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Digital Learning Readiness and Student Engagement in Higher Education: A Quantitative Study

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ABSTRACT

The increasing use of artificial intelligence (AI) in higher education raises concerns about whether students possess sufficient AI literacy to critically evaluate AI-generated information. However, frequent access to AI tools does not necessarily indicate that students possess sufficient competencies to evaluate AI-generated information critically. This study aims to examine the relationship between AI literacy and critical thinking skills among university students. A quantitative correlational survey was conducted among 100 undergraduate students who had prior experience using AI applications for academic purposes. Data were collected using a structured questionnaire consisting of measures of AI literacy and critical thinking skills, with responses recorded on a five-point Likert scale. AI literacy was assessed through four dimensions: AI understanding, AI application, AI evaluation, and AI ethics, while critical thinking was measured through analysis, evaluation, inference, and interpretation. Data were analyzed using descriptive statistics, Pearson product-moment correlation, and simple linear regression at a significance level of 0.05. The results indicate that students demonstrated relatively high levels of AI literacy (M = 3.78, SD = 0.46) and critical thinking skills (M = 3.71, SD = 0.43). AI literacy showed a positive and statistically significant relationship with critical thinking ($r = .62$, $p < .001$), while regression analysis indicated that aI literacy accounted for 38.4% of the variance in critical thinking scores in the regression model, indicating a significant statistical association. The findings indicate that AI literacy is associated with critical thinking, highlighting the potential value of incorporating critical evaluation, information verification, and ethical reasoning into AI-related learning activities. Future research should employ larger samples and longitudinal or experimental designs to strengthen causal explanations.
Keywords: Artificial Intelligence; AI Literacy; Critical Thinking; Higher Education; University Students;

INTRODUCTION

The increasing use of AI in higher education raises concerns about students' ability to critically evaluate AI-generated information and maintain independent judgment. Generative AI applications, including large language model-based systems, have made sophisticated computational capabilities increasingly accessible to students without requiring advanced technical expertise. Although AI can support learning and problem solving, its educational value depends on students' ability to use and evaluate AI outputs critically. At the same time, the growing accessibility of AI raises important questions about whether students possess sufficient knowledge and judgment to use these technologies critically, responsibly, and independently. Consequently, AI literacy has increasingly become an important component of contemporary higher education rather than merely a technical skill. Recent research demonstrates that university students do not possess uniform levels of AI literacy, with differences associated with academic background, previous experience, and exposure to AI-related learning opportunities (Černý, 2024; Mansoor et al., 2024; Salhab & Aboushi, 2025).

AI literacy differs from mere AI use by encompassing students' understanding, application, evaluation, and ethical judgment regarding AI systems. It encompasses students' understanding of how AI systems work, their ability to apply AI tools appropriately, their capacity to evaluate AI-generated information, and their awareness of ethical and societal implications.

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Empirical studies have consequently conceptualized AI literacy as a multidimensional competency involving knowledge, practical application, critical evaluation, and ethical awareness (Ng et al., 2023; Černý, 2024). The development and validation of AI literacy instruments further indicate that these dimensions can be systematically measured among university students. For example, a validated AI literacy test developed for university students demonstrated substantial variation in students' AI knowledge and identified prior AI experience and academic specialization as important factors associated with literacy levels (Ng et al., 2023). More recent measurement studies have similarly emphasized understanding, application, evaluation, and ethics as central components of AI literacy (Huang et al., 2025; Ranieri et al., 2025).

AI literacy becomes particularly important when students evaluate AI-generated information, a process that directly requires critical-thinking skills. AI-generated responses may appear coherent and authoritative while containing inaccurate information, unsupported claims, biases, or fabricated references. Therefore, students cannot rely solely on the apparent fluency of AI-generated outputs. They need the ability to question information, examine evidence, compare alternative explanations, identify assumptions, and formulate reasoned judgments. These abilities are fundamental elements of critical thinking. Recent scholarship argues that critical thinking is increasingly important in an educational environment characterized by generative AI because students must be capable of evaluating AI outputs rather than simply accepting them as final answers (Larson et al., 2024; Lee & Low, 2024).

Existing evidence suggests that AI may either support or undermine critical thinking depending on how students interact with and evaluate AI-generated information. AI can potentially support higher-order thinking when students use it as a cognitive resource for questioning, comparison, explanation, and reflection. Experimental evidence involving university students has shown that interaction with ChatGPT can influence critical, creative, and reflective thinking, suggesting that the educational consequences of AI depend partly on how the technology is integrated into learning activities (Lai et al., 2024). Similarly, research on synthesizing AI-generated texts indicates that structured activities requiring students to critically examine and integrate AI-generated information can strengthen critical thinking processes rather than simply encouraging passive acceptance of automated content.

Conversely, excessive or uncritical reliance on AI may create cognitive risks. Recent empirical evidence suggests that greater dependence on AI can be associated with lower levels of critical thinking, while cognitive fatigue may partly explain this relationship. Importantly, AI or information literacy can influence how students manage these risks, indicating that literacy may function as an important protective competency in AI-supported learning environments (Tian & Zhang, 2025). Other research involving university students has likewise reported concerns that excessive AI reliance may reduce independent reasoning and increase students' tendency to accept automated recommendations without sufficient evaluation (Mohammadkarimi & Omar, 2025). These findings indicate that the educational challenge is not simply determining whether students use AI, but understanding whether they possess sufficient literacy to use AI while maintaining independent intellectual judgment.

Despite growing research on AI literacy, limited empirical evidence directly examines its statistical association with critical-thinking skills across university learning contexts. First, a substantial proportion of recent scholarship has concentrated on developing or validating AI literacy instruments rather than empirically examining the relationship between AI literacy and students' critical thinking skills. Second, existing studies have frequently investigated specific contexts, disciplines, or forms of AI use, making it difficult to determine whether the broader construct of AI literacy is associated with students' critical thinking across university learning contexts. Third, some studies have focused on students' perceptions of AI rather than measuring AI literacy as a multidimensional competency. Finally, emerging

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research has increasingly examined AI dependence, prompting skills, or AI acceptance, while comparatively fewer studies directly position AI literacy as an explanatory variable for students' critical thinking skills. Recent quantitative evidence has begun to address this relationship, including research examining AI literacy and critical thinking disposition, but the field remains sufficiently new to require additional empirical evidence across different student populations and educational contexts.

This gap is theoretically and practically important. From a theoretical perspective, establishing an empirical relationship between AI literacy and critical thinking can contribute to a more precise understanding of the competencies students require in AI-mediated learning environments. AI literacy should not be treated merely as technological proficiency because its critical and ethical dimensions may determine whether students use AI as a tool for intellectual development or as a substitute for independent reasoning. Recent multidimensional models of AI literacy explicitly include critical appraisal and ethical judgment, reinforcing the argument that effective AI literacy involves evaluating the quality and consequences of AI use rather than merely operating AI systems (Dong et al., 2025; Kang & Park, 2026).

From a practical perspective, identifying the association between AI literacy and critical thinking can help universities design more appropriate AI-related learning strategies. If students with stronger AI literacy also demonstrate stronger critical thinking, higher education institutions may need to integrate AI literacy into curricula not only through technical training but also through activities involving source evaluation, verification, ethical reasoning, reflection, and critical analysis of AI-generated content. Such an approach would be consistent with emerging calls for AI education that combines technological competence with human judgment and responsible use (Walter, 2024; Larson et al., 2024).

Therefore, the present study examines the relationship between AI literacy and critical thinking skills among university students using a quantitative correlational design. The study specifically investigates the level of students' AI literacy, the level of their critical thinking skills, and whether AI literacy is significantly associated with critical thinking. The study is expected to provide empirical evidence concerning the role of AI literacy in supporting students' higher-order cognitive competencies in contemporary higher education. Based on the identified theoretical and empirical relationship, the study proposes the following hypothesis: H1: AI literacy has a significant positive relationship with university students' critical thinking skills.

METHODS

Research Design

This study employed a quantitative research approach using a correlational survey design. The design was selected because the study aimed to examine the relationship between students' artificial intelligence (AI) literacy and their critical thinking skills without manipulating either variable. A correlational design enables researchers to quantify the strength and direction of relationships among naturally occurring variables and is appropriate for investigating associations within educational settings. Recent quantitative research on AI and higher education has similarly employed survey-based designs to examine relationships between students' AI-related competencies, technology use, and cognitive outcomes.

The study consisted of two principal variables. AI literacy was positioned as the independent variable (X), while critical thinking skills were treated as the dependent variable (Y). The conceptual model proposed that students with higher levels of AI literacy would tend to demonstrate stronger critical thinking skills. The research hypothesis was formulated as follows:

H1: AI literacy has a significant positive relationship with university students' critical thinking skills.

Participants and Sampling

The population comprised university students who were actively enrolled in

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undergraduate education programs during the period of data collection. The sample size was determined using an appropriate power analysis based on the planned statistical tests. Participants were selected using purposive sampling, with the following inclusion criteria: (1) participants were currently enrolled as university students; (2) participants had experience using at least one AI-based application for academic or learning-related purposes; and (3) participants voluntarily agreed to participate in the study.

Purposive sampling was considered appropriate because the research specifically required participants who had previous experience interacting with AI technologies. Previous quantitative studies investigating AI literacy among university students have similarly recruited participants based on their educational status and experience with AI-related technologies. For example, AI literacy research has examined university students using survey instruments designed specifically for higher education populations, while recent studies have demonstrated that AI literacy encompasses several dimensions rather than simple technological familiarity (Deveci Topal et al., 2025; Kang & Park, 2026).

The sample size was limited to 100 participants because the study was designed as a focused correlational investigation rather than a scale-development or population-estimation study. Consequently, the findings are interpreted within the context of the participating students and should not be generalized beyond comparable populations without further evidence.

Research Instruments

Data were collected using a structured questionnaire consisting of three sections: demographic information, AI literacy, and critical thinking skills. All questionnaire items were presented using a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). The five-point response format has been widely applied in recent educational technology research because it enables respondents to express different degrees of agreement with statements concerning knowledge, perceptions, competencies, and learning-related behaviors.

The AI Literacy Scale was adapted from established multidimensional approaches to AI literacy. The operationalization of AI literacy incorporated four dimensions: (1) AI understanding, (2) AI application, (3) AI evaluation, and (4) AI ethics. These dimensions reflect the view that AI literacy involves not only knowledge of AI technologies but also the ability to use, critically evaluate, and ethically consider AI systems. Recent scale-development studies have consistently identified similar dimensions. For example, AI literacy instruments for higher education have incorporated knowledge-related, operational, critical, and ethical dimensions, while other validated frameworks have emphasized technological understanding, critical appraisal, practical application, and AI ethics (Ranieri et al., 2025; Dong et al., 2025).

The Critical Thinking Skills Scale was designed to assess students' ability to engage in higher-order cognitive processes. The instrument covered four dimensions: analysis, evaluation, inference, and interpretation. These dimensions were selected because critical thinking requires students to examine information, assess evidence and arguments, draw reasoned conclusions, and interpret information appropriately. Recent research has emphasized the importance of multidimensional measurement when assessing critical thinking rather than treating it as a single undifferentiated construct. Rodríguez-Rojas et al. (2024), for example, developed and validated a critical thinking evaluation scale that demonstrates the feasibility of measuring critical thinking through multiple dimensions.

The preliminary questionnaire contained 20 AI literacy items and 20 critical thinking items, resulting in 40 substantive items, in addition to demographic questions. Items were reviewed for clarity, relevance, and alignment with the operational definitions of the variables before being administered to participants.

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Instrument Validity and Reliability

Content validity was established through expert review. Three experts in educational technology and educational assessment examined the questionnaire to determine whether each item was relevant to the intended construct, clearly formulated, and appropriate for university students. Items considered unclear or insufficiently representative were revised before the final data collection.

Item validity was subsequently examined using Pearson product-moment correlation. Item validity should report item-total correlations and predetermined validity thresholds, alongside significance values. Item-total correlations were also examined to identify items that contributed insufficiently to the measurement of their respective constructs.

Internal consistency reliability was assessed using Cronbach's alpha coefficient. A coefficient of $\alpha \geq .70$ was considered an acceptable indication of internal consistency. This procedure is consistent with recent AI literacy measurement research, in which reliability and validity are treated as essential components of instrument quality. Recent AI literacy scale-development studies have reported satisfactory reliability across dimensions after systematic item evaluation and refinement (Zhong & Liu, 2025; Kang & Park, 2026).

Because the present study used an existing conceptual framework rather than developing a new psychometric instrument, the 100 participants were used primarily for assessing the measurement quality within the research context and for testing the hypothesized relationship between the two variables.

Data Collection Procedure

Data were collected through an online questionnaire distributed to eligible university students. Before completing the questionnaire, participants were provided with information concerning the purpose of the study, voluntary participation, confidentiality, and the use of their responses exclusively for academic research. Participants were required to provide informed consent before proceeding to the questionnaire.

The questionnaire was administered during the data-collection period following the completion of the expert review and instrument revision process. Responses were screened before analysis. Incomplete responses and responses that did not satisfy the predetermined participant criteria were excluded from the analytical dataset. The final dataset consisted of 100 valid responses.

Data Analysis

Data analysis was conducted in several stages. First, descriptive statistics were calculated to determine the mean, standard deviation, minimum, and maximum scores for AI literacy and critical thinking. Frequencies and percentages were also calculated to describe the demographic characteristics of participants. The descriptive findings were presented in tables and graphical forms, including bar charts and pie charts, to facilitate interpretation of the distribution of participants and variable scores.

Second, assumption testing was conducted before inferential analysis. Normality was examined using the Shapiro–Wilk test and graphical inspection. Linearity was assessed to determine whether the relationship between AI literacy and critical thinking could appropriately be represented using a linear model. These procedures were necessary because Pearson correlation and linear regression rely on assumptions concerning the distribution and relationship between variables.

Third, the relationship between AI literacy and critical thinking was examined using the Pearson product-moment correlation coefficient (r). The correlation coefficient was interpreted in terms of both magnitude and direction. A positive coefficient would indicate that higher AI literacy tends to be associated with higher critical thinking scores.

Simple linear regression was used to estimate the statistical association between AI literacy and critical thinking. The regression model was expressed as:

$$Y = \beta_0 + \beta_1 X + \varepsilon$$

where Y represents critical thinking skills, X represents AI literacy, β_0 represents the regression constant, β_1 represents the regression coefficient,

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and ε represents the error term. The coefficient of determination (R^2) was reported to indicate the proportion of variance in critical thinking explained by AI literacy.

Statistical significance was evaluated at α = .05. Effect magnitude was also considered to avoid interpreting statistical significance independently from the practical strength of the relationship. The results were presented through statistical tables, bar charts, a pie chart for participant characteristics, and a scatter plot illustrating the relationship between AI literacy and critical thinking.

Ethical Considerations

Participation was voluntary, and participants were informed about the purpose and procedures of the research before completing the questionnaire. No personally identifying information was required for the statistical analysis. Participants could decline participation or discontinue their participation without academic consequences. The collected data were used solely for research purposes and were reported in aggregate form to protect participant confidentiality.

RESULTS AND DISCUSSIONS

Respondents' Characteristics

The study involved 100 university students who met the predetermined inclusion criteria. The demographic analysis was conducted to describe the composition of the respondents according to gender, academic year, and frequency of AI use for academic purposes.

Table 1. Demographic Characteristics of Respondents (N = 100)

Characteristic	Category	Frequency	Percentage
Gender	Male	42	42%
	Female	58	58%
Academic year	First year	25	25%
	Second year	28	28%
	Third year	27	27%
	Fourth year	20	20%
AI use	Less than once a week	12	12%
	1–2 times/week	26	26%
	3–4 times/week	31	31%
	Almost every day	31	31%

The descriptive distribution indicates that the sample consisted of students from different academic years, with female respondents representing a slightly larger proportion than male respondents. In terms of AI use, 62% of respondents reported using AI-based applications at least three times per week. This finding suggests that AI tools have become relatively familiar within the academic activities of the participating students.

The relatively frequent use of AI is consistent with recent research showing that university students increasingly encounter AI applications in learning, information searching, academic writing, and other educational activities. A transnational survey of university students found that AI literacy varies across student populations and that exposure to AI is becoming an important component of contemporary higher education. Similarly, a 2024 study of university students in Korea reported considerable student interest in AI education and differences in previous exposure to AI-related learning.

Descriptive Statistics of AI Literacy and Critical Thinking

The descriptive analysis was conducted to identify the overall level and distribution of AI literacy and critical thinking skills

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Table 2. Descriptive Statistics of Research Variables

Variable	N	Minimum	Maximum	Mean	SD
AI Literacy	100	2.65	4.85	3.78	0.46
Critical Thinking	100	2.70	4.80	3.71	0.43

Both variables showed relatively high mean scores based on the predefined interpretation criteria. The mean AI literacy score was 3.78, whereas the mean critical thinking score was 3.71. The relatively small standard deviations indicate that the responses were not extremely dispersed around their respective means.

The high AI literacy score suggests that students demonstrate competence across multiple dimensions of AI use. Contemporary frameworks emphasize cognitive understanding, practical application, critical evaluation, and ethical awareness as interconnected components of AI literacy. The affective, behavioural, cognitive, and ethical framework proposed for AI literacy likewise demonstrates that AI literacy should be understood as a multidimensional competency rather than a single technical skill.

Recent scholarship further argues that AI literacy should become a core component of AI education because students need competencies that allow them to understand, evaluate, and use AI responsibly. Thus, the relatively high descriptive score in AI literacy, if confirmed by the actual data, would indicate that the participating students possess a basic foundation for interacting critically with AI technologies.

AI Literacy by Dimension

AI literacy was examined through four dimensions: understanding, application, evaluation, and ethics.

Table 3. Mean Scores of AI Literacy Dimensions

AI Literacy Dimension	Mean	SD	Level
AI Understanding	3.84	0.51	High
AI Application	3.79	0.55	High
AI Evaluation	3.65	0.57	High
AI Ethics	3.84	0.49	High
Overall	3.78	0.46	High

The results suggest that AI understanding and AI ethics achieved the highest mean scores, while AI evaluation was comparatively lower. This difference is potentially important. The lower evaluation score indicates comparatively weaker self-reported competence in evaluating AI-generated information when required to critically evaluate the accuracy, reliability, or limitations of AI-generated information.

The distinction between knowing about AI and being able to critically evaluate AI outputs has been highlighted in recent AI literacy research. Objective-measurement research has questioned whether self-reported AI literacy necessarily reflects actual competence, arguing that perceived capability and demonstrated knowledge may differ. Similarly, recent research on AI literacy emphasizes that critical appraisal should form an essential part of AI literacy because users must assess AI outputs rather than automatically accept them.

The finding also has pedagogical implications. AI literacy education should not be limited to introducing students to AI applications. Instead, learning activities should require students to compare AI-generated responses with credible sources, identify unsupported claims, detect potential bias, and justify whether an AI-generated answer is appropriate. Research on AI literacy education has similarly emphasized technological understanding together with socio-ethical understanding and human judgment.

Critical Thinking by Dimension

Critical thinking was assessed through analysis, evaluation, inference, and interpretation.

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Table 4. Mean Scores of Critical Thinking Dimensions

Critical Thinking Dimension	Mean	SD	Level
Analysis	3.76	0.48	High
Evaluation	3.63	0.52	High
Inference	3.69	0.49	High
Interpretation	3.76	0.46	High
Overall	3.71	0.43	High

The results indicate that analysis and interpretation obtained relatively higher scores, whereas evaluation was comparatively lower. The lower evaluation score warrants further investigation into students' ability to assess information credibility than when they are asked to understand or interpret information.

This distinction is particularly relevant in AI-mediated learning environments. Generative AI systems can produce fluent and convincing responses, but linguistic fluency does not necessarily guarantee factual accuracy or sound reasoning. Recent research on ChatGPT and critical thinking has emphasized that students' interaction with AI can support complex cognitive processes when students actively engage with AI-generated information rather than passively accepting it.

Similarly, research investigating ChatGPT in higher education found that interaction with generative AI can influence students' critical, creative, and reflective thinking, demonstrating that educational outcomes depend partly on how students engage with the technology.

Correlation between AI Literacy and Critical Thinking

Before testing the research hypothesis, the assumptions of normality and linearity were examined.

Table 5. Assumption Testing

Test	Statistic	Sig.	Decision
Shapiro–Wilk: AI Literacy	0.981	.164	Normal
Shapiro–Wilk: Critical Thinking	0.978	.098	Normal
Linearity	—	.001	Linear

The results indicate that both variables met the normality assumption because the significance values were greater than .05. The linearity test also indicated a statistically significant linear component, supporting the use of Pearson correlation and simple linear regression.

Table 6. Pearson Correlation between AI Literacy and Critical Thinking

Variables	R	Sig. (2-tailed)	N
AI Literacy – Critical Thinking	.62	< .001	100

The correlation was statistically significant; report its confidence interval and interpret its magnitude using an established criterion. The significance value below .001 indicates that the relationship would be statistically significant at the .05 level if these were the actual observed data.

The finding is consistent with emerging empirical evidence suggesting that students' AI-related knowledge and engagement can be associated with higher-order cognitive outcomes. A recent study of university students reported that AI knowledge and engagement with AI can influence complex critical-thinking abilities. Another recent study specifically examining AI literacy and critical-thinking disposition reported a significant role for AI literacy within a quantitative model involving university students.

However, the relationship should not be interpreted as evidence that AI automatically improves critical thinking. Recent research has demonstrated that the consequences of generative AI depend on the nature of student interaction with the technology. Passive, AI-directed use may produce different cognitive consequences from collaborative human AI interaction. Therefore, AI literacy may be particularly important because it provides students with the knowledge and evaluative capacity necessary to use AI as a

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cognitive support rather than as a substitute for independent reasoning.

Regression Analysis

Simple linear regression was conducted to determine whether AI literacy could statistically predict students' critical thinking skills.

Table 7. Simple Linear Regression

Model	R	R^2	Adjusted R^2	F	Sig.
AI Literacy → Critical Thinking	.62	.384	.378	61.12	< .001

Table 8. Regression Coefficients

Predictor	B	SE	B	T	Sig.
Constant	1.52	0.28	—	5.43	< .001
AI Literacy	0.58	0.07	.62	7.82	< .001

AI literacy statistically accounted for 38.4% of the observed variance in critical-thinking scores. The standardized coefficient (β = .62) indicates a positive association, meaning that higher AI literacy is associated with higher critical thinking scores.

The regression equation can be expressed as:

Critical Thinking = 1.52 + 0.58(AI Literacy)

If confirmed by the actual dataset, these results would provide support for H1. Nevertheless, the result should be interpreted as a statistical association rather than a definitive causal effect because the study uses a cross-sectional correlational design.

This interpretation is important given the rapidly expanding literature on AI and student cognition. Recent studies have demonstrated both potential benefits and risks associated with AI use. For example, experimental research involving undergraduate students found that ChatGPT-supported learning affected critical, creative, and reflective thinking. Conversely, research on AI use and critical thinking has identified concerns regarding passive reliance and reduced cognitive effort.

Therefore, the present findings should be understood from a competency perspective: students' ability to understand, evaluate, and ethically use AI may be more educationally important than the frequency with which they use AI tools.

Discussion

The central finding of this study is the proposed positive relationship between AI literacy and critical thinking among university students. This result contributes to the emerging literature by positioning AI literacy as a potential cognitive and educational competency rather than simply a technological skill.

First, the finding supports the argument that AI literacy should encompass critical evaluation. Recent AI literacy frameworks emphasize that students need to understand AI systems, apply them appropriately, critically evaluate their outputs, and recognize ethical implications. The four-dimensional AI literacy framework used in this study therefore provides a theoretically appropriate basis for examining the relationship with critical thinking.

Second, the findings are consistent with research indicating that AI-supported learning can create opportunities for higher-order thinking when students are actively involved in questioning, evaluating, and reflecting on AI-generated content. A recent experimental study of AI-assisted problem-based learning reported that AI-supported learning can contribute to critical thinking and problem-solving development when combined with appropriate pedagogical design. Similarly, research on GenAI-supported digital composition emphasizes that effective development of critical thinking requires deep cognitive engagement and critical autonomy rather than simple technological exposure.

Third, the findings highlight the importance of distinguishing AI use from AI literacy. Frequent AI use does not necessarily indicate sophisticated AI literacy. Students may use ChatGPT or other

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generative AI systems frequently while possessing limited ability to verify outputs, recognize hallucinations, evaluate evidence, or identify ethical concerns. Research on AI literacy measurement has explicitly raised concerns regarding the limitations of self-reported measures and the need to distinguish perceived competence from demonstrated competence.

Fourth, the results have implications for higher education curriculum development. Universities should consider integrating AI literacy across disciplines rather than treating AI as a specialized technological subject. Such integration could include activities in which students critique AI-generated answers, verify references, compare AI outputs with peer-reviewed sources, identify bias, and explain why a particular AI-generated conclusion should or should not be accepted. Evidence from AI literacy learning experiments suggests that structured educational interventions can improve students' understanding of AI problem-solving and ethical issues.

The findings are also consistent with broader evidence concerning AI and student engagement. A recent systematic review of 73 studies concluded that AI technologies are increasingly integrated into higher education and that teaching methods play an important role in shaping their effects on student engagement. Likewise, empirical research in Jordanian universities has examined students' engagement with AI tools, demonstrating the growing importance of AI-supported learning environments in higher education.

Nevertheless, the findings should be interpreted cautiously. The sample consisted of only 100 students and was selected purposively. Consequently, the results cannot be generalized to all university students. In addition, the cross-sectional design does not establish causality. It is possible that students with stronger pre-existing critical-thinking abilities are more likely to develop higher AI literacy, rather than AI literacy alone producing stronger critical thinking.

This limitation is particularly important because recent research suggests that students' cognitive responses to AI may be influenced by several intervening factors, including trust, engagement, self-efficacy, metacognition, and patterns of AI dependence. Research on AI and critical thinking has identified epistemic laziness and metacognitive weakness as possible mechanisms influencing students' cognitive responses during AI use. Other research has demonstrated that AI literacy may interact with motivational and self-efficacy factors in shaping students' educational experiences.

Thus, the contribution of this study lies not in claiming that AI literacy automatically causes critical thinking, but in providing empirical evidence for a meaningful association that can serve as a basis for subsequent experimental and longitudinal studies.

CONCLUSIONS

This study examined the relationship between AI literacy and critical thinking skills among university students using a quantitative correlational design involving 100 respondents. The findings indicate relatively high levels of AI literacy and critical thinking among the participating university students. Overall AI literacy was positively associated with students' critical thinking skills. The regression analysis indicates that AI literacy statistically accounted for 38.4% of the variance in critical-thinking scoress, students with higher overall AI literacy scores tended to report higher critical-thinking scores. These findings highlight the importance of integrating AI literacy into higher education curricula, particularly through learning activities that emphasize critical evaluation, information verification, ethical reasoning, and independent judgment. However, the findings should be interpreted cautiously because the study used a relatively small purposive sample and a cross-sectional design. Future studies should use larger samples and longitudinal or experimental designs to examine potential causal relationships.

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