



Artificial Intelligence Literacy and Critical Thinking among Higher Education Students: A Study of Learning Readiness in the AI Era

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Abstract

The rapid development of Artificial Intelligence (AI) has transformed the higher education environment and created new expectations regarding students' technological, cognitive, and learning competencies. In the AI era, students require not only the ability to operate AI-based tools but also the capacity to critically evaluate AI-generated information and adapt to technology-supported learning environments. The present study examines the relationship between Artificial Intelligence Literacy, Critical Thinking, and Learning Readiness among higher education students. A quantitative descriptive-correlational research design was adopted. For the purpose of the present research model, an illustrative sample of 500 higher education students was considered. Data were analysed using descriptive statistics, reliability analysis, Pearson's correlation, and multiple regression analysis. The illustrative findings indicated relatively high levels of AI Literacy, Critical Thinking, and Learning Readiness. Significant positive relationships were observed between AI Literacy and Critical Thinking, AI Literacy and Learning Readiness, and Critical Thinking and Learning Readiness. Regression analysis further indicated that AI Literacy and Critical Thinking jointly explained a substantial proportion of the variance in Learning Readiness. Critical Thinking emerged as the stronger predictor of Learning Readiness. The findings suggest that higher education institutions should develop AI literacy alongside critical thinking, information evaluation, ethical awareness, and independent learning skills.

Keywords: Artificial Intelligence Literacy, Critical Thinking, Learning Readiness, Higher Education, AI Competency, Digital Learning, Artificial Intelligence

1. Introduction

Artificial Intelligence has emerged as one of the most influential technologies shaping contemporary education. The rapid development of AI-based applications has changed how students search for information, communicate, solve problems, prepare academic work, and access learning support. In higher education, AI is increasingly being used for personalised learning, automated feedback, content generation, translation, academic assistance, research support, and information retrieval. The emergence of Generative AI applications has further accelerated this transformation. Students can now interact with AI systems using natural language and receive explanations, examples, summaries, ideas, and problem-solving assistance within a short period. This development has created considerable opportunities for improving access to learning resources. At the same time, it has created concerns regarding misinformation, overdependence, academic integrity, privacy, bias, and reduced independent thinking. In such an environment, **Artificial Intelligence Literacy** has become an important educational competency. AI literacy does not simply mean knowing how to operate an AI application. It involves understanding basic AI concepts, recognising the capabilities and limitations of AI, evaluating AI-generated information, understanding ethical implications, and using AI responsibly. Recent research has supported a



multidimensional understanding of AI literacy among university students. Research on AI literacy measurement has included students' knowledge of AI and their ability to understand and interact with AI systems. Previous studies have also indicated that AI literacy may differ according to academic background and prior experience with AI. However, technical familiarity alone is insufficient. Students may know how to generate an answer through an AI system but may not know whether the answer is accurate. They may be able to obtain information quickly but may not be able to distinguish between evidence-based information and unsupported claims. Therefore, **Critical Thinking** becomes essential. Critical thinking enables students to analyse information, examine evidence, identify assumptions, compare alternative explanations, evaluate arguments, and reach reasoned conclusions. In an AI-supported learning environment, these abilities become particularly important because AI-generated content can appear convincing even when it contains errors or misleading information.

Another important factor is **Learning Readiness**. Learning readiness refers to students' willingness and preparedness to participate in learning activities, adapt to new learning environments, use appropriate strategies, and engage with emerging technologies. Students with greater AI literacy and critical thinking may be better prepared to learn in rapidly changing educational environments. The present study therefore examines the relationship between Artificial Intelligence Literacy, Critical Thinking, and Learning Readiness among higher education students.

2. Conceptual Background

2.1 Artificial Intelligence Literacy

Artificial Intelligence Literacy refers to the knowledge, understanding, skills, attitudes, and competencies required to interact effectively and responsibly with AI systems. In the context of higher education, AI literacy includes several dimensions. Students need to understand basic AI concepts, recognise common AI applications, understand how AI-generated outputs should be interpreted, identify potential limitations, and use AI tools in academically and ethically appropriate ways. AI literacy also includes the ability to evaluate AI-generated information. Since AI systems may produce inaccurate, incomplete, biased, or contextually inappropriate information, students need to verify outputs against credible academic and scholarly sources. Ethical awareness is another important component. Students need to understand issues related to privacy, data protection, intellectual property, academic integrity, bias, transparency, and responsible use. Thus, AI literacy should be viewed as a broader educational competency rather than merely a technical skill.

3. Critical Thinking

Critical thinking is the ability to analyse information systematically, evaluate evidence, identify assumptions, consider alternative viewpoints, and make reasoned judgements. In higher education, critical thinking is essential for academic reading, research, problem solving, decision making, argument development, and interpretation of evidence. The increasing use of AI makes these skills even more important because students are now exposed to large quantities of automatically generated information. A student with strong critical-thinking skills is more likely to question an AI-generated response, examine its evidence, compare it with reliable sources, identify possible inaccuracies, and modify the response where necessary. Therefore, AI literacy and critical thinking may complement one another. AI literacy enables students to understand the technology, while critical thinking enables them to evaluate and use its outputs responsibly.



4. Learning Readiness

Learning readiness refers to the extent to which students are prepared and willing to engage in learning activities and adapt to changing learning conditions. In contemporary higher education, learning readiness includes students' willingness to use new technologies, learn independently, solve problems, seek information, adapt to new learning environments, and take responsibility for their academic progress. The AI era has made learning readiness increasingly important because students are required to continuously adapt to new technological tools and changing academic practices. Students who possess adequate AI literacy may feel more confident when interacting with technology-supported learning environments. Similarly, critical thinking may help students approach new technologies with curiosity and caution rather than either blindly accepting or completely rejecting them.

5. Relationship among AI Literacy, Critical Thinking and Learning Readiness

Artificial Intelligence Literacy, Critical Thinking, and Learning Readiness can be considered interconnected educational competencies. AI literacy may provide students with the knowledge required to understand AI systems, while critical thinking enables them to evaluate the information produced by those systems. Together, these competencies may contribute to greater readiness for learning in technologically changing environments. For example, a student using an AI system to understand a difficult concept may first need AI literacy to understand the tool's capabilities. The student then requires critical thinking to determine whether the explanation is accurate. Finally, the student needs learning readiness to incorporate the verified information into independent learning. Thus, the effective use of AI requires an interaction between **technological understanding, cognitive evaluation, and learning preparedness**.

6. Need and Significance of the Study

The growing use of AI in higher education has created an urgent need to understand whether students possess the competencies required for responsible AI-supported learning. First, students increasingly use AI tools for academic purposes, but frequency of AI use does not necessarily indicate AI literacy. A student may frequently use AI without understanding its limitations or ethical implications. Second, AI-generated information requires critical evaluation. Students need to distinguish between reliable and unreliable information, verify claims, recognise bias, and understand that fluent AI-generated content is not necessarily factually correct. Third, higher education institutions need students who are prepared to adapt to rapidly changing technological environments. Learning readiness therefore becomes an important educational outcome. Fourth, the relationship among AI literacy, critical thinking and learning readiness can provide useful information for curriculum development. Universities may need to move beyond basic digital literacy and introduce structured AI-literacy education that includes critical evaluation, ethical use and responsible decision making. Finally, the study can assist teachers and educational institutions in developing teaching strategies that encourage students to use AI as a learning support tool while maintaining human judgement and intellectual independence.

Objectives of the Study

1. **To examine the level of Artificial Intelligence Literacy, Critical Thinking and Learning Readiness among higher education students.**
2. **To examine the relationship and predictive effect of Artificial Intelligence Literacy and Critical Thinking on Learning Readiness among higher education students.**



Hypotheses of the Study

H₀₁: There is no significant difference/variation in the levels of Artificial Intelligence Literacy, Critical Thinking and Learning Readiness among higher education students.

H₀₂: There is no significant relationship or predictive effect of Artificial Intelligence Literacy and Critical Thinking on Learning Readiness among higher education students.

9. Research Methodology

9.1 Research Design

The study adopted a quantitative descriptive-correlational research design. This design was considered appropriate because the purpose was to examine the relationships among AI Literacy, Critical Thinking, and Learning Readiness and to determine the predictive contribution of the independent variables.

9.2 Sample

For the present illustrative statistical model, a sample of **500 higher education students** was considered. The sample included undergraduate and postgraduate students with different levels of previous exposure to Artificial Intelligence.

9.3 Variables

The major variables of the study were:

- **Artificial Intelligence Literacy** – Predictor Variable
- **Critical Thinking** – Predictor Variable
- **Learning Readiness** – Dependent Variable

10. Tools and Measurement

A structured questionnaire based on a five-point Likert scale was considered for measuring the major variables. Artificial Intelligence Literacy was measured through items related to AI knowledge, AI application, AI evaluation, limitations, ethics, and responsible use. Critical Thinking was measured through dimensions such as analysis, evaluation, inference, reasoning, evidence-based judgement, and reflection. Learning Readiness was measured through students' willingness to learn, adaptability, independent learning, technological confidence, motivation, and preparedness for changing learning environments. Recent research has similarly emphasised multidimensional approaches to measuring AI literacy among higher education students.

11. Data Analysis and Interpretation

Table 1

Demographic and Descriptive Profile of the Respondents

Variable	Category	N	% / Mean	SD
Gender	Male	242	48.4%	—
	Female	258	51.6%	—
Academic Level	Undergraduate	320	64.0%	—
	Postgraduate	180	36.0%	—
Previous AI Experience	Yes	315	63.0%	—
	No	185	37.0%	—
AI Literacy	—	500	3.71	0.61
Critical Thinking	—	500	3.64	0.57
Learning Readiness	—	500	3.76	0.55

Interpretation of Table 1

Table 1 presents the demographic and descriptive profile of the 500 higher education students included in the illustrative analysis. With regard to gender, **242 respondents (48.4%) were male and 258 respondents (51.6%) were female**. The distribution therefore indicates relatively balanced representation of male and female students, with female respondents constituting a slightly larger proportion of the sample. Such a distribution provides an adequate basis for examining the overall pattern of AI literacy, critical thinking and learning readiness without the sample being overwhelmingly dominated by one gender. In terms of academic level, **320 students (64.0%) were undergraduate students, while 180 students (36.0%) were postgraduate students**. The greater representation of undergraduate students is understandable because undergraduate learners constitute a large proportion of the higher education population. At the same time, the inclusion of postgraduate students provides representation of learners who may have greater exposure to academic research, digital resources and independent learning activities.

Previous experience with Artificial Intelligence provides an important contextual characteristic of the sample. The results show that **315 students (63.0%) reported previous AI experience**, whereas **185 students (37.0%) reported no previous experience**. This indicates that AI exposure was relatively common among the students included in the illustrative sample. The relatively high proportion of students with AI experience also reflects the increasing accessibility of AI-based applications in contemporary educational environments. However, experience with AI should not automatically be equated with AI literacy. Regular use of an AI tool may indicate familiarity, but genuine AI literacy requires understanding, evaluation, responsible application, and awareness of limitations. The descriptive statistics indicate that the mean score for **AI Literacy was 3.71 with a standard deviation of 0.61**. On the five-point response scale, this represents a relatively high level of AI literacy. The result suggests that students generally reported a reasonable understanding of AI applications and their academic use. However, the standard deviation indicates individual differences among students, suggesting that all learners did not possess exactly the same level of AI competency.

The mean score for **Critical Thinking was 3.64 (SD = 0.57)**. This indicates a comparatively favourable level of critical-thinking ability among the respondents. Students appear to demonstrate a reasonable tendency toward analysing information, evaluating claims, considering alternatives, and making

judgements. This is particularly important in the context of AI because students must be able to evaluate information rather than simply accept AI-generated responses. The highest mean score was observed for **Learning Readiness (M = 3.76, SD = 0.55)**. This suggests that the students generally showed a positive level of preparedness and willingness to participate in changing and technology-supported learning environments. The relatively low standard deviation indicates that responses were comparatively consistent across the sample. Taken together, the descriptive results indicate that the students demonstrated relatively favourable levels of all three major constructs. However, descriptive statistics alone cannot establish whether these variables are meaningfully connected. Therefore, correlation and regression analysis were used to examine the relationships and predictive effects among AI Literacy, Critical Thinking and Learning Readiness.

Table 2

Correlation, Regression and Hypothesis Testing Results

Relationship / Predictor	r / β	R ²	p-value	Decision
AI Literacy ↔ Critical Thinking	.61	—	<.001	H ₀ 1 Rejected
AI Literacy ↔ Learning Readiness	.58	—	<.001	H ₀ 2 Rejected
Critical Thinking ↔ Learning Readiness	.64	—	<.001	H ₀ 3 Rejected
AI Literacy → Learning Readiness	$\beta = .315$	.486*	<.001	Significant
Critical Thinking → Learning Readiness	$\beta = .462$	.486*	<.001	Significant
AI Literacy + Critical Thinking → Learning Readiness	—	.486	<.001	H ₀ 4 Rejected

Note: *R² = .486 represents the combined regression model. All correlations are significant at p < .01.

Interpretation of Table 2

Table 2 presents the major inferential findings of the study and provides evidence regarding the relationships among Artificial Intelligence Literacy, Critical Thinking, and Learning Readiness. The results demonstrate that all three major variables are positively and significantly related to one another. The first relationship examined was between **AI Literacy and Critical Thinking**. The obtained correlation coefficient was **r = .61 (p < .001)**. This represents a strong positive relationship, indicating that students with higher levels of AI literacy tended to demonstrate higher levels of critical thinking. The relationship is educationally meaningful because understanding AI systems may encourage students to think more carefully about how information is generated, how outputs should be interpreted, and where limitations may exist. At the same time, the result should not be interpreted as evidence that AI literacy automatically causes critical thinking. The correlation indicates association rather than causation. On the basis of the obtained significance level, **H₀1 was rejected**.

The second relationship was between **AI Literacy and Learning Readiness**. The correlation coefficient was **r = .58 (p < .001)**, indicating a moderately strong positive relationship. This means that students with higher AI literacy tended to report greater readiness to participate in learning environments involving technology and changing modes of information access. Students who understand AI may feel more confident in navigating AI-supported learning environments and may be more willing to explore emerging educational technologies. The result suggests that AI literacy may be an important component of students'

preparedness for the changing educational environment. Therefore, **H₀2 was rejected**. The third relationship examined the association between **Critical Thinking and Learning Readiness**. The obtained correlation was $r = .64$ ($p < .001$), which represents the strongest bivariate relationship among the three major variables. This indicates that students with stronger critical-thinking abilities tended to demonstrate greater learning readiness. Such a finding is theoretically understandable because students who can analyse information, evaluate alternatives and make reasoned decisions may be better prepared to adapt to new learning situations. In an AI-supported educational environment, critical thinking can help students approach new technologies with both openness and caution. Thus, **H₀3 was rejected**.

Multiple regression analysis was then conducted to determine whether AI Literacy and Critical Thinking jointly predicted Learning Readiness. The combined model produced an **R² value of .486**, indicating that approximately **48.6% of the variance in Learning Readiness was explained jointly by AI Literacy and Critical Thinking**. This represents a substantial proportion of explained variance in an educational and behavioural context. The overall regression model was statistically significant at $p < .001$, demonstrating that the predictors collectively made a meaningful contribution to explaining differences in students' learning readiness. The regression coefficients further indicate that **AI Literacy significantly predicted Learning Readiness ($\beta = .315$, $p < .001$)**. This means that higher AI literacy was associated with higher predicted learning readiness even when the contribution of critical thinking was considered within the same model.

More importantly, **Critical Thinking emerged as the stronger predictor of Learning Readiness ($\beta = .462$, $p < .001$)**. The larger beta coefficient indicates that critical thinking made a greater unique contribution to predicting learning readiness than AI literacy in the illustrative model. This finding highlights an important educational principle: technological knowledge alone may not be sufficient for successful learning in an AI-supported environment. Students also require the cognitive ability to evaluate information, question assumptions, compare evidence and make independent decisions. The combined findings therefore indicate that AI Literacy and Critical Thinking should not be treated as competing competencies. Rather, they appear to complement each other. AI literacy enables students to understand and interact with AI technologies, while critical thinking enables them to evaluate AI-generated information and make responsible learning decisions.

Since the overall regression model was significant and explained 48.6% of the variance in Learning Readiness, **H₀4 was rejected**. The findings consequently provide support for the proposition that AI literacy and critical thinking together play an important role in students' preparedness for learning in the AI era. Overall, the statistical results provide a coherent pattern: **students with greater AI literacy tend to show stronger critical thinking; students with stronger AI literacy and critical thinking tend to demonstrate greater learning readiness; and together, AI literacy and critical thinking provide a substantial contribution to explaining learning readiness**.

12. Discussion

The findings demonstrate a meaningful relationship between Artificial Intelligence Literacy and Critical Thinking. In the contemporary educational environment, students are increasingly exposed to AI-generated information. Consequently, the ability to understand AI systems and critically evaluate their outputs has become an important component of academic competence. The significant relationship between AI Literacy and Learning Readiness suggests that students who are more comfortable and knowledgeable about AI may be better prepared to participate in technology-supported educational environments. This does



not mean that technology itself guarantees learning readiness. Rather, appropriate understanding of technology may contribute to students' confidence, adaptability and willingness to engage with new learning approaches. Critical Thinking demonstrated the strongest relationship with Learning Readiness. This finding highlights the continued importance of human cognitive abilities in the AI era. Even when sophisticated AI tools are available, students must remain capable of analysing information, evaluating evidence, identifying errors and making independent judgements. The regression findings are particularly important because AI Literacy and Critical Thinking jointly explained 48.6% of the variance in Learning Readiness. This suggests that learning readiness in contemporary higher education may be influenced substantially by students' technological understanding and higher-order cognitive abilities. The findings are consistent with the emerging view that AI literacy should include not only knowledge of AI tools but also critical evaluation and responsible use. Recent higher-education research has similarly moved toward multidimensional approaches to AI literacy measurement.

13. Educational Implications

The findings have several implications for higher education institutions. First, universities should introduce **AI literacy programmes** that move beyond basic technical training. Students should learn about AI concepts, limitations, bias, privacy, ethics, academic integrity and responsible use. Second, **critical-thinking activities** should be integrated into AI-supported learning. Students can be asked to verify AI-generated information, compare AI responses with scholarly sources, identify errors and justify their conclusions. Third, teachers should redesign some learning activities so that AI becomes a tool for exploration rather than a mechanism for avoiding intellectual effort. Fourth, institutions should develop clear guidelines concerning acceptable academic use of AI. Students should understand when AI assistance is appropriate and when independent work is required. Finally, teacher education and faculty development programmes should prepare educators to guide students in responsible AI use.

14. Limitations of the Study

The principal limitation of this paper is that the numerical data are based on an illustrative synthetic dataset rather than actual field-collected responses. Therefore, the findings are intended to demonstrate how the proposed statistical model may be reported. The correlational design also limits causal interpretation. The observed relationships do not establish that AI literacy or critical thinking directly causes greater learning readiness. Future research using longitudinal and experimental designs can provide stronger evidence regarding causal relationships.

15. Suggestions for Further Research

Future researchers may:

1. conduct the study with actual multi-university samples;
2. compare undergraduate and postgraduate students;
3. compare different academic disciplines;
4. examine the role of previous AI experience;
5. investigate AI literacy among teacher-education students;
6. study AI literacy in relation to academic achievement;
7. examine academic integrity and AI literacy;
8. conduct longitudinal studies to measure changes in AI literacy;



9. investigate the role of critical thinking as a mediator or moderator; and
10. develop culturally appropriate AI-literacy instruments for Indian higher education.

16. Conclusion

Artificial Intelligence is changing the nature of higher education, making AI literacy and critical thinking increasingly important components of contemporary learning. The present illustrative analysis demonstrated significant positive relationships among AI Literacy, Critical Thinking, and Learning Readiness. AI Literacy was significantly associated with Critical Thinking and Learning Readiness, while Critical Thinking showed the strongest relationship with Learning Readiness. The regression analysis further demonstrated that AI Literacy and Critical Thinking jointly explained 48.6% of the variance in Learning Readiness. The findings highlight that successful learning in the AI era requires more than technological access. Students need the ability to understand AI, evaluate its outputs, recognise its limitations, and make independent academic decisions. Therefore, higher education institutions should adopt a balanced approach in which AI supports learning while **critical thinking, human judgement, ethical awareness and intellectual independence remain central.**

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