

ARTIFICIAL INTELLIGENCE DEPENDENCY AND CRITICAL THINKING SKILLS AMONG UNDERGRADUATE EDUCATION STUDENTS

by

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Abstract

The increasing use of Artificial Intelligence (AI) in education has raised questions about its influence on students' thinking and learning processes. This study explored the relationship between AI dependency and critical thinking skills among undergraduate education students at the Polytechnic University of the Philippines–Lopez, Quezon. The investigation focused on students' use of AI for academic assistance, information retrieval, and assignment completion, as well as their critical thinking skills in terms of analysis, evaluation, and problem-solving. A descriptive-correlational research design was employed, and data were gathered through survey questionnaires during the 2025 academic year. The results showed that the 100 students exhibited a moderate level of AI dependency and a high level of critical thinking skills. The analysis further revealed a significant relationship between the two variables, suggesting that students' use of AI is associated with their ability to analyze information, evaluate evidence, and address academic problems. These findings highlight the importance of promoting responsible AI use while continuing to develop students' higher-order thinking skills. Educational institutions may support this goal through AI literacy initiatives, critical thinking activities, academic integrity programs, and faculty development efforts that encourage the effective and ethical integration of AI in teaching and learning.

Keywords: *artificial intelligence, AI dependency, critical thinking skills, undergraduate education students, higher education, AI literacy*

INTRODUCTION

The rapid advancement of Artificial Intelligence (AI) has significantly transformed various aspects of higher education, particularly in how students access information, complete academic tasks, and engage with learning materials. Studies have shown that AI technologies are increasingly embedded in educational environments, supporting learners in research, writing, and problem-solving activities (Holmes, 2021). Undergraduate education students, who are being trained as future educators, are among those frequently exposed to these AI-powered tools. While these technologies offer convenience and efficiency, recent literature also highlights concerns regarding students' growing reliance on AI systems in their academic work (UNESCO, 2023).

Critical thinking skills remain essential for undergraduate education students as they involve the ability to analyze information, evaluate evidence, and make reasoned judgments in academic and real-life situations. However, scholars argue that excessive dependence on AI tools may affect the development of independent reasoning and deep analytical thinking, as students may rely more on automated outputs rather than engaging in cognitive effort (Kasneci, 2023). In this context, this study explores the relationship between Artificial Intelligence dependency and critical thinking skills among undergraduate education students, aiming to understand how AI use may influence their academic development and thinking processes.

Background of the Study

Artificial Intelligence (AI) has become an important part of higher education, influencing the way students access information, conduct research, and complete academic requirements. The emergence of AI-powered tools such as intelligent search engines, writing assistants, and generative AI platforms has provided learners with convenient and efficient means of accomplishing various academic tasks. As these technologies continue to evolve, many college students have incorporated them into their daily learning practices, benefiting from faster access to information and increased productivity. The growing integration of AI in educational settings has reshaped traditional learning processes and created new opportunities for academic support and personalized learning experiences (UNESCO, 2023).

While AI offers numerous educational advantages, concerns have emerged regarding students' increasing reliance on these technologies and their potential influence on critical thinking skills. Critical thinking is an essential competency for undergraduate education students because it enables them to analyze information, evaluate evidence, and develop logical solutions to problems. However, frequent dependence on AI-generated responses may reduce opportunities for independent reasoning and reflective learning. Although previous studies have explored the benefits and challenges of AI in education, limited research has focused specifically on the relationship between AI dependency and critical thinking skills among undergraduate education students. This gap in the literature highlights the need to investigate how AI dependency may affect students' abilities in analysis, evaluation, and problem-solving (Kasneci, 2023).

Related Studies and Literature

Artificial Intelligence Dependency. The increasing presence of Artificial Intelligence (AI) in education has transformed the way students approach learning and academic tasks. AI-powered applications are now widely used to support studying, gather information, and complete course requirements. Because of their convenience and accessibility, these technologies have become part of many students' daily academic routines.

Zhang (2024) described AI dependency as a condition in which learners become heavily reliant on AI systems when performing tasks that would normally require their own thinking and effort. Their findings indicated that students often turn to AI because of academic demands, pressure to perform well, and the perceived usefulness of these tools. While AI can make learning more efficient, the authors noted that excessive reliance may lessen students' willingness to engage in independent learning and reflective thinking.

A similar observation was reported by Abbas (2024), who found that university students frequently use generative AI to obtain explanations, summarize readings, and assist with coursework. Their study suggested that AI can serve as a helpful learning aid, but overreliance may reduce opportunities for students to strengthen important academic skills through direct engagement with learning activities.

Research conducted by Fernando (2026) further revealed that many college students demonstrate moderate to high levels of dependence on AI, particularly when completing writing and research-related tasks. Students who relied more heavily on AI were found to exhibit lower levels of learning independence and weaker academic competencies. These findings underscore the need to promote responsible AI use while preserving students' ability to think and learn independently.

Academic Assistance, Information Retrieval, and Assignment Completion. One of the primary reasons students utilize AI is for academic assistance. AI tools are capable of explaining lessons, generating examples, providing feedback, and assisting learners in understanding difficult concepts. Hernández (2025) found that students view AI as a readily available learning companion that offers immediate support when academic help is needed. The accessibility and convenience of these tools contribute significantly to their widespread use among students.

In terms of information retrieval, AI has changed how learners access and process information. Instead of manually searching through multiple sources, students can obtain summarized and organized responses from AI systems. According to Zou (2024), many students use AI platforms to gather information quickly and support academic research. However, the authors emphasized that students must still evaluate the accuracy and credibility of AI-generated information, as incorrect or biased outputs may affect learning outcomes.

AI has also become a common tool for assignment completion. Students frequently use AI to develop outlines, generate summaries, draft written outputs, and organize ideas. Although these functions can save time and improve efficiency, researchers have raised concerns about the possibility of reduced cognitive engagement. Abbas (2024) argued that excessive reliance on AI-generated outputs may discourage students from actively participating in the learning process and developing their own solutions to academic tasks.

Critical Thinking Skills. Critical thinking is considered an essential skill for undergraduate education students, particularly because future educators are expected to analyze information carefully, make sound judgments, and solve problems effectively. In higher education, critical thinking supports students in evaluating evidence, interpreting

information, and making informed decisions in both academic and professional contexts.

Maslan and Ubaidah (2026) emphasized that AI can contribute positively to the development of critical thinking when integrated into learning activities that require active participation and reflection. However, they also noted that simply accepting AI-generated responses without questioning or examining them may weaken students' ability to think critically.

Likewise, Tian (2026) highlighted the role of AI dependency in influencing critical thinking. Their study suggested that when students become overly dependent on AI, they may begin to transfer important cognitive tasks to technology rather than engaging in their own reasoning processes. This tendency may ultimately affect the development of higher-order thinking skills.

Analysis. Analysis involves examining information carefully, identifying connections among ideas, and breaking complex concepts into smaller and more manageable components. This skill enables students to understand academic content beyond surface-level information.

According to Lamberti (2025), students who actively examine and critique AI-generated responses tend to demonstrate stronger analytical abilities than those who simply accept the information provided by AI systems. Their findings suggest that AI can support analytical thinking when learners are encouraged to evaluate and question generated content rather than use it passively.

Evaluation. Evaluation refers to the ability to assess the quality, credibility, and relevance of information before reaching conclusions. This skill has become increasingly important as AI-generated content becomes more accessible in educational settings.

Zou (2024) found that students who consistently assess AI-generated information are more likely to recognize potential inaccuracies, biases, and limitations in AI outputs. The study emphasized that evaluation skills play a critical role in promoting the responsible and ethical use of AI in academic work.

Problem Solving. Problem-solving skills enable students to identify challenges, develop possible solutions, and select appropriate actions to address academic and real-life situations. These skills are essential for effective learning and professional practice.

Maslan and Ubaidah (2026) noted that AI can assist students in solving problems by offering suggestions, explanations, and alternative perspectives. Nevertheless, they stressed that meaningful learning occurs when students actively participate in the problem-solving process rather than relying entirely on AI-generated answers.

Statement of the Problem

This study aims to determine the relationship between Artificial Intelligence dependency and critical thinking skills among undergraduate education students.

Specifically, this study seeks to answer the following questions:

1. What is the level of Artificial Intelligence dependency among undergraduate education students in terms of:
 - 1.1 academic assistance
 - 1.2 information retrieval
 - 1.3 assignment completion
2. What is the level of critical thinking skills among undergraduate education students in terms of:
 - 2.1 analysis
 - 2.2 evaluation
 - 2.3 problem solving
3. Is there a significant relationship between Artificial Intelligence dependency and critical thinking skills among undergraduate education students?
4. Based on the findings of the study, what recommendations may be proposed to promote the responsible use of Artificial Intelligence while strengthening the critical thinking skills of undergraduate education students?

Theoretical Framework

This study is anchored on Cognitive Load Theory (CLT) developed by (Sweller, 2023) which explains how individuals process information within the limited capacity of working memory during learning. According to the theory, effective learning takes place when learners actively process, organize, and connect information to existing knowledge. In educational settings, various learning tools and technologies can support students by reducing the complexity of certain tasks and helping them manage information more efficiently. As Artificial Intelligence (AI) becomes increasingly available in higher education, students are using these tools to assist with research, writing, and other academic requirements, thereby changing the way they approach learning activities.

Cognitive Load Theory provides a useful perspective for understanding the possible effects of AI dependency on critical thinking skills. While AI can make academic tasks easier and more accessible, excessive reliance on its outputs may lessen students' engagement in the cognitive processes needed for deeper learning. Instead of independently examining information, evaluating evidence, and developing solutions, students may become more dependent on AI-generated responses. Consequently, opportunities to practice and strengthen critical thinking skills may be reduced. In this regard, the theory helps explain how varying levels of AI dependency may be associated with the development of analysis, evaluation, and problem-solving skills among undergraduate education students (Sweller, 2023).

Hypothesis

The hypothesis that was tested using 0.05 level of significance was that there is no significant relationship between Artificial Intelligence dependency and critical thinking skills among undergraduate education students.

Scope and Delimitation of the Study

The study examines the relationship between Artificial Intelligence (AI) dependency and critical thinking skills among undergraduate education students. It specifically assesses AI dependency in terms of academic assistance, information retrieval, and assignment completion, as well as critical thinking skills in terms of analysis, evaluation, and problem-solving. In addition, the study determines whether a significant relationship exists between the two variables. The period of study was conducted from March 15, 2025 to September 27, 2025. The study was conducted at the Polytechnic University of the Philippines in Lopez Quezon. The findings of the study are also used as a basis for proposing recommendations that promote the responsible use of AI while enhancing students' critical thinking skills.

Significance of the Study

The findings of this study are significant to the following groups:

Students may become more aware of their level of dependency on Artificial Intelligence tools that may also guide them in developing a more responsible and balanced use of AI in their academic tasks.

Teachers may assist them in understanding how the use of AI affects students' learning processes that may serve as a basis for improving instructional strategies that promote higher-order thinking skills while guiding students in the ethical and appropriate use of AI tools.

Campus Administrator may be provided with useful insights for formulating policies, guidelines, and academic programs that regulate and integrate the use of AI in education, while still supporting the development of students' critical thinking skills.

Curriculum Developers may utilize the results of the study as a reference in enhancing curriculum design by integrating learning activities that foster critical thinking and encourage the responsible use of technology, including Artificial Intelligence tools in academic settings.

Future Researchers may use the findings of the study for future research related to Artificial Intelligence dependency and critical thinking skills that may provide them baseline data and support further studies exploring other variables not covered in this research.

MATERIALS AND METHODS

Research Design

This study utilized a descriptive-correlational research design to examine the relationship between Artificial Intelligence (AI) dependency and critical thinking skills among undergraduate education students. The descriptive component was used to determine the level of AI dependency in terms of academic assistance, information retrieval, and assignment completion, as well as the level of critical thinking skills in terms of analysis, evaluation, and problem-solving. This approach allowed the researcher to systematically describe the current status of the respondents based on their survey responses and provide a clear profile of both variables under investigation.

Locale and Population

The setting of the study was at Polytechnic University of the Philippines – Lopez Campus in Quezon. Philippines. The respondents involved 100 education students from the Department of Education.

Research Instruments

The study utilized a structured survey questionnaire as the primary research instrument to gather data on Artificial Intelligence (AI) dependency and critical thinking skills among undergraduate education students. The instrument was divided into two parts, focusing on AI dependency in terms of academic assistance, information retrieval, and assignment completion, and critical thinking skills in terms of analysis, evaluation, and problem-solving. The respondents rated each item in the questionnaire using a 4-point Likert scale.

RESULTS AND DISCUSSION

Problem 1. Level of Artificial Intelligence Dependency Among Undergraduate Education Students

1.1 Academic Assistance. Table 1 showed the level of Artificial Intelligence dependency among undergraduate education students in terms of academic assistance.

Table 1
Level of Artificial Intelligence Dependency among Undergraduate Education Students in terms of Academic Assistance

Indicator	Mean	Verbal Interpretation
Use AI tools to help understand difficult lessons or concepts	3.42	Most of the time
Rely on AI-generated explanations when studying	2.85	Most of the time
Use AI tools in preparing for quizzes and examinations	3.10	Most of the time
Consult AI tools before asking teachers/classmates for academic help	2.33	Seldom of the time
Depend on AI tools to clarify topics that do not fully understand	3.55	All the time
Over-all Mean	3.05	Most of the time

Data showed that the students all of the time depend on AI tools to clarify topics that they do not fully understand as seen from the mean of 3.55, followed immediately that they use AI tools to help understand difficult lessons or concepts based on the mean of 3.42, and that most of the time the students consult AI tools before asking teachers/classmates for academic help as described from the mean of 2.33.

Findings showed that while AI is widely used as a supplementary learning aid, students still recognized the importance of interpersonal interactions in the learning process. According to Holmes (2020), digital

learning technologies can promote independent learning by providing immediate access to information and explanations, enabling students to better understand academic content while complementing traditional instructional support.

1.2 Information Retrieval. Table 2 showed the level of Artificial Intelligence dependency among undergraduate education students in terms of information retrieval.

Table 2
Level of Artificial Intelligence Dependency among Undergraduate Education Students in terms of Information Retrieval

Indicator	Mean	Verbal Interpretation
Use AI tools as primary source of information	2.92	Most of the time
Use AI to search for information	3.68	All the time
Rely on AI-generated information for research-related activities	3.53	All the time
Use AI tools to quickly obtain answers to academic questions.	3.51	All the time
Use AI tools to gather information from various sources	3.15	Most of the time
Over-all Mean	3.13	Most of the time

Findings showed that the students all of the time use AI to search for information as reflected from the mean of 3.68, followed immediately that the students all the time rely on AI-generated information for research related activities based on the mean of 3.53, and that the students seldom of the time rely on AI-generated information for research-related activities as indicated from the mean of 2.40.

The results implied that while AI is widely used for immediate access to information and academic support, students may still recognize the importance of consulting credible references and conducting independent research. According to Holmes (2020), artificial intelligence can enhance learning by providing timely access to information and personalized support, but learners must also develop critical judgment in evaluating the accuracy and reliability of AI-generated content.

1.3 Assignment Completion. Table 3 showed the level of Artificial Intelligence dependency among undergraduate education students in terms of assignment completion.

Table 3

Level of Artificial Intelligence Dependency among Undergraduate Education Students in terms of Assignment Completion

Indicator	Mean	VI
Use AI tools when completing assignments and projects	3.22	Most of the time
Employ AI-generated content in completing academic requirements	2.28	Seldom of the time
Use AI tools to organize and improve assignments	3.48	Most of the time
Utilize AI assistance in completing assignments	3.18	Most of the time
Utilize AI tools for more efficient completion of academic tasks	3.61	All the time
Overall Category Mean	3.15	Most of the time

Findings indicated that the students all of the time utilize AI tools for more efficient completion of academic tasks based on the mean of 3.61, followed immediately that most of the time the students use AI tools to organize and improve assignments as seen from the mean of 3.48, and that most of the time employ AI-generated content in completing academic requirements as described from the mean of 2.28.

Finding suggested a balanced use of AI, where students utilize the technology as a support tool rather than as a complete substitute for their work. According to Zawacki-Richter (2020), artificial intelligence can improve learning efficiency and academic productivity by assisting students with task management and content development while still requiring active learner engagement and oversight.

Problem 2. Level of Critical Thinking Skills Among Undergraduate Education Students

2.1 Analysis. Table 4 showed the level of critical thinking skills among undergraduate education students in terms of analysis.

Table 4

Level of Critical Thinking Skills Among Undergraduate Education Students in Terms of Analysis

Indicator	Mean	Verbal Interpretation
Identify the main ideas and supporting details when reading academic materials	3.45	High
Examine information carefully before accepting it as true	3.12	High
Distinguish facts from opinions in academic discussions.	2.98	High
Identify relationships among ideas and concepts.	3.31	High
Break down complex problems into smaller and manageable parts	2.42	Moderate low
Overall Category Mean	3.06	High

Data revealed that the students were assessed high in identifying the main ideas and supporting details when reading academic materials based on the mean of 3.45, followed immediately that they are high in identifying relationships among ideas and concepts as reflected from the mean of 3.31, and that the students are moderately high in breaking down complex problems into smaller and manageable parts based on the mean of 2.42.

The finding suggested that the education students are capable of connecting information, recognizing patterns, and understanding how different concepts relate to one another within academic contexts. This skill is essential for meaningful learning because it enables students to organize knowledge, develop deeper comprehension, and applied concepts across various situations. The result further implied that students possessed a strong foundation for higher-order thinking, as the ability to establish connections among ideas supports analysis, interpretation, and informed decision-making. According to Facione (2020), critical thinking involves analyzing and interpreting information by recognizing relationships, assumptions, and logical connections, which are necessary for effective problem-solving and academic success.

2.2 Evaluation. Table 5 showed the level of critical thinking skills among undergraduate education students in terms of evaluation.

Table 5

Level of Critical Thinking Skills among Undergraduate Education Students in terms of Evaluation

Indicator	Mean	VI
Assess the credibility of information before using it	2.95	High
Compare different sources before making conclusions	3.38	High
Evaluate the strengths and weaknesses of arguments	2.58	High
Verify information obtained from AI tools and online sources	3.56	Very High
Evaluate information based on evidence rather than personal opinions	3.10	High
Over-all Mean	3.09	High

Findings indicated that the students are very high in verifying information obtained from AI tools and online sources based from the mean of 3.56, followed immediately in comparing different sources before making conclusions based on the mean of 3.38, and that the students were assessed high on evaluating the strengths and weaknesses of arguments as seen from the mean of 2.58.

The result suggested that students possess foundational evaluation skills that support informed decision-making and responsible use of information. The findings are consistent with recent studies emphasizing that critical evaluation involves not only verifying the reliability of information but also analyzing evidence and assessing the soundness of arguments before reaching conclusions (Facione, 2020). Such

competencies are particularly important in learning environments where students frequently interact with digital and AI-generated content.

2.3 Problem Solving. Table 6 showed the level of critical thinking skills among undergraduate education students in terms of problem solving.

Table 6

Level of Critical Thinking Skills among Undergraduate Education Students in terms of Problem Solving

Indicator	Mean	VI
Identify possible solutions when faced with academic problems	3.46	High
Evaluate alternative strategies before making decisions	2.90	High
Apply learned concepts to solve real-life situations	2.38	Low
Apply appropriate decision-making strategies in challenging academic situations	3.28	High
Evaluate the effectiveness of a solution after implementing it	2.82	High
Over-all Mean	2.97	High

It was found out that the students were assessed high in identifying possible solutions when faced with academic problems based from the mean of 3.46, followed immediately by applying appropriate decision-making strategies in challenging academic situations as described from the mean of 3.28, and that the students were assessed low in applying learned concepts to solve real-life situations as indicated from the mean of 2.38.

The findings supported the view that learning becomes more meaningful when students are given opportunities to use what they have learned in situations beyond the classroom. Students who can relate academic concepts to practical experiences tend to develop a deeper understanding of the subject matter and become more effective problem solvers. Recent studies also suggest that higher education should provide learning experiences that encourage students to transfer knowledge and skills across different contexts, helping them address both academic tasks and real-world challenges with greater confidence and competence (Fullan, 2022).

Problem 3. Significant relationship between Artificial Intelligence dependency and critical thinking skills among undergraduate education students

Table 11

Relationship between Artificial Intelligence dependency and critical thinking skills among undergraduate education students

Variables	Pearson's r	Correlation	t		Decision	Remarks
			Comp	Tab		
Artificial Intelligence dependency	0.81	High correlation	3.72	1.645	Reject	Significant
Critical thinking skills among students						

Based on the results of Pearson's r of 0.81, it can be said that there is a high correlation between Artificial Intelligence dependency and critical thinking skills among undergraduate education students. Furthermore, the hypothesis was rejected and concludes that there is a significant relationship between the Artificial Intelligence dependency and critical thinking skills among undergraduate education students since the computed t-value of 3.72 is greater than the tabular t-value of 1.645 using 0.05 level of significance.

The relationship suggested that students' level of reliance on AI tools is linked to how they analyze information, evaluate evidence, and solve academic problems. Ruiz (2024) said that as AI becomes increasingly integrated into educational settings, many students use it for gathering information, understanding lessons, and completing academic requirements. The findings are consistent with the study of Amaya (2025), which reported that greater dependence on generative AI was associated with lower levels of critical thinking among university students. The authors explained that when learners rely heavily on AI-generated outputs, they may become less engaged in reasoning, analysis, and decision-making tasks that are essential for intellectual growth.

Problem 4. Proposed Recommendations to promote the responsible use of Artificial Intelligence while strengthening the critical thinking skills of undergraduate education students

In light of the findings of the study, several recommendations are presented to encourage the responsible use of Artificial Intelligence (AI) while supporting the development of critical thinking skills among undergraduate education students.

4.1 Strengthening AI Literacy and Digital Competence. The university is encouraged to integrate AI literacy into the curriculum to develop students' ability to understand, evaluate, and use AI tools responsibly in academic tasks and learning activities.

4.2 Enhancing Instructional Strategies for Higher-Order Thinking. Education teachers should design learning experiences that foster analysis, interpretation, reflection, and problem-solving, rather than encouraging dependence on quick AI-generated outputs.

4.3 Formulation and Enforcement of AI Use Policies. The campus is advised to establish and consistently implement clear policies

on the ethical and responsible use of AI to uphold academic integrity, originality, and accountability among education students.

4.4 Promotion of Reflective and Metacognitive Learning Practices. Education students should be guided to engage in reflective learning by explaining, justifying, and evaluating their thought processes, thereby strengthening independent thinking and critical reasoning skills.

4.5 Faculty Development on Effective AI Integration. The institution should provide continuous training and professional development for faculty members to enhance their capability in integrating AI tools effectively into instruction while still promoting critical thinking among students.

4.5 Strengthening Information Verification and Academic Integrity Practices. Education students should be encouraged to critically verify AI-generated information using credible academic sources to ensure accuracy, strengthen analytical skills, and promote responsible information use.

4.6 Expansion of Future Research on AI Dependency and Critical Thinking. Further studies should be conducted in various academic contexts to deepen understanding of AI dependency and its influence on the critical thinking skills of education students.

CONCLUSIONS

Based on the findings of the study, the following conclusions were drawn:

1. The undergraduate education students show a moderate level of AI dependency across academic assistance, information retrieval, and assignment completion, indicating that they frequently use AI tools mainly for understanding lessons, accessing quick information, and improving academic tasks.

2. The undergraduate education students exhibit a high level of critical thinking skills, particularly in analyzing information, evaluating sources, and solving academic problems.

3. Significant relationship exists between Artificial Intelligence dependency and critical thinking skills among undergraduate education students.

4. To ensure the responsible use of AI in supporting and developing students' critical thinking skills, it needs to improve AI literacy, strengthen teaching strategies that promote higher-order thinking, implementing clear policies on AI use, encourage reflective learning, enhancing faculty training, reinforce information verification and academic integrity.

Recommendations

Based on the findings and conclusions of the study, the following recommendations were offered:

1. The undergraduate education students may use AI tools responsibly and in moderation by balancing their use with independent learning strategies, and critical thinking.

2. The university may continue to strengthen students' critical thinking skills by providing learning activities that promote deeper

analysis, evidence-based evaluation, and authentic problem-solving experiences.

3. Teachers may identify which variable of Artificial Intelligence dependency affects critical thinking skills among undergraduate education students.

4. To ensure the responsible use of AI in supporting and developing students' critical thinking skills, it needs to improve AI literacy, strengthen teaching strategies that promote higher-order thinking, implementing clear policies on AI use, encourage reflective learning, enhancing faculty training, reinforce information verification and academic integrity.

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