

Critical Literacy in the AI Era: Student Perceptions of the ‘Prompt-Observe-Evaluate’ Method in an Engineering Fintech-Focused EAP Course

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Abstract

Integrating Generative AI into English for Academic Purposes (EAP) risks inducing “cognitive offloading,” where thinking processes are outsourced to AI, undermining the critical literacy engineering students need to analyze complex Fintech issues. This two-year action research study (2024–2025) at the Chinese University of Hong Kong (N=96) evaluated whether constraint-based AI protocols can successfully shift AI from a simple content generator to a metacognitive scaffold. Using mixed methods (surveys and interviews), the study examined an intervention featuring a “Prompt-Observe-Evaluate” reading protocol and “Persona-Based” writing feedback, explicitly banning direct AI summarization. Results showed significantly increased student self-efficacy in ethical AI use. Students also reported improved critical thinking, driven by the requirement to verify AI outputs against source texts to spot hallucinations and bias. By 2025, 100% of participants recognized ethical risks like dependency and data privacy. Ultimately, these findings suggest that EAP instruction requires “human-in-the-loop” constraints, positioning AI as a collaborative reasoning partner rather than a substitute for active cognitive engagement.

Keywords

critical literacy, generative AI, metacognition

Introduction

The rapid integration of Generative AI (GenAI) into higher education has driven a fundamental shift in English for Academic Purposes (EAP). Traditionally, EAP curricula focus on the process of writing and reading as the primary vehicle for developing critical thinking. However, the emergence of Large Language Models (LLMs) capable of instant synthesis and composition creates a unique challenge: the risk of “cognitive offloading,” where students bypass the struggle of articulation and analysis required for deep learning (McMinn, 2025).

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This challenge is particularly relevant in specialized EAP contexts such as ELTU2024: English for Engineering Students, a course designed to build literacy on Financial Technology (Fintech) issues. Engineering students, often pragmatic in their approach to problem-solving, may view writing tasks as transactional outputs rather than opportunities for cognitive development. In a course where the primary learning outcomes include “critically evaluating information sources” and “fostering lifelong learning”, an objective directly aligned with the university’s core graduate attribute of equipping students to adapt to future technological disruptions (The Chinese University of Hong Kong [CUHK], 2025a), the unguided use of AI threatens to reduce students to passive editors of machine-generated text.

Conversely, if properly scaffolded, AI offers the potential to act as a “reasoning partner,” shifting the student’s role from critical evaluator to content generator. The central pedagogical tension addressed in this study is the conflict between AI’s efficiency and the EAP goal of metacognitive engagement. Metacognition, defined as the ability to monitor and regulate one’s own thinking, is essential for evaluating the “credibility and reliability” of Fintech news, a core requirement of the ELTU2024 curriculum. If students utilize AI simply to summarize articles without first cultivating the foundational capacity to independently generate content, they fail to develop the “evaluative judgment” necessary to detect bias or hallucination. Therefore, this study posits that for AI to empower rather than diminish the student mind, it must be integrated through strict, constraint-based protocols that force the student to remain the “human-in-the-loop.”

Literature Review

AI as a Catalyst for Metacognitive Growth in EAP

Academic discourse consistently highlights the potential of AI to enhance various aspects of learning, particularly within the domain of English for Academic Purposes (EAP). While Generative AI (GenAI) tools are often viewed merely as efficiency engines (McMinn, 2025), recent scholarship suggests they can be transformative for enhancing learning outcomes and global education goals when integrated strategically (Iqbal et al., 2025).

The Role of Metacognition in EAP Writing

Metacognition, the awareness, and regulation of one’s own cognitive processes, is a critical component for successful learning outcomes (Zimmerman & Moylan, 2009). In the specific context of EAP and academic writing, metacognition is essential. Writers must draw extensively on metacognitive skills to generate internal feedback, plan arguments, and regulate their writing processes (Cho et al., 2010). Studies emphasize that metacognitive awareness, specifically regarding feedback literacy strategies, significantly predicts academic writing proficiency (Teng & Ma, 2024). However, the introduction of AI into EAP presents a unique challenge: the risk that students will bypass these internal regulatory processes by offloading the cognitive labor of writing to the algorithm. Therefore, the pedagogical challenge lies in using AI to support rather than replace these metacognitive functions (Teng, 2025).

Scaffolding Reflective Practices and Feedback

To address this challenge, recent research proposes using AI to support reflective practices. Neshaei et al. (2025) argue that GenAI tools can facilitate metacognitive processes by providing adaptive feedback and insights into writing patterns, enabling students to reflect more effectively on their learning journey. This is supported by findings that AI-enabled writing assistants can enhance reflective writing by offering personalized, interactive support that simulates instructor interactions (Rad et al., 2023). Furthermore, AI-assisted feedback provides immediate, contextualized suggestions that can boost student motivation and self-efficacy (Huang & Mizumoto, 2024). Unlike potentially unreliable human peer feedback, the consistent nature of AI feedback helps students understand and question their drafts, provided they possess the “feedback literacy” to interpret it critically (Teng & Ma, 2024).

Cultivating Critical Thinking and Evaluative Judgment

Beyond feedback, AI serves as a potent tool for developing evaluative judgment, a core EAP competency. Teaching fact-checking through deliberate AI errors helps students cultivate appropriate skepticism towards AI-generated information (Eaton, 2025). By analyzing AI error patterns, students develop critical thinking skills and a mental model of AI capabilities that prevents both over-reliance and unnecessary cynicism (Cong-Lem et al., 2025). This aligns with the argument that AI literacy curricula must incorporate self-regulated learning concepts (McMinn, 2025). Designing course-specific chatbots that intermittently prompt students to reflect on problem-solving strategies and break down complex tasks is essential. Such “human-in-the-loop” interventions prevent cognitive laziness and ensure that students remain the intellectual drivers of the writing process.

Shared Metacognition and Cognitive Offloading

Finally, it is important to distinguish between harmful dependency and beneficial “Shared Metacognition” (SMC). Iqbal et al. (2025) describe SMC as a process of collaborative reflection where AI supports shared problem-solving. In this view, “Cognitive Offloading,” the practice of delegating mental labor to external tools—is not necessarily an evasion of work (Risko & Gilbert, 2016). As McMinn (2025) notes, while offloading can lead to cognitive laziness, it can also be a strategic choice to free up mental resources for higher-order thinking. To prevent detrimental offloading, educators must employ “Strategic Integration,” defined within this study as the deliberate application of pedagogical constraints. Aligning with Sidra and Mason (2024), who assert that human oversight is mandatory because AI systems lack self-awareness, this study argues that effective integration requires the friction of verification. Furthermore, evaluative judgment necessitates foundational writing proficiency. As Hudson (2025) observes, students must wrestle with the mechanics of composition to genuinely internalize knowledge. Consequently, robust AI pedagogy requires a “Write First” imperative, wherein students produce initial drafts independently before utilizing AI as a comparative feedback mechanism.

Defining “Strategic Integration”

In this study, we define “Strategic Integration” not merely as adoption, but as the deliberate application of pedagogical constraints. This definition builds upon the framework of metacognitive thinking proposed by Sidra and Mason (2024), which argues that human workers must monitor and evaluate AI output because AI systems lack self-awareness. Aligning with this view, the

course's restricted-use policy applied integration by limiting student agency. By forbidding the "summarize this" command, the protocol forced students to engage in evaluative judgment rather than passive consumption. The data supports this interpretation. The 11.63% of students who reported manually reviewing AI errors were actively auditing the algorithm. This suggests that strategic integration requires the friction of verification to prevent the decline of cognitive skills.

The "Write First" Imperative

It is widely acknowledged that evaluative judgment requires foundational writing skills. Students cannot effectively critique a summary if they lack the ability to construct one. As Hudson (2025) argues, students must struggle with the details and wrestle with the facts of composition to truly make knowledge their own. Addressing this prerequisite, the study's design explicitly mandated a generative-first workflow. Assessment B required students to draft their initial summaries and opinion pieces without AI assistance (the Human Draft phase) before engaging the peer-review bot. This sequencing ensured that the AI functioned strictly as a feedback mechanism on student-generated thought, rather than a substitute for the initial mental labor of composition.

The Research Gap and Objectives

While current literature predominantly examines GenAI as an efficiency tool, there is a notable lack of empirical data regarding the pedagogical impact of constraint-based protocols in specialized Engineering contexts. Few studies have moved beyond general literacy to investigate how restricting AI functionality impacts learner self-efficacy. Consequently, this study addresses this gap by evaluating student perceptions of the "Prompt-Observe-Evaluate" (POE) method, a constraint-based protocol that strictly forbids direct AI summarization in favour of rhetorical analysis and manual verification.

Specifically, this study investigates four primary Research Questions (RQs):

- RQ1: Baseline Adoption and Beliefs: What is students' prior exposure to AI and their baseline beliefs regarding its efficacy and accuracy in academic tasks? (Addressed via Pre-Course Survey Items 1–7)
- RQ2: Learner Self-Efficacy: How does constraint-based AI use affect student confidence regarding proper and ethical academic integration? (Addressed via Post-Course Survey Item 6)
- RQ3: Critical Thinking and Pedagogy: How does the POE method impact students' self-reported critical thinking and evaluative skills? (Addressed via Post-Course Survey Items 1, 8-11, and semi-structured interviews)
- RQ4: Ethics and Policy: How do student attitudes toward academic integrity and university AI policy shift after mandatory, restricted AI use? (Addressed via Post-Course Survey Items 3-4, 7, and 12-14)

Methodology

The methodology for this study was designed to directly investigate the four research objectives outlined above. Because these objectives focus on students' perceptions of AI use, their self-efficacy, and their evaluative judgment, a mixed-methods approach was adopted. This allows the study to capture broad trends across the cohort through surveys, while providing deeper qualitative

explanations through interviews. To ensure the data meaningfully addressed the research questions, each instrument was explicitly linked to the study's objectives:

- **RQ1 (Baseline Adoption and Beliefs):** Addressed via the **pre-course survey**. This established students' starting point before they encountered the POE protocol, measuring usage frequency, perceived benefits, and initial concerns like over-reliance.
- **RQ2 (Learner Self-Efficacy):** Addressed via the **post-course survey**. Confidence-rating items were used to measure growth in student self-efficacy following structured, constraint-based AI use.
- **RQ3 (Critical Thinking and Pedagogy):** Addressed through both the **post-course survey** and **semi-structured interviews**. This combination clarified the mechanism behind the changes, explaining how the POE cycle prompted students to act as evaluators.
- **RQ4 (Ethics and Policy):** Addressed via **post-course survey** items on academic integrity, alongside **interviews** that probed students' reactions to submitting unedited AI transcripts.

By building the data collection around naturally occurring, mandatory course assessments, the methodology preserves ecological validity and ensures the findings reflect authentic classroom practice.

Context and Participants

This study was conducted within ELTU2024: English for Engineering Students I, a specialized EAP course at the Chinese University of Hong Kong. Because this course heavily emphasizes the critical analysis of dense technical texts, it serves as an ideal environment for investigating the mechanics of cognitive offloading. The participants were undergraduate engineering students ($N=96$ invited) enrolled during the 2024 and 2025 academic years. The sample represents a population with high technical aptitude but varying levels of critical AI literacy.

Pedagogical Intervention: The POE Protocol

To evaluate the impact of AI on metacognition, the course utilized a restricted-use policy, formally designated by the university's academic integrity guidelines as "Approach 2: Use only with prior permission." Under this institutional framework, students are permitted to use AI tools only in specific, instructor-defined scenarios; furthermore, educators are required to clearly communicate which tools are allowed, how they may be applied, and the pedagogical rationale behind these constraints (CUHK, 2025b). This framework was implemented through two major assessments (50% of the total grade) designed to force a human-in-the-loop workflow:

Assessment A: The group summary report (reading and synthesis). This assessment (25%) required students to synthesize four to six online Fintech articles. The course explicitly forbade the command "Do not ask AI to summarize." Students were permitted to use DeepSeek-V3 only via the Prompt-Observe-Evaluate (POE) cycle. They were required to run specific prompts to isolate rhetorical elements, such as "Identify bias through omission" or "Analyze funding sources," and then manually verify the AI's output against the source text. To ensure compliance, students were required to submit their AI conversations. (See Appendix D for a Group Summary sample, which includes direct links to the unedited AI transcript conversations). Students were then required to submit their work to our university's Veriguide plagiarism and AI detection system.

Assessment B: Individual reflections (writing and feedback). This assessment (25%) consisted of five reflections where students read an article and wrote a summary and opinion piece. It was very important that the initial summary and opinion be written without AI assistance. To ensure this, students were provided with an unnamed article and spent 30 minutes in class reading, annotating, and discussing the author's main points. Then, the instructor would lead a 10-minute question and answer session to make sure that the class had identified all the key points of the article. The first and fifth assessments were done in class via a lockdown browser, while for assessments two, three and four, the students were allowed to take the article home with them to complete the assignment.

After drafting, students were required to use the AI as a Peer Reviewer using a specific instructor-provided prompt (See Appendix C for the specific prompt text, and Appendix E for an Article Reflection summary sample). Students then wrote a Language Reflection paragraph without AI assistance, critiquing the AI's suggestions and specifically evaluating whether the AI's corrections were accurate. As with assessment A, each article reflection was submitted to Veriguide.

Data Collection Instruments

The study employed three primary instruments designed to align with the theoretical frameworks of self-regulated learning. The specific perceived benefits and drawbacks categorized in the survey instruments (e.g., timesaving, objective analysis, contextual nuances) were deliberately formulated based on the primary learning outcomes of the ELTU2024 curriculum and recurring thematic concerns identified during preliminary pilot discussions with engineering cohorts. As the survey questions remained identical across both the 2024 and 2025 cohorts, the complete, consolidated survey instruments are available in Appendices A and B.

Pre-Course Survey (Baseline): Administered in Week 1, this measured usage frequency and perceived risks (such as over-reliance) to establish a baseline for AI readiness.

Post-Course Survey (Impact): Administered in Week 13, this measured Learner Self-Efficacy (Bandura, 1977) and the attribution of critical thinking skills.

Semi-Structured Interviews: To triangulate quantitative data, interviews were conducted with a subset of students (n=8). These focused on the user experience of the POE method, probing instances where the AI provided conflicting advice.

Data Analysis

Quantitative data from surveys were analyzed to identify shifts in student perceptions regarding self-efficacy and ethical awareness. Qualitative data from interviews were coded thematically to explain why specific shifts occurred, focusing on how the POE method influenced critical thinking.

Results

The data from the 2024 and 2025 cohorts ($N=89$ respondents total) reveals substantial shifts in student perceptions regarding AI utility, self-efficacy, and ethical awareness. To directly address the research objectives, the findings below are synthesized into thematic categories rather than presenting individual survey questions chronologically.

Baseline Adoption and the Shift in Perceived Utility (RQ1)

The pre-course survey established that students entered the course with high technical familiarity but unrefined academic strategies. As shown in Table 1, approximately 66% to 70% of students reported frequent usage of AI prior to the course, indicating a population that had moved well beyond the novelty phase.

Table 1. Have you Used any AI tools? (Pre-Course)

Have you used any AI tools?	2024 (%)	2025 (%)
Yes, I have used AI tools frequently.	70.45	66.67
Yes, but only a few times.	29.55	33.33
No, but I am open to trying them.	0.00	0.00
No, and I am not interested in using them.	0.00	0.00

Initially, students viewed AI primarily as an engine for cognitive offloading. When asked to select from predefined survey options, pre-course expectations were heavily weighted toward time and effort savings (over 90%), while approximately 80% anticipated benefits in objective analysis (Table 2).

Table 2. Potential Benefits of AI Integration (Pre-Course Perceptions)

Potential benefits of using AI to help summarize, analyze, and proofread?	2024 (%)	2025 (%)
Saves time and effort, allowing more focus on content creation.	90.91	91.67
Provides objective analysis and proofreading, reducing human error.	81.82	79.17
Processes and analyzes large amounts of data quickly.	81.82	79.17

Note. Respondents could select multiple options; percentages do not sum to 100%.

However, following the intervention, post-course data revealed an important shift. The perception of AI as merely a time-saver decreased slightly, while its valuation for objective analysis increased to 86% (Table 3). This synthesis of the data addresses the initial research questions by demonstrating that the strict POE prompting protocols successfully taught students that effective AI use requires dedicated time and effort but yields much higher analytical value.

Table 3. Potential Benefits of AI Integration (Post-Course Realizations)

Potential benefits of using AI to help summarize, analyze, and proofread?	2024 (%)	2025 (%)
Time and effort savings, allowing more focus on content creation.	88.37	88.37
Objective analysis and proofreading reducing human error.	86.05	86.05
Processing and analyzing large amounts of data quickly.	83.72	83.72

Note. Respondents could select multiple options; percentages do not sum to 100%.

Regarding potential drawbacks, baseline awareness of AI limitations was already pronounced. Over 80% of students were initially concerned about over-reliance and contextual nuances (Table 4). Notably, the pedagogical intervention did not alleviate these concerns; rather, it reinforced them.

Table 4. Perceived Potential Drawbacks of AI (Pre-Course Baseline)

Potential drawbacks of using AI to help summarize, analyze, and proofread?	2024 (%)	2025 (%)
AI may not fully understand context or nuances in language.	81.82	79.17
Over-reliance on AI may decrease one's critical thinking and language skills.	84.09	83.33
AI tools might make mistakes or miss subtle errors that a human would catch.	81.82	79.17

Note. Respondents could select multiple options; percentages do not sum to 100%.

As shown in Table 5, tracking these parameters post-course reveals a slight elevation in critical awareness across both linguistic limitations and cognitive vulnerabilities.

Table 5. Perceived Potential Drawbacks of AI (Post-Course)

Potential drawbacks of using AI to help summarize, analyze, and proofread?	2024 (%)	2025 (%)
AI may not fully understand context or nuances in language.	83.72	83.72
Over-reliance on AI may decrease one's	86.05	86.05

critical thinking and language skills.

AI tools might make mistakes or miss subtle errors that a human would catch.	83.72	83.72
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Note. Respondents could select multiple options; percentages do not sum to 100%.

When identifying their primary concern, over-reliance dominated both before and after the course (Tables 6 and 7). Qualitative data from the semi-structured interviews corroborates this lingering apprehension. As one participant articulated: "I was constantly worried that if I indiscriminately accepted the AI's structural revisions, my writing would lose its authentic voice and I would become dependent on the tool for fundamental assignments." However, post-course data revealed a positive shift wherein an increased proportion of students concluded that the analytical benefits outweigh the inherent risks.

Table 6. Primary Concerns Regarding AI Application (Pre-Course Baseline)

Do you have any concerns about using AI tools for critical analysis?	2024 (%)	2025 (%)
Yes, I'm concerned about accuracy.	38.64	37.50
Yes, I'm worried about over-reliance.	47.73	54.17
No, I trust the technology entirely.	0.00	0.00
I have concerns, but benefits outweigh them.	13.64	8.33

Table 7. Primary Concerns Regarding AI Application (Post-Course)

Do you have any concerns about using AI tools for critical analysis?	2024 (%)	2025 (%)
Yes, I'm concerned about accuracy.	39.53	34.88
Yes, I'm worried about over-reliance.	51.16	48.84
No, I trust the technology entirely.	0.00	2.33
I have concerns, but benefits outweigh them.	9.30	13.95

Growth in Learner Self-Efficacy (RQ2)

A primary objective of the study was to measure changes in student confidence regarding the proper academic use of AI. Despite being frequent casual users, students entered the course with only moderate confidence, scoring 6.21 out of 10 in the 2025 cohort (Table 8). Post-course confidence scores rose substantially to 8.05 (Table 9).

Table 8. Pre-Course Student Self-Efficacy Scores (Scale 1–10)

Cohort Year	Mean Score
2024	6.77
2025	6.21

Table 9. Post-Course Student Self-Efficacy Scores (Scale 1–10)

Cohort Year	Mean Score
2024	7.63
2025	8.05

This increased self-efficacy was particularly evident in specific tasks like proofreading. Initially, only 16% to 20% of students viewed AI as very effective for proofreading (Table 10).

Table 10. Perceived Effectiveness of AI Proofreading (Pre-Course Baseline)

How effective do you think AI is in proofreading documents?	2024 (%)	2025 (%)
Very effective, catches more than I do.	20.45	16.67
Somewhat effective, misses some errors.	65.91	66.67
Neither effective nor ineffective.	4.55	4.17
Somewhat ineffective, misses subtle bugs.	9.09	12.50
Very ineffective.	0.00	0.00
Never used AI for proofreading before.	0.00	0.00

After practicing the Persona-Based prompt, which required students to explicitly instruct the AI to use an “informal but non-colloquial” tone, the percentage of students rating AI as very effective more than doubled to 37.21% in 2025 (Table 11). This demonstrates that targeted constraints directly improve student self-assurance.

Table 11. *Perceived Effectiveness of AI Proofreading (Post-Course Assessment)*

How effective do you think AI is in proofreading documents?	2024 (%)	2025 (%)
Very effective, catches more than I do.	34.88	37.21
Somewhat effective, misses some errors.	60.47	58.14
Neither effective nor ineffective.	2.33	0.00
Somewhat ineffective, misses subtle bugs.	2.33	2.33
Very ineffective.	0.00	2.33
Never used AI for proofreading before.	0.00	0.00

Critical Thinking and the POE Method (RQ3)

The study sought to determine if the POE method could prevent cognitive laziness. Synthesizing the impact data provides a clear answer. Zero percent of students reported no impact on their critical thinking skills. Instead, 27.91% explicitly stated they learned to use AI as a guide rather than a definitive answer, and 11.63% reported actively identifying issues in the AI output to manually review them (Table 12).

Table 12. *Self-Reported Impact of Restricted AI Use on Critical Thinking*

How did using AI tools during the course impact your critical thinking skills?	2024 (%)	2025 (%)
Helped develop skills by using AI as a guide, not a definitive answer.	23.26	27.91
Compared AI analysis with my own and noted discrepancies.	2.33	2.33
Used AI to identify potential issues and manually audited them.	13.95	11.63
All of the above activities combined.	60.47	58.14
I did not find any measurable impact.	0.00	0.00

The qualitative interviews thoroughly explicate this development. Students indicated that the friction introduced by the POE protocol compelled them to act as auditors. As one student noted, observing the AI failed to accurately identify a funding source mandated that they scrutinize the source text to rectify the output. These self-reported outcomes indicate that the POE cycle effectively reconfigured the conventional instructional hierarchy, elevating the student to the position of primary evaluative authority (Table 13).

Table 13. Overall Evaluative Experience with Constraint-Based AI Pedagogy

How would you describe your overall experience with AI during the course?	2024 (%)	2025 (%)
Very positive, learned a lot from tools.	46.51	60.47
Somewhat positive, encountered challenges.	51.16	37.21
Neutral evaluation.	2.33	2.33
Somewhat negative, hindered learning.	0.00	0.00
Very negative, severely detracted.	0.00	0.00

Ethical Awareness and Policy Preferences (RQ4)

The final objective assessed attitudes toward academic integrity. In 2025, ethical awareness reached total saturation, with 100% of respondents identifying every listed ethical risk, including dependency, unfair advantage, and data privacy (Table 14).

Table 14. Ethical Implications of AI Integration in Coursework and Assessments

Ethical Implications of allowing university students to use AI in their course work and assessments?	2024 (%)	2025 (%)
It may create an unfair advantage for students who have more access to AI technology.	90.91	100.00
It may limit the development of critical thinking skills as students may rely too much on AI.	90.91	100.00
It could potentially lead to a lack of diversity and creativity in student work.	90.91	100.00
It may create dependency on AI technology, hindering independent problem-solving skills.	90.91	100.00
It may compromise the privacy and confidentiality of student data.	90.91	100.00
It could widen the digital divide among students with different socioeconomic backgrounds.	90.91	100.00

Note. Respondents could select multiple options; percentages do not sum to 100%.

Regarding university policy, students showed a strong preference for regulated use both before and after the course. In the post-course survey, 62.79% supported AI use only with restrictions and guidelines to prevent misuse, rejecting total bans and total freedom (Tables 15 and 16). Notably, the percentage of students who felt AI inherently compromises development remained negligible at 2.33%. This synthesis confirms that students view AI as a legitimate educational tool that requires strict institutional governance.

Table 15. Student Perceptions of AI Content Creation (Pre-Course Baseline)

Should the university allow students to create content with AI for assessment purposes?	2024 (%)	2025 (%)
Yes, it will foster innovation among students.	18.18	16.67
No, it may compromise the integrity of academic assessments.	9.09	4.17
Yes, but with proper guidelines and restrictions to maintain academic standards.	68.18	70.83
No, it may lead to academic dishonesty or plagiarism.	4.55	8.33

Table 16. Student Perceptions of AI Content Creation (Post-Course)

Do you think the university should continue allowing students to create content with AI tools?	2024 (%)	2025 (%)
Yes, it's a useful tool that can enhance learning and productivity.	37.21	30.23
No, it may compromise the development of students' own skills.	2.33	2.33
Yes, but with certain restrictions and guidelines to prevent misuse.	60.47	62.79
No, because not all students may have equal access to AI technology.	0.00	0.00
Yes, equal access to AI technology for all students.	0.00	4.65

Discussion

This study aimed to determine if the strategic integration of AI could enhance metacognitive engagement. The findings suggest that when AI is framed as a constraint-based tool, it fosters critical literacy.

Correlating Self-Efficacy with Metacognitive Literature

The marked increase in student self-efficacy regarding AI proofreading (rising from a mean of 6.21 to 8.05) provides empirical support for Teng's (2025) assertion that AI-assisted feedback elevates student confidence, provided the learners possess the requisite literacy to interpret it. Because the POE method explicitly mandated the composition of a post-AI Language Reflection in which students critiqued the algorithm's suggestions, participants were forced into the active self-regulation loop modeled by Zimmerman and Moylan (2009). The students did not passively offload their cognitive labor; instead, they engaged in "Shared Metacognition" (Iqbal et al., 2025), treating the AI as an interactive peer rather than an infallible oracle.

Ethics and the "Transcript Effect"

The attainment of 100% ethical awareness in the 2025 cohort suggests that abstract theoretical discussions of academic integrity are less effective than rigorous procedural requirements. By compelling students to submit unedited AI transcripts, the curriculum rendered the "black box" of AI interaction transparent. Students could not conceal their dependency; they were required to document it. This transparency likely heightened their awareness of over-reliance, validating Rashid's (2025) warning that habitual AI usage necessitates rigorous, transparent assessment policies to prevent the erosion of independent thought.

Significance of the Study

The significance of these findings lies in their practical application for curriculum designers. Much of the current discourse treats AI either as an unstoppable cheating mechanism or a flawless efficiency engine. This study proves a middle ground exists. Based on the finding that 62.79% of students actively support restricted AI use with proper guidelines, this study demonstrates that engineering students are not inherently seeking to bypass cognitive labor. Rather, they recognize that over-reliance threatens their own skill development. Furthermore, the substantial increase in learner self-efficacy (rising to a mean of 8.05) and the universal recognition of ethical risks provide empirical validation for the Prompt-Observe-Evaluate method. Ultimately, this study offers curriculum designers a practical, context-specific blueprint. By shifting the assessment focus from open-ended content generation to constraint-based evaluation, such as the mandatory submission of AI transcripts, EAP courses can successfully adapt to the AI era without sacrificing academic rigor or student metacognition.

Limitations

While these findings are promising, several limitations must be noted. First, the sample size (N=89 over two years) is relatively small and limited to a single institution in Hong Kong. Second, the participants were engineering students, who may possess higher baseline technical literacy than students in other disciplines. Therefore, their rapid adoption of the prompting protocols might not be generalizable to all EAP contexts. Finally, the switch from ChatGPT 3.5 in 2024 to DeepSeek-

V3 in 2025 introduced a variable in tool performance that may account for some differences in student satisfaction scores.

Conclusion

The integration of Generative AI into higher education does not inherently necessitate a compromise in critical thinking. As this two-year action research study demonstrates, engineering students are highly capable of navigating the tension between algorithmic efficiency and cognitive engagement, provided the pedagogical framework is sufficiently robust.

These findings challenge the prevailing narrative that students predominantly utilize AI to circumvent cognitive labor. Supported by the empirical finding that 62.79% of post-course respondents actively prefer restricted AI use governed by institutional guidelines, it is evident that engineering students seek structured guidance rather than illicit shortcuts. They demonstrate a clear recognition that unmonitored over-reliance actively threatens their own professional and intellectual development.

For EAP curriculum designers, the actionable insight is definitive: educators must enforce a “write-first” imperative and embed human-in-the-loop protocols within assessments. By shifting the task prompt from “Write a summary” to “Evaluate the AI’s summary for bias,” and by institutionalizing mandatory AI transcript submissions, educators transform a potential mechanism for cheating into a rigorous metacognitive scaffold.

While this study was constrained by a localized sample size and a discipline-specific cohort, the success of the Prompt-Observe-Evaluate protocol offers a viable blueprint for GenAI assessment adaptation. Future research should seek to replicate these constraint-based methodologies across disparate disciplines, such as the humanities and social sciences, to determine if this Strategic Integration model remains effective outside of engineering contexts. Furthermore, subsequent studies would benefit from incorporating longitudinal tracking of objective student writing rubrics, thereby corroborating these self-reported perceptions of critical thinking with quantifiable performance metrics.

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Appendix A: Pre-Course Survey Questionnaire (Administered to 2024 and 2025 Cohorts)**Section 1: General Use of AI Tools****1. Have you used any AI tools?**

- Yes, I have used AI tools frequently.
- Yes, but only a few times.
- No, but I am open to trying them.
- No, and I am not interested in using them.

2. If you have used AI tools, please describe your experience.

(Open-ended)

3. Have you used any AI tools for summarizing articles or text in your university studies?

- Yes
- No
- Occasionally, but not regularly

4. Have you used any AI tools to proofread or help correct your language?

- Yes, I use AI tools to proofread my work all the time.
- I have used them occasionally when I am unsure about my language.
- No, I rely on my own language skills or ask others for help.
- I didn't know AI tools could be used for proofreading.

5. If you have used AI tools to proofread or help correct your language, which ones have you tried?

(Open-ended — examples shown: Grammarly, ChatGPT, Poe)

Section 2: Perceptions of AI Use**6. How effective do you think AI is in proofreading documents?**

- Very effective — it catches more errors than I do.
- Somewhat effective — it catches some errors but misses others.
- Neither effective nor ineffective.
- Somewhat ineffective — it often misses errors or makes incorrect corrections.
- Very ineffective.
- I have never used AI for proofreading, so I can't say.

7. How can students develop their critical thinking skills when using AI tools?

- By using AI tools as a guide, not a definitive answer.
- By comparing AI analysis with their own and noting differences.
- By using AI tools to identify potential issues and then manually reviewing these issues.
- All of the above.

8. What are the potential benefits of using AI to help summarize & analyze articles and proofread writing?

- It can save time and effort, allowing more focus on content creation.
- It can provide objective analysis and proofreading, reducing human error.
- It can process and analyze large amounts of data quickly.
- All of the above.

9. What are the potential drawbacks of using AI?

- AI may not fully understand context or nuances in language.
- Over-reliance on AI may decrease one's own critical thinking and language skills.
- AI tools might make mistakes or miss subtle errors that a human would catch.
- All of the above.

10. Do you have any concerns about using AI tools for critical analysis, summarization, or proofreading?

- Yes, I'm concerned about the accuracy of AI tools.
- Yes, I'm worried about becoming overly reliant on AI tools.
- No, I trust the technology and find it helpful.
- I have some concerns, but the benefits outweigh them.

11. How confident are you in your abilities to properly utilize AI in this course?

(Scale 1–10)

Section 3: Institutional Policy Questions

12. Should the university allow students to create content with AI?

- Yes, it's a useful tool that can enhance learning and productivity.
- No, it may compromise the development of students' own skills.
- Yes, but with certain restrictions and guidelines to prevent misuse.
- No, because not all students may have equal access to AI technology.

13. Should the university allow students to create AI-generated content for assessment purposes?

- Yes, it will foster innovation among students.
- No, it may compromise academic assessment integrity.

- Yes, but with proper guidelines and restrictions to maintain academic standards.
- No, it may lead to academic dishonesty or plagiarism.

14. Ethical implications (ranking question):

Rank the following from most to least important:

1. May limit development of critical thinking
2. May create dependency on AI
3. May reduce diversity and creativity in student work
4. May create unfair advantage because of unequal access
5. May compromise privacy and confidentiality of student data
6. May widen the digital divide

15. Additional comments or concerns about using AI tools in the course

(Open-ended)

Appendix B: Post-Course Survey Questionnaire (Administered to 2024 and 2025 Cohorts)**1. How did using AI tools during the course impact your critical thinking skills?**

- It helped me develop critical thinking by using AI tools as a guide, not a definitive answer.
- I compared AI analysis with my own and enhanced my critical thinking skills.
- I used AI tools to identify potential issues and then manually reviewed them.
- All of the above.
- I did not find any impact on my critical thinking skills.

2. What are the main benefits you experienced when using AI tools?

- Time and effort savings, allowing more focus on content creation
- Objective analysis and proofreading, reducing human error
- Processing and analyzing large amounts of data quickly
- All of the above
- Other (open-ended)

3. What were the potential drawbacks of using AI?

- AI may not fully understand context or nuances in language
- Over-reliance may decrease critical thinking/language skills
- AI may miss subtle errors
- All of the above
- Other (open-ended)

4. Do you still have concerns about using AI tools?

- Yes, accuracy concerns
- Yes, concerns about over-reliance
- No, I trust the technology
- I have concerns, but the benefits outweigh them
- Other

5. How effective is AI at proofreading documents?

- Very effective
- Somewhat effective
- Neither effective nor ineffective
- Somewhat ineffective
- Very ineffective
- I have never used AI for proofreading

6. How confident do you feel in your ability to use AI tools after completing the course?

(Scale 1–10)

7. Should the university continue allowing students to create content with AI tools?

- Yes, it enhances learning and productivity
- No, it may compromise skills
- Yes, but with restrictions
- No, due to unequal access
- Other

8. How would you rate the integration of AI tools in the course?

- Excellent
- Good
- Fair
- Poor
- Very poor

9. What improvements would you suggest for future iterations of the course?

- More guidance on how to use AI tools effectively
- More opportunities to use AI in practical assignments
- More ethics discussions
- Less reliance on AI
- Other

10. Did you find the AI tools user-friendly?

- Very user-friendly
- Somewhat user-friendly
- Neutral
- Not very user-friendly
- Not at all user-friendly

11. How would you describe your overall experience with AI tools in the course?

- Very positive
- Somewhat positive
- Neutral
- Somewhat negative
- Very negative

12. How likely are you to use AI tools in the future (study/work)?

(Scale 1–10)

13. Did the course's use of AI tools prepare you for the future workplace?

- Yes, significantly
- Yes, to some extent
- Neutral
- No (but not less prepared)
- No, less prepared

14. Should the course continue using AI in the future?

- Yes
- No

15. Suggestions for future cohorts

(Open-ended)

Appendix C: Instructor-Provided "Peer Review" Persona Prompt (Assessment B)

I am a non-native English university student in Hong Kong, and my professor has asked me to summarize an online article and provide an opinion using only an informal, conversational, tone of English. Can you please review my writing and provide feedback on grammatical errors, structural issues, vocabulary usage, writing voice consistency, tense usage, logical flow, sentence clarity and coherence, punctuation, spelling, keeping in mind that my tone MUST more informal but non-colloquial.

Instead of rewriting any sections, just provide a detailed list of suggestions for improvement and explain why these specific changes are suggested.

Appendix D: Group Summary Sample (Assessment A)

Gamification of Trading Apps: Balancing Engagement and Investor Protection

Financial technology has fundamentally transformed the landscape of retail investing through the integration of “gamification” into trading applications. Many of them like Robinhood, Futubull include game-like features—leaderboards, achievement badges, and confetti animations that pop up after a trade. These features have brought in millions of new investors, many of whom might never have used a brokerage before. Supporters say this makes investing more accessible. By the contrary, critics argue that turning trading into a game can lead people to take risks they do not fully understand (Correspondent & Correspondent, 2025). Accordingly, this report explores the dual nature of gamified trading platforms by analysing their commercially driven engagement mechanisms, the psychological risks they pose to investors, and the differing regulatory approaches emerging to address these concerns.

Gamification fundamentally operates by optimizing platform engagement metrics, effectively transforming what were once utilitarian financial instruments into highly addictive, community-driven ecosystems. From a business-to-business perspective, features including competitive leaderboards, simulated fantasy funds, and real-time news alerts are widely celebrated for their capacity to substantially enhance user retention, prolong screen time, and ultimately drive platform revenue (Axcera, 2025; Team, 2025). For instance, although real-time news alerts are ostensibly marketed as indispensable tools for navigating economic turbulence, they may inadvertently overwhelm novice investors, steering them toward reactive trading behaviours rather than fostering strategic, long-term planning (Team, 2025). Moreover, while platform developers frequently contend that such interactive functionalities accelerate financial learning and cultivate investor confidence, their primary benchmarks for success remain corporate profitability and community stickiness, rather than the cultivation of genuine financial literacy (Axcera, 2025). Consequently, the underlying commercial logic prioritizes continuous user engagement, thereby establishing a foundation wherein a platform's financial prosperity becomes inextricably linked to sustaining high levels of user activity.

Building upon this engagement-driven framework, gamified mechanisms—amplified by social media trends—deliberately exploit cognitive biases, thereby encouraging addictive and inherently risky trading behaviours. Features such as push notifications and lottery-style rewards activate dopamine-driven feedback loops, closely mirroring the psychological mechanics of gambling rather than promoting disciplined, long-term investment strategies (Correspondent & Correspondent, 2025). The tangible harm arising from these practices is substantial; a controlled experiment conducted by the Financial Conduct Authority (FCA) conclusively demonstrated that Digital Engagement Practices significantly increased trading frequency by up to 12% and elevated the proportion of high-risk investments held by retail consumers. Notably, these effects disproportionately impacted younger, less experienced investors and those possessing lower levels of financial literacy (“FCA Keeps Trading Apps”, 2024).

This psychological exploitation reveals a deeply entrenched conflict of interest, which is a fundamental misalignment between the profit-driven models of trading platforms and the financial well-being of their retail clientele. Business models heavily dependent on Payment for Order Flow

(PFOF) inherently incentivize brokers to encourage high-frequency trading—a strategy statistically proven to generate financial losses for the overwhelming majority of retail investors (Correspondent & Correspondent, 2025). The inherent tension is unmistakable: a reckless trader generating substantial trading volumes is temporarily more profitable to the platform than a cautious, long-term investor. Thus, what proves beneficial for application growth—namely, increased trading frequency—directly contravenes a regulator's Consumer Duty to ensure safe, suitable, and fair investment outcomes (“FCA Keeps Trading Apps”, 2024). Additionally, while platforms occasionally temper their gamification strategies—for instance, by deliberately avoiding overtly “casino-like” aesthetics—critical analyses suggest such restraint is primarily a defensive measure designed to evade regulatory scrutiny, rather than a genuine ethical commitment to user welfare (Axcera, 2025).

In response to these systemic risks, regulators around the world are struggling to keep pace with digital engagement practices. Their approaches differ widely, reflecting deeper disagreements over how far to go in protecting consumers versus preserving market freedom. Currently, approaches adopted in the United States and the United Kingdom remain predominantly reactive. They rely heavily on post-hoc litigation or keeping applications “under review” without enacting specific, proactive prohibitions on deceptive interface designs (Btlj & Btlj, 2025; “FCA Keeps Trading Apps”, 2024). By contrast, the European Union has implemented a markedly proactive and paternalistic framework through initiatives, for example, the Retail Investment Strategy. The EU has taken a different path. It aims to make sure broker incentives are aligned with investor safety from the very beginning by proposing to ban practices like Payment for Order Flow outright. The message is clear that “preventing harm matters more than leaving markets completely unrestricted” (Btlj & Btlj, 2025).

In conclusion, gamified trading apps are a double-edged sword. They have opened up financial markets to more people than ever before, but they have also introduced real psychological and financial risks (Correspondent & Correspondent, 2025). At its core, the issue is straightforward that platforms benefit when users trade often. But that same activity can harm the very people they serve. If the goal is true financial inclusion, technology should be used to educate investors, not manipulate them. That will require regulation focused on long-term user well-being, not just engagement metrics. Therefore, both regulators and platform developers need to ensure that the tools designed to open markets do not end up exploiting the very people they aim to help.

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DeepSeek Appendix

FCA keeps trading apps under review over gaming concerns

Article Link: <https://www.fca.org.uk/news/press-releases/fca-keeps-trading-apps-under-review-over-gaming-concerns>

DeepSeek Link: <https://chat.deepseek.com/share/zwzaiz0obe01iey9th>

Financial news' role in times of economic disruption

Article Link: <https://www.norkon.net/financial-news-role-in-times-of-economic-disruption/>

DeepSeek Link: <https://chat.deepseek.com/share/mcfy3gryxhsmn1mep9>

Gamification in prop trading platforms: What works (And what does not)?

Article Link: <https://axcera.io/blog/gamification-in-prop-trading-platforms-what-works-and-what-does-not>

DeepSeek Link: <https://chat.deepseek.com/share/bl5qeoufuaz1w1mqol>

The gamification of investing with Robinhood - Global Business Outlook

Article Link: <https://globalbusinessoutlook.com/magazine/banking-and-finance-magazine/the-gamification-of-investing-with-robinhood/>

DeepSeek Link: <https://chat.deepseek.com/share/sq91re3ev6uce7idvm>

The Gamification of Investments: A comparative approach between the US and EU

Article Link: <https://btlj.org/2025/11/the-gamification-of-investments-a-comparative-approach-between-the-us-and-eu/>

DeepSeek Link: <https://chat.deepseek.com/share/okj354xse4gqx20hcs>

Appendix E: Article Reflection Summary Sample (Assessment B)

I am a non-native English university student in Hong Kong, and my professor has asked me to summarize an online article and provide an opinion using only an informal, conversational, tone of English. Can you please review my writing and provide feedback on grammatical errors, structural issues, vocabulary usage, writing voice consistency, tense usage, logical flow, sentence clarity and coherence, punctuation, spelling, keeping in mind that my tone MUST more informal but non-colloquial.

Instead of rewriting any sections, just provide a detailed list of suggestions for improvement and explain why these specific changes are suggested:

The adoption of GenAI in the financial sector in Hong Kong has increased a lot. 75% companies surveyed are taking action to apply AI in their work, and this figure is expected to rised to 90% in the next five years. Larger financial institutions are more likely to adopt AI in their working process currently compared with small firms. GenAI can learn from training data and then create various outputs based on it. The applications of GenAI in the financial sector can lead to better customer experience and higher efficiency in analyzing digital information. However, challenges like model accuracy, data privacy and security as well as constraints related to sources are also raised due to the wider applications. Authorities in Hong Kong have started updating regulatory guidelines and launching some projects to support the innovation and adoption of GenAI. Strengthened local technology and talent ecosystems are expected to be built to promote GenAI adoption, which includes expanding financial literacy programs, enhancing industry infrastructure and further collaboration among stakeholders.

In my opinion, the adoption of GenAI is a trend in the future of financial industry. The appropriate use of GenAI can greatly improve the efficiency in working, which is beneficial for the companies to reduce time and human-resource costs, thus increasing profits. More and more companies are adopting it. However, it is important that the government should taking steps to expand and regulate the application of GenAI in Hong Kong to support its further development.

AI Feedback Provided via DeepSeek: Here's a detailed breakdown of suggested improvements to make your writing more conversational, informal (but not colloquial), and polished while keeping the meaning intact:

1. Grammar & Tense Fixes: "financial" goes to "financial" (Spelling error.) "75% companies surveyed" goes to "75% of the companies surveyed" (Needs "of" for correct phrasing.) "apply AI in there work" goes to "apply AI in their work" ("There" vs. "their" confusion.) "expected to rised" goes to "expected to rise" (Wrong verb form, "rise" is correct after "to.") "are also rised" goes to "are also rising" (Correct past participle of "rise.") "government should taking steps" goes to "government should take steps" ("Should" requires base verb form.)
2. Sentence Clarity & Flow (Conciseness & Natural Sounding Phrasing): "The adoption of GenAI... has increased a lot." goes to "GenAI adoption in Hong Kong's finance sector has grown a lot." (More direct.) "Larger financial institutions are more likely to adopt AI in their working process currently compared with small firms." goes to "Right now, big banks

and financial firms are using AI more than smaller companies.” (More conversational, avoids redundancy.) “GenAI can learn from training data and then create various outputs based on it.” goes to “GenAI learns from data and generates different outputs.” (Shorter, smoother.) “The applications of GenAI... can lead to better customer experience and higher efficiency...” goes to “GenAI improves customer experience and makes data analysis faster.” (More natural phrasing.) “Strengthened local technology and talent ecosystems are expected to be built...” goes to “Hong Kong will likely strengthen its tech and talent pools...” (Less passive, more direct.)

3. Vocabulary & Tone Adjustments (More Informal but Professional): “taking action to apply AI” goes to “using AI” (Simpler phrasing.) “constraints related to sources” goes to “limits on data sources” (More conversational.) “launching some projects” goes to “rolling out projects” (More natural phrasing.) “beneficial for the companies” goes to “good for businesses” (Less formal.) “thus increasing profits” goes to “which means higher profits” (More fluid.)
4. Logical Flow & Transitions: The summary jumps from adoption rates to AI capabilities to challenges to government action. Consider a smoother flow: Start with how many companies use AI. Then explain how AI helps them (efficiency, customer experience). Next, mention the challenges (privacy, accuracy, data limits). Finally, say what’s being done (government updates, talent development). For better transitions: After discussing challenges, add “That’s why Hong Kong’s authorities are stepping in...” (Makes the shift smoother.) Instead of “In my opinion,” try “I think GenAI is definitely the future for finance because...” (More personal & engaging.)
5. Opinion Section Tweaks (More Conversational & Engaging): Original: “The appropriate use of GenAI can greatly improve the efficiency in working...” Suggestion: “If used well, GenAI makes work way more efficient...” (More casual but still clear.) “More and more companies are adopting it.” goes to “With these benefits, it’s no surprise more companies are jumping on board.” (Stronger flow.) “However, it is important that the government should taking steps...” goes to “But the government also needs to regulate and support GenAI’s growth.” (More concise.)
6. Punctuation & Minor Errors: “financial industry” goes to “financial sector” (More commonly used in this context.) “efficiency in working” goes to “work efficiency” (More natural.) “human-resource costs” goes to “labor costs” (More common term in business.)

Final Notes: Your summary is already clear and well-structured, but small tweaks in grammar, phrasing, and flow will make it sound more natural and engaging. Keep the tone friendly but polished. Imagine you're explaining this to a classmate in a discussion. Avoid passive voice (“are expected to be built”) where possible. Active voice (“Hong Kong will likely build”) sounds more direct and conversational.

Student Language Reflection (Post-AI): Since I wrote this summary in class in a time limit, there are some spelling errors and grammatical errors which DeepSeek detect accurately. For the vocabulary choosing, there are still some words that can be more informal, such as using “roll out” instead of “launch”, “limits” instead of “constraints”, which can make the tone more conversational. However, I find that DeepSeek isn’t good at detecting errors based on the continuity of the preceding and following text. For example, it suggests me to replace “thus increasing profits” with “which means higher profits”, but it fails to notice that I have already used

a subordinate clause in the first half of the sentence, so such a change might seem redundant. Besides, in terms of logical flows, although DeepSeek indicates that my structure is not smooth enough, the suggestions it gives are still the same with my original structure. I find that I have made a progress in terms of capturing the main points and choosing appropriate words when writing a summary, and have learned more about how to utilize AI tools to help me in writing. I believe that it is very useful for my study and work in the future.

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I certify that this paper has not been previously published (in English or other languages) and is neither currently being reviewed nor will be submitted for review while the manuscript is being considered by AJELT.

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