasks, and the modelling provided by teachers. This is consistent with previous arguments that the effectiveness of AI depends on pedagogical and governance frameworks (Huang *et al*., 2024; UNESCO, 2023). As such, the current study confirms previous studies by showing that engagement is not simply a result of learners themselves, but an emergent property of a managed system, in line with the logic of the CIPO model.

5.2. Research Question 2: Which component of the CIPO model has the strongest influence on student engagement?

The results show that the two components, Process and Context, have the strongest influence on student engagement.

a. Process as a key driver

The regression results indicate that Process is the strongest predictor of engagement, reinforcing previous evidence that teacher mediation and task design play a central role in technology-enabled learning environments (Huang *et al.,* 2024; Reeve, 2006). Students repeatedly highlighted the need for specific modelling, clear language goals, and reflective guidance. This reflects the conclusion from previous studies that AI tools are only truly effective when integrated within a coherent pedagogical structure (Holmes *et al.,* 2019).

In addition, the strong role of motivation in this study is consistent with Self-Determination Theory, which suggests that engagement increases when tasks meet needs for competence, autonomy, and social connection (Ryan & Deci, 2000). The emphasis students place on progress,

relevance, and autonomy suggests that these motivational mechanisms continue to be strong in AI-rich environments.

b. Context as a supporting determinant

The strong impact of Context in the quantitative results and students' emphasis on clarity of policies and digital infrastructure both support UNESCO's (2023) finding that organizational governance is fundamental to the effective and responsible application of AI. Studies in Vietnam (D. T. Nguyen, 2017; N. T. Nguyen, 2018) also show that CIPO-based governance improves consistency and quality of learning. This study extends these findings to the AI domain, showing that policy consistency, ethical guidance, and access to AI tools are important enablers of learning engagement.

c. Input: Necessary but not sufficient

Although students had positive attitudes and above-average digital competence, these factors did not significantly predict learning engagement. This finding is consistent with Bond *et al.* (2024), who argue that positive perceptions of technology are not reliable predictors of actual learning behaviour. Instead, learner attitudes serve as indicators of readiness, but their impact depends on strong contextual and pedagogical support.

Thus, the study provides new evidence that in AI-enabled English learning environments, the two components, Process and Context – rather than Input – are strategic levers for enhancing learning engagement.

Beyond statistical significance, the regression coefficients also suggest several practical implications for higher education management. The relatively strong effects of the Process (β = .477) and Context (β = .452) components indicate that improvements in pedagogical design and institutional governance may have a substantial impact on student engagement in AI-supported learning environments. In practical terms, universities may benefit from prioritizing instructor professional development, particularly in areas such as AI-integrated task design, guided use of AI tools, and reflective feedback practices. At the same time, the significant role of the Context component highlights the importance of clear and consistent institutional policies regarding the ethical and responsible use of AI. When expectations are transparent across courses and modules, students may feel more confident engaging with AI-supported learning activities.

5.3. Research Question 3: What management strategies can enhance sustained learning engagement in AI-enabled English learning environments?

Based on the research findings and existing literature, three prominent strategic directions are proposed:

(1) Strengthen pedagogical processes through developing teaching competencies

Since the Process component is the main driver of learning engagement, universities need to invest in developing lecturers not only in technical skills but also in AI-integrated pedagogical competencies, reflective task design, and regular assessment. This is in line with the growing recognition that it is the combination of lecturers and AI – not just the tool itself – that shapes learning engagement (Holmes *et al*., 2019; Huang *et al.,* 2024).

(2) Develop a coherent and transparent AI policy framework at the institutional level

The strong role of Context suggests that institutions need to develop coherent policies on AI ethics, academic integrity, data protection, and assessment. UNESCO (2023) emphasizes that institutional readiness and governance are prerequisites for safe and effective AI deployment. This was echoed by students in this study, who found that policy inconsistencies across modules were demotivating and confusing.

(3) Support student motivation, autonomy, and competence in ethical use of AI

The study found that engagement increased when students perceived progress, understood task objectives, and were confident in using AI responsibly. Therefore, institutions could incorporate AI literacy modules, reflective tasks, and formative assessment into their curricula. This is consistent with recent recommendations on integrating AI ethics and critical digital skills

into higher education (APEC, 2023; Vuorikari *et al*., 2022).

Contributions to the Literature

This study contributes to the field in three ways:

(1) Extending the CIPO model to the context of AI-assisted English language learning, and demonstrating with empirical data that learning engagement is most strongly influenced by two components: Process and Context.

(2) Challenging traditional views of technology acceptance, which often overemphasize the role of attitudes as the primary driver of learning engagement.

(3) Proposing a practice-oriented governance framework that integrates governance, pedagogy, and learner experience, thereby responding to regional recommendations for building a systemic strategy for AI-enhanced education.

6. Conclusions, Limitations and Recommendations

This study provides evidence that student engagement in AI-enabled English learning environments is primarily shaped by systemic and pedagogical conditions, rather than solely by learners' attitudes or digital competencies. In both quantitative and qualitative data, the Process component emerged as the strongest determinant of engagement. Instructor support, task clarity, and post-task reflection were repeatedly identified as factors that transform AI tools from convenient tools to meaningful learning resources. This suggests that the core of engagement lies in how instructors design, direct, and organize AI-enabled learning tasks.

The Context component also plays a significant and complementary role. Engagement is significantly higher when organizational policies, digital infrastructure, and expectations for AI use are clearly, consistently, and transparently communicated across modules. In contrast, students reported reduced engagement when faced with ambiguous or conflicting regulations, suggesting that effective governance is central to supporting responsible and confident use of AI. These findings emphasize that engagement is not just a classroom-level issue, but also a governance issue that requires coordinated action at the institutional level.

In contrast, the Input component—student attitudes toward AI and digital competencies—did not significantly predict engagement after accounting for contextual and pedagogical factors. Although students had generally positive perceptions and average levels of digital readiness, these characteristics were not sufficient to sustain deep engagement. This suggests that Input factors act as facilitators rather than determinants, reinforcing the view that learner readiness must be embedded in appropriate pedagogical and organizational structures.

Novel contributions

Two key contributions distinguish this study. First, it extends the application of the CIPO model to the context of AI-mediated language learning by demonstrating that learning engagement operates as a system-level outcome, primarily shaped by Context and Process mechanisms. Second, the lack of a significant impact of the Input component challenges common assumptions in technology acceptance research, suggesting that positive attitudes and digital competence do not automatically translate into meaningful learning engagement without strong institutional and pedagogical support. These insights refine existing theories and open up new approaches to managing AI integration in higher education.

Limitations

While this study provides useful insights into student engagement in AI-enabled learning environments, several limitations should be acknowledged. First, the data were collected from a single technology-oriented university in Vietnam; therefore, the findings may not be fully generalizable to institutions with different organizational contexts or lower levels of digital infrastructure. Second, the study relied on self-reported survey data, which may be subject to social desirability bias. Future research could extend this line of inquiry by incorporating longitudinal designs or multi-institutional comparisons across the Asia-Pacific region to further examine the systemic mechanisms identified in the CIPO model.

Recommendations

Based on these findings, a number of recommendations can be made to improve the governance of AI-assisted English language teaching:

First, universities should prioritize the development of clear and consistent policies on the use of AI, ensuring students understand what is allowed, how to use AI ethically, and the role of AI in assessment and learning. Policy consistency should be maintained across programs, courses, and instructors, helping students avoid conflicting expectations.

Second, universities should invest in professional development for instructors that focuses on pedagogical competence, not just technical competence. Instructors should be supported in designing AI-integrated tasks that promote critical thinking, autonomy, creativity, and higher-order competencies. Training programs should emphasize how to build a framework to support the use of AI in the classroom, how to design prompts to create meaningful engagement, and how to guide students in evaluating and adjusting AI-generated output.

Third, infrastructure and support services need to be strengthened to create an environment that is conducive to responsible and effective use of AI. Stable internet access, licensed AI tools, security systems, and technical support services all contribute to increasing learner confidence. Additionally, schools can consider implementing workshops, mentoring programs, or online modules that help students develop the skills needed to interact with AI responsibly and effectively.

Finally, schools need to adopt a continuous improvement approach by monitoring learning engagement through indicators aligned with the CIPO model. Regularly collecting data on engagement, student experience, faculty feedback, and institutional readiness will help university leaders identify gaps, adjust policies, and improve pedagogical and technological strategies. This ensures that AI integration is aligned with learning and development goals based on real-world needs.

In summary, research shows that successful AI-assisted English learning depends on a well-coordinated system of organizational governance, faculty capacity, and learner experience. Engagement increases when these elements work in harmony and decreases when they are fragmented. By embedding governance strategies within the CIPO framework, universities can build AI-enhanced learning environments that are pedagogically meaningful, ethical, and sustainable over time.

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The authors declare that there is no conflict of interest regarding the publication of this study.

Author contributions

1. Do Thi Thu: Conceptualization, Methodology, Software, Writing – Original Draft.

2. Do Thi Thu Ha: Investigation, Formal Analysis, Writing – Review & Editing.

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