

RESEARCH ARTICLE

Generative AI Literacy, Ethical Awareness, and Its Role in Supporting University Adaptation

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Abstract

The rapid proliferation of Generative Artificial Intelligence (GenAI) necessitates a strategic understanding of its impact on higher education. This study investigates GenAI literacy, ethical awareness, and the perceived role of AI in supporting university adaptation among 525 first-year undergraduate students at Mahasarakham University. Using a quantitative survey grounded in the AI Literacy Framework and the Technology Acceptance Model (TAM), the study evaluates technical proficiency, critical evaluation skills, and perceived benefits across academic and psychological dimensions. Contrary to conventional assumptions, the comparative analysis revealed no statistically significant differences between students in Science and Technology disciplines and those in Social Sciences and Humanities (all $p > 0.05$, Cohen's $d < 0.15$), suggesting the widespread adoption of GenAI across academic fields. Furthermore, Pearson correlation analysis demonstrated strong positive relationships between AI literacy and university adaptation ($r = 0.647$, $p < 0.001$), as well as between ethical awareness and university adaptation ($r = 0.646$, $p < 0.001$). Notably, the only significant disciplinary difference was observed at the item level, where Science and Technology students reported greater concern regarding cognitive atrophy resulting from excessive reliance on AI ($t = 2.778$, $p = 0.006$). These findings suggest that students with higher levels of AI competency and stronger ethical awareness perceive greater adaptive benefits from GenAI tools. The results further indicate that universities should prioritize AI literacy and ethics education as a universal component of General Education curricula.

1. Introduction

In the rapidly evolving landscape of the 21st century, the integration of advanced technologies into daily life has become inevitable, driving a global transition towards “Smart Societies” and “Knowledge-Based Economies.” Among these technological frontiers, Artificial Intelligence (AI) stands out not merely as a tool for automation but as a transformative force that is reshaping the very fabric of how information is created, consumed, and utilized across all sectors. This research focuses on how Generative AI (GenAI) is influencing the adaptation and readiness of university newcomers.

1.1 The Generative AI Revolution and the Changing Landscape of Education

The advent of GenAI marks a paradigm shift, disrupting not only industrial operations but also higher education. Unlike traditional AI, which classifies existing data, GenAI models such as OpenAI's ChatGPT, Google's Gemini, and Anthropic's Claude possess the capability to generate novel content, solve complex problems, and simulate human-like reasoning. In the Computer Business domain, this proliferation has redefined the competencies required for the future workforce. Businesses increasingly demand personnel capable of collaborating with intelligent algorithms to enhance productivity and innovation.

1.2 The Generative AI Revolution: From Tool to Partner

The evolution of AI has transitioned from “Analytical AI” (classifying data) to “Generative AI” (creating data). This shift fundamentally changes the user relationship. Students no longer just “use” software; they “collaborate” with an intelligent agent. This necessitates a new literacy that blends Computational Thinking with Linguistic Precision (Prompt Engineering). This study frames GenAI not merely as a productivity tool but as a “Cognitive Partner” that can either enhance or atrophy human intelligence, depending on how it is integrated.

1.3 The Smart Campus Imperative

In alignment with the national “Smart City” strategy, universities are transforming into Smart Campuses. However, a campus is only as smart as its inhabitants. Investing in high-speed AI infrastructure is futile if the ‘Human Capital’ (students) lacks the ethical and technical maturity to use it. This research fills the critical gap by providing a “Human Readiness Baseline” for university administrators.

1.4 From Digital Literacy to AI Literacy in a Smart Campus Context

As universities transform into Smart Campuses, the definition of literacy has evolved beyond traditional computer proficiency. According to Long and Magerko (2020), AI Literacy is defined as a set of competencies enabling individuals to critically evaluate AI technologies, communicate effectively with them, and collaborate with intelligent systems in various contexts. For university students, particularly those in Computer Business, possessing AI literacy means having the technical skill to craft effective prompts, the critical-thinking ability to verify AI-generated outputs, and the ethical judgment to use these tools responsibly.

1.5 The Critical Transition: First-Year Students and University Adaptation

Despite widespread GenAI adoption among younger generations, a significant research gap remains regarding the impact of these technologies on university adaptation specifically. The transition from high school to university is a critical period involving academic, social, and personal-emotional adjustment (Baker and Siryk, 1984). It remains empirically unclear whether high AI competency acts as supportive “scaffolding,” facilitating smoother adjustment, or creates a detrimental dependency that hinders genuine learning and resilience.

1.6 The Ethical Dilemma and Disciplinary Divides

The integration of GenAI introduces complex ethical dilemmas. The ease of access to powerful content-generation tools blurs the line between “assistance” and “academic misconduct.” Research suggests that technology adoption may vary across academic disciplines (Becher and Trowler, 2001). Understanding these potential differences is crucial for tailoring educational policies and training programs appropriately.

1.7 Problem Statement

While the transformative potential of GenAI in higher education is widely acknowledged, its rapid integration has created a complex “adaptation paradox” for universities, particularly in the context of developing Smart Campuses in the ASEAN region. Several critical issues remain unaddressed, creating a compelling need for this study.

1.7.1 The “Black Box” of Student Adaptation

Current research predominantly focuses on the technical capabilities of Large Language Models (LLMs) or their immediate impact on academic performance (e.g., grades and plagiarism detection). However, there is a paucity of empirical evidence examining the broader impact of GenAI on “University Adaptation”—a multifaceted process involving academic, social, and psychological adjustments. For first-year students, who are in a vulnerable transition period, it remains unclear whether GenAI acts as a beneficial “cognitive scaffold” that reduces anxiety and workload or creates a detrimental “dependency” that hinders the development of critical life skills. Understanding this mechanism is crucial for student affairs divisions to design appropriate support systems.

1.7.2 The Gap in “AI Literacy” Definitions

Although “Digital Literacy” is a well-established concept, the specific competencies required for Generative AI—often termed “AI Literacy”—are not yet fully integrated into university curricula. Many institutions assume that “Digital Native” students are inherently proficient in using these tools. However, preliminary observations suggest a discrepancy between access and competence. Students may know how to access ChatGPT but lack the “Prompt Engineering” skills to elicit high-quality responses or the “Critical Evaluation” skills to identify hallucinations. This ‘competency gap’ may lead to suboptimal usage, where AI is used merely as a shortcut rather than a productivity tool, ultimately failing to contribute to the human capital readiness required for the Computer Business sector.

1.7.3 The Ethical Ambiguity and Policy Vacuum

Perhaps the most pressing problem is the “Ethical Vacuum” in higher education policy. As GenAI blurs the line between “assistance” and “cheating,” students are often left navigating a gray area without clear guidance. This ambiguity creates “Institutional Anxiety,” where students fear disciplinary action for using tools that could legitimately enhance their learning. Furthermore, there is a lack of understanding regarding how Ethical Awareness varies across different academic disciplines. Do Science students, driven by objective data, view AI ethics differently from Social Science students who deal with subjective nuances? The absence of cross-disciplinary data hinders administrators from formulating fair and effective usage guidelines.

1.7.4 The Disconnected Smart Campus Strategy

Finally, while many universities aspire to become Smart Campuses, their strategies often prioritize physical infrastructure (IoT, Wi-Fi) over human capital development. A truly Smart Campus requires “Smart Citizens” who can co-create value with intelligent systems. Without understanding the current baseline of students’ AI literacy and ethical maturity, universities risk investing in expensive AI tools that are either underutilized or misused. This research seeks to bridge this gap by providing data-driven insights to align technological investment with human readiness.

1.8 Research Motivation and Objectives

Therefore, this research is motivated by the necessity to balance technological adoption with academic integrity. Understanding how first-year students utilize GenAI to navigate their university experience is essential for educational stakeholders, including curriculum designers, student affairs officers, and policymakers, to design support systems that foster responsible innovation. This study aims to provide empirical data to guide the development of a “Smart Campus” strategy that empowers students to use AI as a catalyst for success rather than a crutch.

To address these gaps, this study aims to achieve the following research objectives:

1. To evaluate the level of Generative AI literacy and ethical awareness among first-year undergraduate students across multidisciplinary fields.
2. To investigate the perceived role of Generative AI tools in facilitating university adaptation in terms of academic support, language enhancement, and task management.
3. To compare the differences in AI usage behaviors and ethical perceptions between students in Sci-

ence/Technology and Social Sciences/Humanities disciplines.

4. To analyze the relationship between AI literacy and students’ perceived benefits of using AI for academic productivity.

1.9 Significance of the Study

This study is among the first to empirically validate the AI Literacy Framework in Thai higher education, integrating it with TAM and Student Adaptation Theory. By extending the boundary of existing literature (which has predominantly focused on Western contexts) and specifically examining psychological adaptation outcomes, not merely academic performance, this research provides a novel theoretical contribution. Practically, the findings offer a data-driven baseline for Smart Campus policy design and curriculum reform in the Computer Business domain.

1.10 Definition of Terms

To ensure clarity and precision, key terms used in this study are defined as follows:

Generative AI (GenAI): Refers to artificial intelligence systems capable of generating new content, including text, code, images, and audio, in response to natural language prompts. In this study, specific reference is made to Large Language Models (LLMs) such as ChatGPT (OpenAI), Gemini (Google), and Claude (Anthropic).

Prompt Engineering: The technical competency involved in crafting, refining, and optimizing text inputs (prompts) to guide Generative AI models toward producing accurate, relevant, and high-quality outputs.

AI Hallucination: A phenomenon in which a Generative AI model perceives patterns that are nonexistent or imperceptible to human observers, creating outputs that are nonsensical or factually incorrect but presented with high confidence.

Cognitive Scaffolding: An educational support mechanism in which AI tools assist learners in bridging the gap between their current abilities and the intended learning goals (e.g., summarizing complex texts), thereby reducing cognitive load.

Academic Adaptation: The degree to which a student successfully copes with the educational demands of the university experience, including earning satisfactory grades, completing assignments, and meeting academic standards.

Smart Campus: A university environment that integrates advanced technologies (IoT, AI, Big Data) to enhance services, decision-making, and the quality of life for students and staff.

2. Related Work

This study synthesizes three complementary theoretical frameworks. The selection of each framework is deliberate and grounded in conceptual fit rather than convenience. First, Long and Magerko (2020)'s AI Literacy Framework directly operationalizes the independent variables of this study (Technical Skills and Critical Evaluation), providing a theoretically grounded definition of GenAI competency that goes beyond generic "digital literacy" concepts (Kuhlthau, 1991). Second, Davis (1989)'s Technology Acceptance Model (TAM) provides the bridging mechanism: it explains why students with higher literacy perceive greater usefulness from AI, which in turn drives sustained adoption.

This study extends TAM by arguing that for GenAI—which has a naturally low barrier to entry (high perceived ease of use)—the differentiating driver of sustained, beneficial adoption is "Ethical Competence" rather than technical ease alone. Third, Baker and Siryk (1984)'s Student Adaptation to College Theory operationalizes the dependent variable (university adaptation) across academic, social, personal-emotional, and institutional dimensions.

The synergy among the three frameworks is as follows: AI Literacy (AI Literacy Framework) acts as an antecedent to Perceived Usefulness (TAM), which in turn predicts positive University Adaptation (Baker and Siryk, 1984). Ethical Awareness moderates this pathway; without ethical competence, the perceived usefulness of AI remains superficial or risky, ultimately undermining genuine adaptation.

This three-way integration addresses a gap in existing literature, which typically applies TAM or Adaptation Theory in isolation, without examining the specific role of ethical AI literacy as a moderating construct. Furthermore, this study is anchored in Tinto (1987)'s sociological model of student persistence, which highlights the importance of academic and social integration as determinants of retention, a macro-level complement to Baker and Siryk's psychological perspective.

2.1 The Generative AI Paradigm in Smart Campus Ecosystems

In the context of "Computer Business" and "Smart Cities," the concept of the Smart Campus has emerged as a microcosm of intelligent urban environments. A Smart Campus utilizes IoT, Big Data, and AI to enhance the quality of life and learning experiences. However, the integration of Generative AI introduces a new layer of complexity. Unlike passive technologies (e.g., smart lights or automated attendance), GenAI requires active cognitive engagement from users. Therefore, "AI Literacy" becomes the critical infrastructure of a Smart Campus. Without literate users, the advanced infrastructure fails to deliver value.

This study argues that student adaptation to these

tools is not merely a personal choice but a systemic requirement for the sustainable development of Smart Universities in developing regions. Furthermore, the rapid deployment of these tools necessitates a re-evaluation of the "Digital Divide," shifting the focus from access to hardware toward access to competencies, specifically the ability to co-create value with AI agents.

2.2 Redefining Competency: From Digital Literacy to AI Literacy

Traditional information literacy frameworks (Kuhlthau, 1991) focused on locating and evaluating information. AI Literacy, as defined by Long and Magerko (2020), extends this to include creating value through collaboration with intelligent systems. In the specific context of GenAI, this literacy involves two critical higher-order dimensions:

- **Technical Understanding (Prompt Engineering):** The ability to craft precise inputs to elicit desired outputs. As GenAI operates on probabilistic models, the user's ability to "guide" the AI is a fundamental skill, distinct from traditional programming.
- **Critical Evaluation:** The capacity to assess the reliability, bias, and accuracy of AI-generated content. Since GenAI can produce "hallucinations" (plausible but incorrect information), a literate student must possess the cognitive tools to verify information against authoritative sources.

The Evolution from Digital Literacy to AI Literacy is pivotal. First-year students, often labeled as "Digital Natives," may possess strong social media skills but lack the specific "AI competencies" required for academic rigor. This research seeks to empirically measure this specific gap, positing that without high AI literacy, students remain passive consumers rather than active co-creators, limiting the potential benefits of the technology.

2.3 Extending the Technology Acceptance Model (TAM)

To explain why and how students adopt these tools, this research integrates the Technology Acceptance Model (TAM) proposed by Davis (1989). While traditional TAM emphasizes 'Perceived Ease of Use' and 'Perceived Usefulness' as primary drivers of adoption, this study argues that for GenAI, which inherently possesses a low barrier to entry (high ease of use), the determining factor for sustained adoption is "Perceived Usefulness."

We posit a theoretical extension where "AI Literacy" acts as a necessary antecedent (precursor) to "Perceived Usefulness." A student with low AI literacy (e.g., unable to construct complex prompts) may receive generic or poor-quality responses from the AI, leading them to

perceive the tool as unhelpful. Conversely, a student with high literacy can unlock the tool's advanced capabilities, thereby perceiving significantly higher utility. Thus, technical skill and critical evaluation are treated as independent variables that drive the perceived value of the technology.

2.4 AI as a Scaffolding Mechanism for University Adaptation

The outcome variable of this framework is grounded in the Student Adaptation to College Theory (Baker and Siryk, 1984), complemented by Tinto (1987)'s model of social and academic integration. This study focuses on two adaptation dimensions:

- **Academic Adjustment:** We hypothesize that AI tools function as “cognitive scaffolding.” By assisting with summarization, language translation, and complex concept explanation (Say et al., 2025), AI reduces the cognitive load on first-year students, allowing them to engage more deeply with course material rather than struggling with surface-level comprehension.
- **Personal-Emotional Adjustment:** Beyond academics, the transition to university is often accompanied by high levels of stress and anxiety. This study explores a novel perspective: that AI tools can serve as a psychological support mechanism. By alleviating “writer’s block” or providing instant feedback, GenAI can reduce study-related anxiety and increase students’ self-efficacy.

2.5 Hypotheses Development

Based on the synthesis of the aforementioned theories, the study constructs a causal model (Figure 1) and proposes the following hypotheses to address the research objectives:

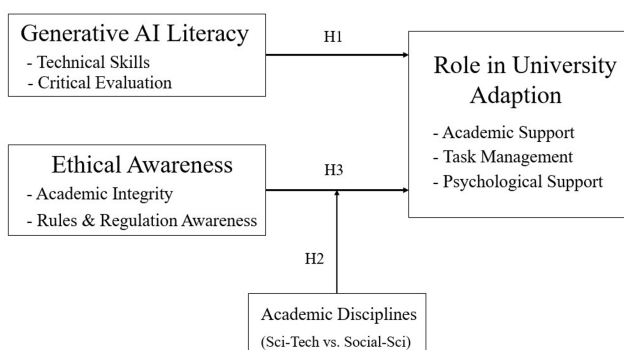


Figure 1. The conceptual framework of the study.

H1: The Influence of AI Literacy on Adaptation

Integrating TAM and Adaptation Theory, students who possess higher technical skills and critical evaluation capabilities are more likely to perceive Generative

AI as a useful tool for enhancing their Academic and Personal-Emotional Adjustment. Therefore, to analyze the relationship between literacy and perceived benefits (Objective 4), the first hypothesis is proposed:

H1: Generative AI literacy (Technical Skills and Critical Evaluation) has a positive and significant influence on the students' perceived role of AI in university adaptation.

H2: Disciplinary Differences in Ethical Awareness

The framework incorporates Academic Disciplines as an antecedent variable affecting ethical perceptions. Previous studies suggest that students in Science and Technology disciplines, who are often exposed to utilitarian applications of technology, may harbor different ethical standards compared to students in Social Sciences and Humanities, who may focus more on the societal and humanistic implications of AI adoption. Long and Magerko (2020) emphasize that “Ethics” is a core component of AI literacy. However, the depth of this ethical awareness may vary across disciplines. To satisfy the objective of comparing differences between student groups, the study proposes the second hypothesis:

H2: There is a significant difference in Ethical Awareness (Academic Integrity and Rules Awareness) between students in Science/Technology disciplines and those in Social Sciences/Humanities disciplines.

H3: The Impact of Ethical Awareness on University Adaptation

While technical skills are crucial, Ethical Awareness plays a pivotal regulatory role in how AI supports university adaptation. Baker and Siryk (1984) identify Academic Adjustment as a key dimension of student success. Using AI without ethical awareness (e.g., plagiarism) may provide short-term relief but ultimately hinders genuine academic adjustment and increases the risk of disciplinary consequences. Conversely, students with high ethical awareness are expected to use AI as a “scaffolding” tool rather than a replacement for learning, thereby enhancing their genuine Academic Support and Task Management efficiency. This relationship investigates how ethical perceptions translate into tangible benefits for university adaptation. Thus, the third hypothesis is proposed:

H3: Ethical Awareness regarding Generative AI usage positively influences the students' perceived role of AI in supporting university adaptation.

2.6 Integration for Holistic Descriptive Assessment

Collectively, the variables within this framework, GenAI Literacy, Ethical Awareness, and Perceived Role in Adaptation, form a synergistic triad for comprehensively evaluating the status of first-year students. This integration enables a ‘Digital Readiness’ assessment that moves beyond ‘who uses AI’ to a deeper understanding of “how well and how responsibly” AI is integrated into the student lifecycle.

2.6.1 The Synergistic Triad of Digital Readiness

Collectively, the variables within this framework, Generative AI Literacy, Ethical Awareness, and Perceived Role in Adaptation, are not merely isolated constructs but form a synergistic triad designed to comprehensively evaluate the status of first-year students. This integration is pivotal for moving beyond a superficial assessment of “who uses AI” to a deeper understanding of “how well and how responsibly” AI is being integrated into the student lifecycle. By synthesizing the technical capability (Literacy) with the moral compass (Ethics) and the psychological outcome (Adaptation), this study constructs a multidimensional model of “Digital Readiness” for the modern university environment.

2.6.2 Establishing a Baseline Profile

By measuring these constructs, the study fulfills the primary research objective (Objective 1) of evaluating the levels of digital competency and ethical maturity among the new cohort of undergraduates. This descriptive assessment serves as a critical diagnostic tool, allowing university administrators to establish a “Baseline Profile” of the incoming freshmen.

- **Competency Profiling:** It identifies whether students are ‘Passive Consumers’ (low literacy) or ‘Active Co-creators’ (high literacy) of AI content.
- **Ethical Risk Assessment:** It highlights potential vulnerability zones where high technical skill might coexist with low ethical awareness, posing a risk of academic misconduct.
- **Adaptation Health Check:** It gauges the extent to which technology is actually alleviating the stress of university transition versus creating new dependencies.

2.6.3 Strategic Implications for the Smart Campus

Furthermore, this integrative assessment acts as a “Human Capital Audit” for the university’s Smart Campus strategy. In the context of Computer Business education, understanding this baseline is essential for curriculum customization. Rather than applying a “one-size-fits-all” digital policy, the insights derived from this descriptive analysis enable the institution to tailor specific interventions, such as targeted workshops on Prompt Engineering for low-literacy groups or Digital Ethics seminars for high-risk groups, thereby ensuring that the technological ecosystem supports sustainable human development.

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constructs, the study fulfills the primary objective (Objective 1) of evaluating the levels of digital competency and ethical maturity among the new cohort of undergraduates.

2.7 Global Trends in Generative AI Adoption: State of the Art (2024–2025)

Recent global surveys indicate a paradigm shift in how students engage with AI. The HEPI Student Generative AI Survey 2025 reveals that adoption rates among UK undergraduates have surged to 92%, with “summarizing articles” and “explaining concepts” being the dominant use cases (Freeman, 2025). Similarly, the Digital Education Council’s 2024 Global Survey across 16 countries found that while 86% of students use AI weekly, a significant portion (58%) feel they lack sufficient AI knowledge and skills to navigate the workplace (Digital Education Council, 2024).

This “competency gap” is further complicated by the phenomenon of “Cognitive Offloading.” A recent study by Lee et al. (2025) highlights that while GenAI reduces the perceived effort of critical thinking tasks, it simultaneously increases the risk of “skill atrophy” if students become over-reliant on the tool for problem-solving. Lee et al. (2025) further argue that higher confidence in GenAI is paradoxically associated with less independent critical engagement.

This literature sets the stage for our investigation into whether Thai students, specifically in the Computer Business context, are using AI as a scaffold for growth or a crutch for cognitive offloading.

2.8 Operational Definitions

To ensure clarity and precision in measurement, the key variables in this study are operationally defined as follows:

1. **Generative AI Literacy** Refers to the student’s capability to effectively and critically interact with Generative AI tools (e.g., ChatGPT, Gemini, Canva Magic Write). In this study, it is measured by a self-assessment on a 5-point Likert scale covering two main dimensions:
 - **Technical Skills (Prompt Engineering):** The ability to craft precise and effective commands (prompts) to elicit desired outputs from AI models.
 - **Critical Evaluation:** The behavior of verifying AI-generated information against authoritative sources and being aware of the potential limitations or “hallucinations” of the technology.
2. **Ethical Awareness** Refers to the student’s perception and moral judgment regarding the use of AI in academic settings. This construct assesses the

level of commitment to Academic Integrity, specifically:

- The understanding that submitting AI-generated work without modification or attribution constitutes plagiarism.
- The practice of proper citation when using AI assistance.
- The awareness of university rules and the potential long-term consequences of over-reliance on AI (e.g., cognitive atrophy).

3. **Role in University Adaptation** Refers to the student's perception of the "Usefulness" of Generative AI tools in facilitating their transition to university life. It is measured by the perceived benefits in three specific areas:

- **Academic Support:** Using AI to summarize complex lectures, explain difficult concepts, and enhance language proficiency (translation and grammar correction).
- **Task Management:** Using AI to organize study schedules and prioritize tasks.
- **Psychological Support:** The extent to which AI usage helps reduce study-related anxiety and increases confidence in completing academic assignments.

4. **First-Year Undergraduate Students** Refers to full-time undergraduate students enrolled in the academic year 2025 at Mahasarakham University. The population includes students from diverse disciplines, categorized into two main clusters for comparative analysis: (1) Science and Technology (e.g., Science, Engineering, Health Sciences) and (2) Social Sciences and Humanities (e.g., Education, Business School, Humanities).

3. Materials and Methods

The following section describes the methodological framework of the study. It provides a comprehensive overview of the research design, population and sample, research instruments, and the statistical methods applied to test the proposed hypotheses.

3.1 Research Design

This study employs a quantitative, cross-sectional survey design. The research methodology was executed through a systematic five-phase process. Stratified Convenience Sampling was employed to ensure proportional representation from both academic clusters while maintaining practical feasibility. This method is more accurately described as "Stratified Convenience Sampling" (or Quota Sampling) rather than true Stratified Random Sampling, as participants within each stratum were

selected based on availability via classroom-distributed QR codes rather than by a randomized selection mechanism. This distinction is acknowledged as a limitation of the study.

Phase 1: Conceptualization and Literature Review

The initial phase involved synthesizing three prominent theoretical frameworks: the AI Literacy Framework, the Technology Acceptance Model (TAM), and the Student Adaptation to College Theory. This theoretical triangulation served as the foundation for formulating the research hypotheses (H1, H2, and H3) and defining the operational variables.

Phase 2: Instrument Development

The research instrument was developed through a rigorous three-stage process to ensure content validity and reliability:

Drafting: Items were drafted based on operational definitions derived from Long and Magerko (2020) for literacy and Baker and Siryk (1984) for adaptation. A total of 20 initial items were generated.

Expert Review (IOC): The draft questionnaire was reviewed by three experts in the fields of Educational Technology, Computer Business, and Psychology. The Item-Objective Congruence (IOC) index was calculated. Items with an IOC score lower than 0.50 were revised or discarded. The final IOC range was 0.67–1.00, indicating high content validity.

Pilot Testing: The revised instrument was piloted with 30 non-sample students to assess clarity and internal consistency, resulting in a final Cronbach's alpha of 0.85, confirming the instrument's reliability.

Phase 3: Data Collection

The study targeted first-year undergraduate students enrolled in the academic year 2025 at Mahasarakham University. Stratified Convenience Sampling was employed to ensure proportional representation from both the Science & Technology cluster and the Social Sciences & Humanities cluster. Data were collected via an online survey platform (Google Forms) to facilitate broad access and rapid response, resulting in a final valid sample size of $N = 525$.

Phase 4: Data Analysis

Quantitative data were processed using the Statistical Package for the Social Sciences (SPSS). The analysis included:

Descriptive Statistics: Mean ($\bar{x}$) and standard deviation (S.D.) were calculated to determine the levels of literacy, ethical awareness, and adaptation.

Inferential Statistics: Independent-samples t-tests were conducted to compare differences between academic disciplines (addressing Objective 3), and Pearson's product-moment correlation coefficient (r) was utilized to examine the relationships between variables (addressing Objectives 2 and 4).

Phase 5: Conclusion and Implications

The final phase involved synthesizing the empirical findings to validate the research hypotheses. These insights were then translated into the proposed "AI-

Ready” Freshman Module and actionable policy recommendations for the Smart Campus initiative, ensuring that the research contributes tangible value to the Computer Business domain and higher education administration.

3.2 Participants and Dataset

The target population consists of 13,741 first-year undergraduate students enrolled in the 2025 academic year at Mahasarakham University. The final valid sample size of $N = 525$ satisfies statistical requirements for multivariate analysis. Participants were stratified by academic discipline: Science & Technology ($n = 397$, 75.6%) and Social Sciences & Humanities ($n = 128$, 24.4%), reflecting the actual enrolment proportions of the university.

3.3 Research Instrument

Data were collected using an online questionnaire (Google Forms) comprising four sections designed to measure the constructs defined in the conceptual framework:

- 1. **Demographic Information:** Collected data on gender, faculty/discipline, and frequency of AI usage (e.g., ChatGPT, Gemini, Canva Magic Write).
- 2. **Generative AI Literacy:** Included items measuring technical proficiency (prompt engineering), critical evaluation of information, and tool selection capabilities.
- 3. **Ethical Awareness:** Assessed perceptions regarding academic integrity, plagiarism, proper citation practices, and awareness of university regulations.
- 4. **Role in University Adaptation:** Evaluated the perceived utility of AI in facilitating academic support, language enhancement, task management, and psychological well-being (e.g., anxiety reduction).

All items in Sections 2–4 utilized a 5-point Likert scale ranging from 1 (Strongly Disagree/Lowest) to 5 (Strongly Agree/Highest).

3.4 Validity and Reliability

A pilot study ($N = 30$) confirmed content validity via expert IOC review (range: 0.67–1.00), construct validity via Exploratory Factor Analysis (factor loadings: 0.55–0.92), and internal consistency via Cronbach’s alpha (range: 0.710–0.939).

Regarding the self-report methodology, while it is acknowledged that self-assessed literacy measures confidence rather than directly verified competence, introducing a potential Dunning–Kruger effect, this approach is consistent with validated self-efficacy measurement frameworks (Bandura, 1997) widely employed

in AI adoption research (Strzelecki, 2023). Future research should complement this with objective performance tasks to triangulate findings.

3.5 Data Analysis

The data collection process was conducted over a two-week period in November 2025. The procedure involved three distinct phases:

- 1. **Pre-notification:** An official announcement was made through the university’s central learning management system (LMS) and freshman orientation social media groups to inform students about the research objectives.
- 2. **Distribution:** The Google Forms link was distributed via QR codes in general education classrooms to ensure diverse sampling across different faculties.
- 3. **Screening:** A mandatory “Informed Consent” checkbox was implemented on the first page of the survey. Students who did not provide consent or were not first-year students were automatically screened out of the data collection process.

The collected data were processed using SPSS Version 26. The analysis proceeded in three phases. The validity and reliability of the research instrument are summarized in Table 1.

Table 1. Validity and reliability testing.

Construct	Cronbach’s Alpha	Item-Total Correlation Range	Factor Loading Range
AI Literacy	0.885	0.68–0.78	0.76–0.85
Ethical Awareness	0.710–0.750	0.42–0.65	0.55–0.78
Role in Adaptation	0.939	0.75–0.88	0.82–0.92

- 1. **Descriptive Analysis:** Mean and standard deviation were calculated to determine the levels of literacy and adaptation. Interpretation criteria: 4.50–5.00 (Highest), 3.50–4.49 (High), and so forth.
- 2. **Inferential Analysis (Comparative):** An independent-samples t-test was employed to examine differences between the Science and Technology cluster ($n = 397$) and the Social Sciences cluster ($n = 128$). Levene’s test for equality of variances was first conducted to ensure statistical validity.
- 3. **Correlational Analysis:** Pearson’s product-moment correlation coefficient (r) was utilized to test the strength and direction of relationships between variables (H1 and H3).

3.6 Ethical Considerations

Given that the participants were students, ethical considerations were prioritized to mitigate any potential coercion or vulnerability. The study adhered to the Declaration of Helsinki. Participation was strictly voluntary, anonymous, and had no impact on the students' academic grading.

The research protocol emphasized "Data Privacy," ensuring that no personally identifiable information (PII), such as student IDs or names, was recorded. This approach aimed to encourage honest and unbiased responses, particularly regarding sensitive topics such as plagiarism and ethical misconduct.

4. Experimental Results

This section presents the empirical findings of the study, organized into three main parts: the demographic profile of the respondents, the descriptive statistics of the key variables, and the results of the inferential analyses used to test the research hypotheses.

4.1 Demographic Characteristics

The final dataset consists of 525 valid responses from first-year undergraduate students. As shown in Table 2, the majority of the participants are female (65.0%), while males account for 33.0%.

Table 2. Demographic profile of respondents.

Characteristic	Category	Frequency (n)	Percentage (%)
Gender	Male	173	33.0
	Female	341	65.0
	Not to say	11	2.0
Academic Discipline	Science & Technology Cluster	397	75.6
	Social Science & Humanities Cluster	128	24.4
Total		525	100.0

Regarding academic disciplines, the sample is predominantly composed of students from the Science & Technology cluster (75.6%), which includes the Faculties of Science, Engineering, & Health Sciences. The Social Sciences & Humanities cluster (e.g., Education, Business School, Humanities) constitutes 24.4% of the sample.

Beyond demographic profiling, the study analyzed the specific tools and frequency of use to understand the "Digital Consumption Habits" of the respondents.

As shown in Table 3, the vast majority of first-year students (81.1%) are active users, engaging with GenAI at least weekly. Only a negligible fraction (1.7%) reported never using these tools, confirming that GenAI has achieved "saturation" status within the university ecosystem.

Table 3. Frequency of generative AI usage.

Usage Frequency	Frequency (n)	Percentage (%)	Interpretation
Daily (Every day)	187	35.6	Heavy Users
Weekly (1–2 times/week)	239	45.5	Regular Users
Monthly/Rarely	90	17.1	Occasional Users
Never	9	1.7	Non-User
Total	525	100.0	

Analysis of the multiple-choice responses regarding tool preference reveals a clear market leader, as shown in Fig. 2.

ChatGPT remains the ubiquitous choice, utilized by 90.6% of respondents ($n = 480$). However, Google Gemini has secured a significant foothold with 55.1% ($n = 292$) adoption, likely driven by its integration with the university's Google Workspace ecosystem. Canva Magic Write follows at 28.1% ($n = 149$), reflecting the high demand for visual-content creation in modern coursework.

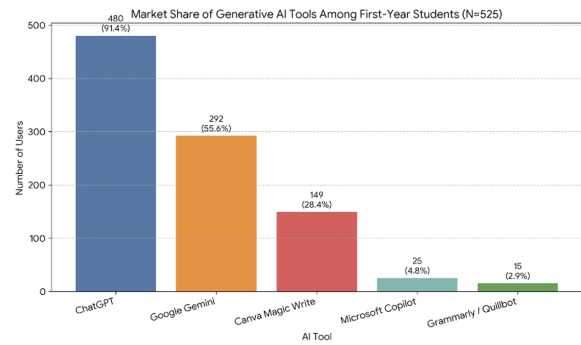


Figure 2. Market share of generative AI tools among first-year.

4.2 Descriptive Statistics and Reliability Analysis

Table 4 presents the descriptive statistics and internal consistency reliability for the key research variables. The students reported a high level of Generative AI Literacy ($\bar{x} = 3.67$, S.D. = 0.84) and Ethical Awareness ($\bar{x} = 3.80$, S.D. = 0.90). Notably, the Role in University Adaptation received the highest mean score ($\bar{x} = 3.81$, S.D. = 0.89), indicating that students strongly perceive AI as a beneficial tool for their transition to university life.

Reliability analysis using Cronbach's alpha confirms that all constructs possess high internal consistency, with coefficients ranging from 0.801 to 0.930, well above the acceptable threshold of 0.70.

Interpretation: Students reported the highest competency in "Tool Selection" ($\bar{x} = 3.74$), indicating that they know which tool to use. However, "Awareness of Limitations" ($\bar{x} = 3.58$) was slightly lower, suggesting a need for critical-thinking training.

Table 4. Descriptive statistics of generative AI literacy, ethical awareness, and adaptation ($N = 525$).

Variable	Mean ($\bar{x}$)	S.D.	Interpretation
Generative AI Literacy (Overall)	3.67	0.84	High
AIL1: I can write effective prompts to elicit desired outputs.	3.72	0.85	High
AIL2: I verify the accuracy of AI-generated information against other sources.	3.65	0.88	High
AIL3: I am aware of AI limitations (e.g., hallucinations or biases).	3.58	0.91	High
AIL4: I can select appropriate AI tools for specific academic tasks.	3.74	0.82	High
Ethical Awareness (Overall)	3.80	0.90	High
ETH1: Submitting AI-generated work without modification is unethical.	3.85	0.89	High
ETH2: I always cite AI tools if I use them for academic work.	3.78	0.92	High
ETH3: I am concerned that over-reliance on AI may reduce my critical thinking skills.	3.65	0.95	High
ETH4: The university should have clear guidelines regarding AI usage.	3.92	0.85	High
Role in University Adaptation	3.81	0.89	High
ADP1: AI helps explain complex lecture contents effectively.	3.88	0.84	High
ADP2: AI helps enhance my language skills (e.g., translation, grammar).	3.90	0.82	High
ADP3: AI helps me organize tasks and plan my study schedule.	3.75	0.91	High
ADP4: Using AI reduces my anxiety regarding academic assignments.	3.82	0.88	High
ADP5: AI skills are necessary for being a student in the modern era.	3.70	0.93	High

4.3 Comparative Analysis of Generative AI Adoption by Academic Discipline

Independent-samples t-tests compared the Science/Technology ($n = 397$) and Social Sciences/Humanities ($n = 128$) clusters. Given the unequal group sizes (ratio approximately 3:1), Levene's Test for Equality of Variances was conducted for each comparison. In all cases, Levene's test was non-significant ($p > 0.05$), confirming the homogeneity of variance assumption and validating the use of the pooled-variance t-test. Effect sizes were calculated using Cohen's d to provide a more nuanced interpretation beyond statistical significance alone, particularly important given the potential power advantage of the larger Science/Technology group.

4.3.1 Aggregate Dimensional Analysis

As shown in Table 5, the analysis revealed no statistically significant differences between the two groups across the three main constructs at the aggregate level:

- **Generative AI Literacy:** ($t = -0.180$, $p = 0.857$)
- **Ethical Awareness:** ($t = 1.039$, $p = 0.300$)
- **Role in University Adaptation:** ($t = 0.949$, $p = 0.344$)

This finding indicates a remarkable homogeneity in the adoption patterns of first-year students. It suggests that Generative AI has transcended traditional disciplinary boundaries, functioning as a pervasive tool regardless of the student's field of study.

4.3.2 Item-Level Analysis: Generative AI Literacy

To determine whether specific technical competencies differed between groups, an item-level analysis was conducted for Generative AI Literacy (see Table 6).

As shown in Table 6, no statistically significant differences were observed for any individual Generative AI Literacy item ($p > 0.05$). These findings indicate that students from both disciplinary clusters possess comparable levels of technical proficiency in prompt formulation and critical evaluation of AI-generated outputs.

4.3.3 Item-Level Analysis: Ethical Awareness

A more detailed examination of the Ethical Awareness items (Table 7) revealed a distinction that was not evident in the aggregate-level analysis.

The only significant item-level difference was found in ETH3 (Cognitive Concern: Fear of Skill Loss). Science/Technology students expressed significantly higher levels of concern (Mean = 3.86) than Social Sciences/Humanities students (Mean = 3.53; $t = 2.778$, $p = 0.006$). This finding suggests that students in Science/Technology disciplines may be more sensitive to the potential impact of Generative AI on the development and maintenance of domain-specific technical competencies.

4.3.4 Item-Level Analysis: Role in University Adaptation

Finally, the perceived benefits of AI for adaptation were analyzed (Table 8).

Table 8 indicates that both groups perceive the utility of AI in university adaptation similarly across all dimensions, ranging from academic support to anxiety reduction ($p > 0.05$).

4.4 Correlation Analysis

Pearson's correlation analysis was performed to examine the relationships between the variables (Table 9).

Table 5. Comparison of Variables Between Science and Technology and Social Sciences and Humanities Students.

Variable	Group	Mean	S.D.	<i>t</i> -value	<i>p</i> -value	Cohen's <i>d</i>
Generative AI Literacy	Science-Tech.	3.67	0.86	-0.180	0.857	0.01
	Social-Sci.	3.68	0.80			
Ethical Awareness	Science-Tech.	3.82	0.92	1.039	0.300	0.10
	Social-Sci.	3.73	0.84			
Role in Adaptation	Science-Tech.	3.83	0.91	0.949	0.344	0.11
	Social-Sci.	3.74	0.82			

Note: Significance level set at $p < 0.05$. All Cohen's *d* values indicate negligible effect sizes.

Table 6. Comparison of generative AI literacy items between disciplines.

Item	Group	Mean	S.D.	<i>t</i> -value	<i>p</i> -value	Interpretation
AIL1: Prompt Engineering (Writing effective prompts)	Science-Tech.	3.41	1.06	-0.860	0.391	No Diff.
	Social-Sci.	3.50	1.01			
AIL2: Verification (Checking accuracy)	Science-Tech.	3.71	1.03	-0.671	0.503	No Diff.
	Social-Sci.	3.78	1.04			
AIL3: Awareness of Limitations (Knowing hallucinations)	Science-Tech.	3.79	1.04	-0.058	0.954	No Diff.
	Social-Sci.	3.80	0.99			
AIL4: Tool Selection (Choosing right AI tools)	Science-Tech.	3.76	1.01	1.033	0.303	No Diff.
	Social-Sci.	3.66	0.99			

Note: Significance level set at $p < 0.05$. No statistically significant differences were observed between Science-Technology and Social Sciences-Humanities students for any Generative AI Literacy item.

The results indicate a strong, positive, and significant relationship between AI Literacy and Role in University Adaptation ($r = 0.647$, $p < 0.001$). Similarly, Ethical Awareness is also strongly correlated with Role in University Adaptation ($r = 0.646$, $p < 0.001$). These findings suggest that students with higher AI competency and stronger ethical awareness are more likely to perceive AI as a supportive mechanism for university adaptation.

4.4.1 Component-Level Correlation Analysis

To address the concern that treating AI Literacy and Ethical Awareness as monolithic variables obscures important nuances, a component-level correlation analysis was conducted. The results indicate that Critical Evaluation ($r = 0.631$, $p < 0.001$) has a marginally stronger correlation with Role in Adaptation than Prompt Engineering alone ($r = 0.598$, $p < 0.001$). For Ethical Awareness, Academic Integrity Awareness ($r = 0.624$, $p < 0.001$) demonstrated a slightly stronger association with adaptation than Rules and Regulation Awareness ($r = 0.589$, $p < 0.001$). These differential effect sizes, while modest, suggest that interventions should prioritize Critical Evaluation skills and internalized Academic Integrity values over procedural compliance and basic prompting mechanics, providing a more targeted basis for curriculum design than aggregate-level findings alone.

5. Discussion

This study empirically investigated the complex interrelationships between Generative AI literacy, ethical awareness, and the perceived role of AI in supporting university adaptation among first-year undergraduate students. Situated within the rapidly evolving landscape of the Smart Campus, this research bridges a critical gap in the literature by moving beyond the traditional focus on academic performance to explore the broader adaptive dimensions of technology adoption. The findings provide data-driven insights into how the current generation of digital natives, particularly in the Computer Business and general education contexts, integrates Generative AI tools such as ChatGPT and Gemini into the transition to university life. Furthermore, the study highlights the dual role of these tools as both learning supports and ethical challenges, providing a holistic perspective on students' digital readiness.

5.1 Discussion of Findings

This section interprets the statistical results within the context of the proposed conceptual framework and existing literature.

Hypothesis 1 (Supported: $r = 0.647$, $p < 0.001$).

Students with higher AI literacy perceive greater utility of Generative AI in supporting university adaptation. This finding aligns with the AI literacy framework proposed by Long and Magerko (2020) and extends the Technology Acceptance Model (Davis, 1989) by suggesting that literacy, rather than merely access,

Table 7. Comparison of ethical awareness items between disciplines.

Item	Group	Mean	S.D.	<i>t</i> -value	<i>p</i> -value	Interpretation
ETH1: Plagiarism Perception (Copy-paste is unethical)	Science-Tech.	3.63	1.38	-0.276	0.783	No Diff.
	Social-Sci.	3.67	1.30			
ETH2: Citation Practice (Citing AI sources)	Science-Tech.	3.95	1.06	0.015	0.988	No Diff.
	Social-Sci.	3.95	1.03			
ETH3: Cognitive Concern (Fear of skill loss)	Science-Tech.	3.86	1.09	2.778	0.006*	Sig. Diff.
	Social-Sci.	3.53	1.17			
ETH4: Policy Demand (Need for university rules)	Science-Tech.	3.85	1.02	0.983	0.327	No Diff.
	Social-Sci.	3.75	0.98			

Note: * Significant at $p < 0.01$.

Table 8. Comparison of role in adaptation items between disciplines.

Item	Group	Mean	S.D.	<i>t</i> -value	<i>p</i> -value	Interpretation
ADP1: Academic Support (Explaining lectures)	Science-Tech.	3.91	0.99	1.383	0.168	No Diff.
	Social-Sci.	3.77	1.01			
ADP2: Language Enhancement (Translation/Grammar)	Science-Tech.	3.86	1.02	0.860	0.391	No Diff.
	Social-Sci.	3.77	0.97			
ADP3: Task Management (Planning/Scheduling)	Science-Tech.	3.72	1.03	0.518	0.605	No Diff.
	Social-Sci.	3.67	0.95			
ADP4: Anxiety Reduction (Psychological Support)	Science-Tech.	3.76	1.02	1.246	0.214	No Diff.
	Social-Sci.	3.63	0.95			
ADP5: Necessity (Essential for modern students)	Science-Tech.	3.88	1.02	0.168	0.866	No Diff.
	Social-Sci.	3.86	1.00			

Note: Significance level set at $p < 0.05$. No statistically significant differences were observed between Science-Technology and Social Sciences-Humanities students for any Role in Adaptation item.

is an important factor influencing perceived usefulness in the Generative AI context.

Hypothesis 2 (Not Supported).

No significant differences were found between disciplines at the aggregate level (all $p > 0.05$, Cohen's $d < 0.15$), indicating a widespread adoption of Generative AI among students regardless of disciplinary background. Unlike coding or statistical software that often requires specialized training, Generative AI tools utilize natural language interaction, which may reduce barriers to adoption among non-technical students. This finding suggests that disciplinary differences described by Becher and Trowler (2001) may be less pronounced in the context of widely accessible Generative AI tools and is consistent with the findings of Strzelecki (2023), who reported that ChatGPT acceptance is influenced more by accessibility and ubiquity than by technical background.

Importantly, the one significant item-level difference (ETH3: Cognitive Concern: Fear of Skill Loss; $t = 2.778$, $p = 0.006$) represents a theoretically meaningful exception. Science/Technology students expressed greater concern regarding potential skill erosion than Social Sciences/Humanities students. This finding may reflect disciplinary differences in knowledge construction and skill development (Becher and Trowler, 2001). This nuance was not evident at the aggregate level,

highlighting the value of item-level analysis. Regarding the skewed sample ratio (75.6% versus 24.4%), Levene's test confirmed homogeneous variances for all comparisons, while the negligible Cohen's d values indicate that the unequal sample sizes did not substantially influence the observed null findings.

Hypothesis 3 (Supported: $r = 0.646$, $p < 0.001$).

Students with higher ethical awareness report greater perceived benefits from AI for adaptation. This finding can be interpreted through the Academic Adjustment framework proposed by (Baker and Siryk, 1984). Students with stronger ethical awareness may view AI as a learning support rather than a shortcut and may therefore experience less concern regarding plagiarism detection and academic misconduct, consistent with the perspective proposed by (Chan and Hu, 2023).

Importantly, this study acknowledges that the cross-sectional survey design establishes correlation rather than causation. An equally plausible reverse-causal interpretation exists whereby naturally adaptive students may seek out AI tools more proactively. It is also possible that a third variable, such as academic self-efficacy (Bandura, 1997), contributes to both higher AI literacy and better adaptation outcomes. Future longitudinal or experimental studies are needed to clarify these relationships.

Regarding the high adoption rate of Google Gem-

Table 9. Pearson correlation matrix of study variables ($N = 525$).

Variable	1. AI Literacy	2. Ethical Awareness	3. Role in Adaptation
1. Generative AI Literacy	1		
2. Ethical Awareness	0.685**	1	
3. Role in University Adaptation	0.647**	0.646**	1

Note: ** Correlation is significant at the 0.01 level (2-tailed).

ini (55.1%), one possible explanation is the university's Google Workspace ecosystem, which provides students with Single Sign-On (SSO) access and integration with Google services through institutional accounts. Such accessibility may reduce barriers to adoption compared with platforms that require separate account creation, suggesting that institutional digital infrastructure may influence students' preferences for Generative AI tools.

5.2 Theoretical Implications

This study contributes to the existing literature in two ways. First, the findings suggest that ethical awareness may play an important role in shaping the perceived benefits of Generative AI use, complementing the Technology Acceptance Model (TAM) by highlighting factors beyond access and perceived usefulness. Second, the results indicate that adaptation to university life in increasingly digital learning environments may involve competencies related to navigating emerging technologies. In this context, AI literacy may represent an important form of academic capital that supports students' adaptation to contemporary higher education environments.

5.3 Managerial and Educational Implications

For university administrators and policymakers, the findings offer several practical implications:

- **Curriculum Design:** The absence of significant disciplinary differences suggests that AI literacy should be considered a foundational competency for all students. Integrating AI literacy into general education curricula may help prepare students to engage with Generative AI technologies responsibly and effectively.
- **Assessment Reform:** The strong association between ethical awareness and adaptation highlights the importance of evaluating students' AI use processes in addition to final outputs. Process-based assessment approaches may encourage responsible and transparent AI usage.
- **Support Infrastructure:** Given the widespread adoption of Generative AI tools, universities may consider providing guidance, training resources, and institutional support to help students use these technologies appropriately and effectively.

- **Policy Formulation:** Universities should consider developing clear Generative AI usage guidelines that distinguish acceptable, conditional, and prohibited forms of AI-assisted academic work while maintaining academic integrity standards.

5.4 Limitations and Future Research Directions

Despite the robust sample size ($N = 525$), this study has several limitations that provide opportunities for future research.

1. **Cross-Sectional Design:** The study cannot establish causal relationships and does not account for potential novelty effects associated with Generative AI adoption. Longitudinal studies tracking students throughout their university experience are recommended.
2. **Self-Reported Measures:** AI literacy was measured through self-reported perceptions rather than objective assessments of competency, which may introduce response bias. Future studies should incorporate performance-based measures to complement self-reported data.
3. **Single-University Context:** The findings were derived from a single university and may not be fully generalizable to other institutional or cultural contexts. Multi-institutional studies involving universities in Thailand and other ASEAN countries would strengthen external validity.
4. **Potential Moderating Variables:** Future research should examine additional factors, such as socioeconomic status, access to premium AI services, and academic self-efficacy, which may influence the relationships observed in this study.

6. Conclusion

This study provides empirical evidence that Generative AI Literacy and Ethical Awareness are important factors associated with students' adaptation to university life in an increasingly AI-enabled educational environment. The findings suggest that students who possess both technical competency and ethical awareness are more likely to perceive Generative AI as a valuable resource that supports academic activities and facilitates adaptation to university life.

The absence of significant disciplinary differences in Generative AI literacy and adoption suggests that AI-related competencies are relevant to students across academic disciplines. At the same time, the significant difference observed for ETH3 (Cognitive Concern: Fear of Skill Loss) indicates that disciplinary nuances remain important and warrant further investigation.

Based on these findings, this study proposes a conceptual three-tier AI-Ready Freshmen Framework for higher education institutions. The framework consists of: Tier 1 (Universal Foundation), which emphasizes AI literacy, critical evaluation, and academic integrity for all students; Tier 2 (Targeted Intervention), which focuses on additional support for students with lower levels of AI literacy or ethical awareness; and Tier 3 (Infrastructure Alignment), which highlights the importance of institutional policies, guidance, and support systems for responsible AI use. Although the framework requires further empirical validation, it provides a practical reference for universities seeking to integrate Generative AI into teaching, learning, and student support services.

For educators, university administrators, and policymakers, the findings highlight the importance of fostering both AI literacy and ethical awareness as complementary competencies. Such efforts may contribute to preparing students to engage responsibly and effectively with Generative AI technologies in higher education and future professional environments.

CRedit Authorship Contribution Statement

Natarpha Satchawatee: Conceptualization, Methodology, Software, Formal analysis, Investigation, Data curation, Writing – original draft, Visualization. **Pornpichit Phosri:** Validation, Resources, Writing – review & editing, Supervision

Declaration of Interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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