

MEDIATING ROLE OF DIGITAL LITERACY ON THE EFFECT OF AI GENERATED USAGE ON CRITICAL THINKING SKILL

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Abstract

This research is motivated by the importance of critical thinking skills to be able to face the era of disruption and the use of technology with its positive and negative impacts. However, the reality faced is a decline in students' critical thinking. This is indicated by a decrease in the ability to interpret data and information, analyze, and evaluate. Many things can improve critical thinking, one of which is the use of technology. However, the use of technology to improve critical thinking is still a debate, especially the use of artificial intelligence. Based on this, this study aims to analyze the effect of the use of AI Generated mediated by digital literacy on critical thinking skills. This research was conducted with a quantitative approach with an explanatory survey method which is a causal study. The population in this study were students, using random sampling techniques, 119 students were obtained. Data collection was carried out by distributing questionnaires and interviews. The data that has been obtained is processed with descriptive and verification statistics using SEM PLS. The results of this study state that the use of AI has a negative effect on critical thinking and digital literacy mediates the effect of the use of AI Generated on critical thinking skills.

Keywords: artificial intelligence, critical thinking, digital literacy

INTRODUCTION

Thinking skills are very urgent for every human being in the era of disruption and massive technological development. The urgency of critical thinking in the era of disruption is to help distinguish between facts and opinions and information that are valid or fake. Critical thinking also allows for adaptive to change and being able to analyze these changes and adjust strategically. In an era of disruption full of uncertainty, critical thinking provides a framework to make mature and creative decisions and solve complex problems and make the right decisions in the midst of uncertain situations (Rahardhian, 2022). Critical thinking is also indispensable in the era of advances in artificial intelligence technology. The era of artificial intelligence technology. Critical thinking is needed to evaluate and verify the information provided by AI Preventing Overdependence Dependence on AI can erode the ability to think independently. The younger generation, in particular, need to maintain analytical skills so that they do not only passively receive information. Critical thinking also filters out Algorithm-Adjusted Information. AI algorithms often present information that matches the user's preferences, which can narrow the point of view. Critical thinking helps us stay open to other perspectives and not get caught up in a "filter bubble". Critical thinking leads to ethical and wise decision-making so that AI can help in decision-making, but it cannot replace ethical considerations and human values. This is where the role of critical thinking becomes very important. Critical thinking allows us to choose when and how to use AI effectively so that it can accelerate learning and innovation. But. In fact, critical thinking skills are currently declining.

A study by MIT's Media Lab found that prolonged use of AI tools like ChatGPT may reduce users' cognitive engagement. Participants who relied on ChatGPT to write SAT-style essays showed

lower brain activity (measured via EEG) compared to those using Google or no tools at all. Over time, these users also became less diligent, often copying AI-generated content without reflection. <https://www.technewsworld.com>. Many young adults, especially post-pandemic, are stuck in “survival thinking” rather than reflective, analytical thought. This shift is attributed to burnout, digital distractions, and a focus on short-term problem-solving over deep reasoning. <https://www.psychologytoday.com>. A multinational study involving participants from the U.S., U.K., Germany, and Japan found that younger generations are increasingly struggling with deep thinking. The report noted that attention spans are shrinking, and many individuals are defaulting to passive content consumption rather than critical evaluation. <https://www.psychologytoday.com>. How algorithm-driven content, social media, and screen time contribute to a decline in analytical reasoning. People are more likely to accept information at face value, reinforcing biases and reducing independent thought. <https://criticalthinkingsecrets.com/is-critical-thinking-declining>.

To improve critical thinking skills based on some previous research. Improving data critical thinking is enhanced by 1) learning strategies 2) metacognition strategies 3) Digital Literacy and Technology Access 4) Social and cultural environment Learning strategies that can improve include methods such as problem-based learning, inquiry learning, and reflective discussions proven to encourage students to analyze, evaluate, and synthesize information in depth (Gomez et al., 2025). In addition, structured reflective writing and classroom dialogue can enhance students' awareness of their cognitive processes, leading to better critical thinking outcomes. Metacognition strategies showed students who practiced metacognitive reflection (e.g., evaluating their reasoning, identifying biases) demonstrated significant improvement in critical thinking performance. The social and cultural environment through diverse perspectives, cultural norms, and open social interactions can enrich ways of thinking and encourage students to consider different points of view (Gomez et al., 2025)

The focus of this study is to examine the influence of the use of technology, especially AI, in improving students' critical thinking. The use of AI can increase critical thinking if the user actively evaluates and reflects on the information provided and is able to reflect deeply. The ability to evaluate and reflect digital information is a skill that students must have so that the AI used can improve critical thinking in addition to other skills such as finding information, communicating and collaborating using digital devices. Therefore, in this study, the author uses digital literacy as a mediation variable. The use of AI in previous studies has been subject to much debate, the negative and positive impacts of AI use depend on the way and context of its use. The use of AI causes cognitive offloading, which is an over-reliance on AI to answer questions or complete tasks, which can reduce the brain's training in analyzing and evaluating information independently. Over-reliance on AI may reduce students' motivation to think independently or verify information, academic integrity ability, especially when students use AI-generated content without critical engagement. AI can improve critical thinking if users actively evaluate and reflect on the information provided, used thoughtfully and with clear pedagogical intent, offering instant access to diverse perspectives, which helps students analyze and compare viewpoints, assisting in argument construction and information evaluation, especially in writing and research tasks. Providing personalized feedback, which can guide learners toward deeper reflection. Therefore, it is important to educate users especially students and university students to use AI reflectively, not passively.

LITERATURE REVIEW AND HYPOTHESIS FORMULATION

The effect of AI usage on critical thinking with digital literacy as a mediating variable is using teori Cognitive Offloading Theory which suggests that people increasingly rely on AI tools to perform

cognitive tasks like remembering facts or generating ideas which can reduce the mental effort required for problem-solving. While this can free up mental bandwidth for higher-order thinking, over-reliance may weaken the development of critical thinking skills over time (Gerlich, 2025). However, Dual-Effect Hypothesis AI can both enhance and hinder critical thinking depending on how it's used. For example, tools like ChatGPT can expose users to diverse viewpoints and help structure arguments. Previous research on the impact of the use of AI on critical thinking states that the impact of Artificial Intelligence (AI) on critical thinking in educational settings is multifaceted, revealing both enhancements and challenges. Research indicates that while AI can facilitate critical thinking through personalized learning and data analysis, it also poses risks of dependency and cognitive offloading, which may hinder students' analytical skills. Positive impact of AI usage **Enhanced Analytical Skills**: AI tools assist students in data analysis and problem-solving, fostering critical thinking abilities (Jasmadi et al. 2024). AI aids in quickly evaluating information and exploring alternative perspectives, which can improve reasoning skills (Hading et al., 2024; Lawasi et al., 2024)

Based on this, the research question is

RQ 1 : How to describe critical thinking, the use of AI, and digital literacy

RQ 2 : How does the use of AI affect students' critical thinking

RQ 3: How does digital literacy mediate the influence of the use of AI on students' critical thinking.

AI is not a substitute for critical thinking, but it can be a tool that strengthens or weakens that ability, depending on how the user uses it. The previous research about the relationship between AI usage and critical thinking reveal that AI enhances critical thinking skills in data analysis, problem-solving, and decision-making while also noting potential negative impacts like dependency on technology (Jasmadi et al., 2024). The research emphasizes that AI can enhance critical thinking through personalized learning and interactive simulations, contingent on users' questioning skills and interpretation of AI-generated content. Lawasi et al. (2024) theoretical framework highlighting the growing relevance of AI in education, suggesting that AI tools can enhance cognitive abilities and critical thinking skills, thereby transforming the teaching-learning process in diverse educational environments (García-García et al., 2024). However, it highlights students' perceptions, indicating that AI can both hinder and assist critical thinking development, emphasizing the need for balanced and responsible AI use in education (Hading et al., 2024). The paper highlights cognitive offloading as a mediating factor affecting critical thinking due to AI tool usage. It suggests that reliance on AI may diminish critical thinking skills, emphasizing the need for educational strategies to foster critical engagement with technology. Gerlich (2025) The study highlights that AI tools can enhance critical thinking through cognitive flexibility and reflective thinking. However, over-reliance on AI may lead to superficial understanding, indicating a need for careful guidance in its use to foster deeper learning. Panit (2024) Necessity of incorporating critical thinking in evaluating AI's impact on TEFL, emphasizing philosophical perspectives such as ontology, epistemology, and axiology, which collectively inform the understanding of AI's role in enhancing critical thinking in education (Fikri, 2024). AI's impact on critical thinking, emphasizing competencies like ethical reasoning and reflective thinking. It proposes a framework with 12 propositions to guide research and pedagogical strategies in AI-assisted education (Gonsalves, 2024). AI tools can enhance critical thinking when used ethically. It emphasizes student-centered teaching methodologies, which promote active engagement and improve critical thinking skills through practical activities like seminars and workshops (Chaparro-Banegas et al., 2024). Thus, the hypothesis in this study is:

H1 : The use of AI has a negative effect on critical thinking

H2: digital literacy mediates the influence of the use of AI on critical thinking.

This research was conducted by surveying students in the city of Bandung by distributing questionnaires and conducting interviews. The data obtained were then analyzed descriptively and inferentially.

RESEARCH METHODS

The research method was carried out with a quantitative approach and explanatory survey. This research is a causal research with the research subjects being students and the objects are the level of critical thinking, the use of AI and the level of digital literacy. The population used is students in the city of Bandung with a sample size of 119 students. Data collection was carried out by distributing questionnaires and interviews. The variable used in this study is the ability to think critically as a dependent variable. Variable independent is the use of AI and variable mediator is digital literacy. After the data is obtained, it is then analyzed using descriptive and verifiable statistics. Descriptive statistics aim to determine centralized trend data. Verifiable statistics are used to test hypotheses using Smart SEM PLS. The steps of SEM PLS, include steps 1) formulation of a theoretical model, which determines the construct variables and their indicators, determines the type of reflective or formative relationship and describes the structural/inner model and the measurement model/outer model 2) compiling instruments and data collection, by compiling the data in an excel csv format 3) initial data processing, by checking validity and reliability, rechecking the code and ensuring the readiness of the data to be processed with Smart PLS. 4) Compile a model in SMART PLS software 5) Evaluation of Measurement Model (Outer Model) by including convergent validity, discriminant validity and reliability tests. 6) Evaluation of Structural Model (Inner Model) consisting of R-Square (R^2), Q Square (Q^2) path coefficient value and path significance with bootstrapping. 7) Mediation test tested through indirect effect).

RESULTS AND DISCUSSION

Descriptive Statistics Critical Thinking

Critical thinking is the ability to analyze, evaluate, and synthesize information objectively and logically in order to make the right decisions or solve complex problems. What is criticized in the research is macroeconomic problems at the university level. Critical thinking is shown with 6 dimensions, namely 1) interpretation, 2) Analysis, 3) Evaluation, 4) Inference, 5) Explanation, 6) Self-regulation. The results of the research on the level of critical thinking are as follows:

Table 1. Critical Thinking

Dimension	N	Minimum	Maximum	Mean	Std. Deviation
Interpretation	119	1,50	5,83	2,8429	,72072
Analysis	119	1,67	7,00	3,2070	,86266
Evaluation	119	1,75	6,50	4,2269	,98452
Inference	119	2,00	7,00	3,7647	1,41844
Explanation	119	2,25	7,00	4,0294	1,28723
Self Regulation	119	1,50	7,00	4,0924	1,20551
Valid N (listwise)	119				

Source: results of the research 2025

Based on the results of the study, the score of the critical thinking dimension is shown by the relatively higher self-regulation and ability to explain. The relatively low score of the critical thinking dimension is the ability to interpret and analyze with low interpretive ability, this can be caused by a lack of understanding of basic concepts, difficulty understanding questions or information (Lavender, 1995), lack of practice and habituation in learning, teachers rarely use interpretation-based questions and result in difficulty understanding complex information, low academic achievement, failure to make the right decisions, lack of critical thinking skills, and low global competitiveness (Iryani & Yani, 2022). Low analytical ability due to cognitive limitations, educational approaches, and experience levels. Also, research indicates that working memory capacity (WMC) plays a crucial role in analytical thinking, with students exhibiting low WMC struggling to process information effectively, leading to poorer problem-solving outcomes (Anjariyah et al., 2022), pedagogical methods employed in education, such as Problem-Based Learning (PBL) and Inquiry-Based Learning (IBL), have been shown to enhance analytical skills, suggesting that

inadequate exposure to these methods may contribute to lower analytical abilities (Syachruraji et al., 2024).

Descriptive Results of AI Generated Usage

The use of AI is the application of artificial intelligence technology to complete tasks that usually require human intelligence to provide job command. The use of AI consists of 6 dimensions, namely 1) Efficiency and Productivity, 2) Adoption and Accessibility, 3) Impact on Decision-Making, 4) Ethical Considerations, 5) Integration and Collaboration, 5) Learning and Adaptation. The results of the research on the use of AI can be seen in the Table 2

Table 2. Descriptive Statistics AI Generative Usage

Dimension	N	Minimum	Maximum	Mean
Efficiency and Productivity	119	3,00	7,00	3,2521
Adoption and Accessibility	119	2,00	7,00	3,1798
Impact on Decision Making	119	1,00	7,00	2,1050
Ethical Considerations	119	3,00	7,00	2,7227
Integration and Collacoration	119	4,00	7,00	4,7101
Learning and Adaptation	119	2,50	7,00	3,4076
Valid N (listwise)	119			

Source: results of the research 2025

The results of the research on the use of AI, the highest score of AI use from the integration and collaboration dimension which is shown by compatibility with existing systems and workflows and facilitation of teamwork and collaboration through AI tools. Meanwhile, the lowest dimension is impact decision making which is shown by the frequency of use of AI in providing insights in strategic and operational decision-making and the level of trust in AI recommendations for the right decisions. In addition, ethical considerations score is relatively low, this is shown by adherence to ethical guidelines in AI usage and transparency in AI-generated processes and outputs. AI provides complete data for decision-making. Unused Decision Making can result in Slow and Less Efficient Decisions, Lack of Accuracy in Data Analysis (1)(2), High Cognitive Burden (3), Difficulties in Prediction and Planning, Risk of Technology Lag.

Descriptive Results Digital Literacy

Digital literacy is a person's ability to understand, use, evaluate, and create information through digital technology wisely, safely, and responsibly. Digital literacy can be seen from information and data literacy, communication and collaboration, digital competence, digital security, digital problem solving, digital creativity, digital creativity. The results of the research description are as follows

Table 3. Descriptive Statistics Literasi Digital

Dimensi	N	Minimum	Maximum	Mean	Std. Deviation
information and data literacy	119	2,33	7,00	4,4510	1,01808
communication and collaboration	119	2,00	7,00	4,6891	1,06563
digital competence	119	1,00	7,00	4,5903	1,25200
digital security	119	1,00	7,00	4,0630	1,42846
digital problem solving	119	1,00	7,00	4,3571	1,39178
digital creativity	119	1,00	7,00	2,3571	1,35475
digital creativity	119	1,50	7,00	2,3950	1,23658
Valid N (listwise)	119				

Source: results of the research 2025

The results of the digital literacy research stated that the communication and collaboration dimensions occupied the highest score. Followed by the ability in information and data literacy. The dimension of communication and collaboration is the skill of interacting and working together using digital technology (Karitas & Suwartono, 2023), which is measured from the skills of interacting and working together using digital technology (Karitas & Suwartono, 2023). Information and data literacy is the ability to search, evaluate, and use information effectively (Karitas & Suwartono, 2023). The lowest scores of digital literacy are digital creativity and digital ethics. Digital creativity is while digital ethics is the ability to create and innovate using digital technology (Ariani et al., 2023). Digital creativity is measured from the ability to create using digital technology and innovate using digital technology (Ariani et al., 2023) and digital ethics is measured from the understanding of norms and responsibilities in the use of digital technology (Ariani et al., 2023)

Testing hypothesis

Hypotheses are compiled based on theoretical foundations, literature reviews, and clear problem formulations. The hypothesis in the study is that the use of AI has a negative effect on critical thinking and digital literacy mediates the influence of the use of AI on critical thinking. This hypothesis is formulated in the statistical hypothesis as follows:

Ho: $U_1 > U_2$; The use of AI has a positive effect on critical thinking

Ha : $U_1 < U_2$: The use of AI has a negative effect on critical thinking,

To test the above hypothesis, an internal model analysis was carried out using SEM PLS. To test the hypothesis of digital literacy mediation, it is formulated:

Ho: $U_3 = U_4$; Digital Literacy does not mediate the influence of the use of AI on critical thinking.

Ha: $U_3 \neq U_4$; digital literacy mediates the influence of the use of AI on critical thinking.

The results of the analysis of the influence of the use of AI on critical thinking are as follows: This hypothesis will be tested with the t test and the F test calculated with smart PLS. For the statistik hypothesis 2, the formulation of the statistik hypothesis is as follows:

Table 4 Path Coefficient

Path Coefisien	Original sampel	P value
AI Usage-- \rightarrow critical thinking	-0.398	0.000
Literasi Digital - \rightarrow critical thinking	0.506	0.000
AI Usage- \rightarrow Digital Literacy--- \rightarrow critical thinking	0,268	0,000

Source: results of the research 2025

The hypothesis that the use of AI has a negative effect on critical thinking skills. and digital literacy mediates the influence of AI use on critical thinking. The use of AI is mostly for collaboration and communication but low for decision-making and ethical behavior in the use of AI. Thus, the first null hypothesis that states that AI has an effect on critical thinking is rejected, as well as the second null hypothesis that digital literacy does not mediate the influence of AI use on critical thinking is rejected. In this case, digital literacy has a positive effect on critical thinking. The results of this study state that the use of AI accompanied by digital literacy is more effective in improving critical thinking skills.

DISCUSSION

The use of artificial intelligence (AI) tools has been shown to negatively impact critical thinking skills, primarily through mechanisms of cognitive offloading and dependency. As individuals increasingly rely on AI for tasks such as writing, reading, and problem-solving, their engagement in active thinking processes diminishes, leading to a decline in critical analytical abilities. Frequent use of AI tools leads to cognitive offloading, where individuals depend on technology to perform cognitive tasks, reducing their own mental effort and engagement and also younger users exhibit a higher reliance on AI, correlating with lower critical thinking scores compared to older users who may engage more deeply with content (Gerlich, 2025). AI's role in academic writing can threaten originality and creativity, as students may resort to AI-generated content, inhibiting their own analytical skills and leading to potential plagiarism. This dependency on AI tools can undermine intellectual integrity, as students may not develop the necessary skills for independent thought and reflection (Octoberlina et al., 2024). Challenges in learning, use AI in educational settings, AI integration can reduce interpersonal interactions and collaborative learning, which are essential for developing critical thinking skills (Ododo, 2024). Studies indicate that students who heavily rely on AI for reading assistance perform worse in critical reading assessments, suggesting a detrimental effect on deeper analytical engagement (Cahyani et al., 2024).

The low ethical use of AI can significantly hinder critical thinking by fostering dependency on technology rather than encouraging independent cognitive engagement. This reliance on AI tools often leads to superficial understanding and uncritical acceptance of information, as students may treat AI as a shortcut rather than a means for deeper learning (Panit, 2024). Low ethical use of AI can lead to low critical thinking because reliance on unregulated AI tools may discourage independent analysis and evaluation, fostering a passive learning environment where students accept information without questioning its validity or ethical implications (Silva et al., 2024).

Based on the results of the study, AI is not used for decision-making. The integration of AI in decision-making does not inherently lead to diminished critical thinking; rather, it can enhance human cognitive processes by providing support and structure. AI enhances decision-making by processing vast amounts of data quickly, which helps in identifying patterns and insights that humans might overlook (Whittlestone). Tools like predictive analytics and scenario planning improve decision quality and operational efficiency, as demonstrated by companies like Google and Walmart (Zein, 2025; Balbaa & Abdurashidova, 2024). The findings of this study also show that the digital creativity of digital students is low. Low digital creativity can lead to low critical thinking due to the intertwined nature of these cognitive processes. Both creativity and critical thinking are essential skills that reinforce each other, and a deficiency in one can hinder the development of the other. Critical thinking enhances creativity by providing a framework for evaluating and refining ideas, while creativity fosters innovative approaches to critical analysis (Misechko & Lytniova, 2022). Low digital creativity limits opportunities for students to engage in reflective and analytical thinking, which are crucial for effective critical thinking (Rosba et al., 2021).

CONCLUSION

The results of this study state that the description of critical thinking is shown by relatively higher self-regulation and explanatory ability. The relatively low dimension of critical thinking is the ability to interpret and analyze with low interpretive ability, this can be caused by a lack of understanding of basic concepts, difficulty understanding problems or information. The description of the use of AI in learning is shown by the high intensity of the use of AI to communicate and collaborate in completing tasks. The use of AI for data collection purposes for decision-making is relatively low. Additionally, ethical considerations when using AI are low. This study found that the use of AI among students causes low critical thinking among students, especially the ability to interpret and evaluate. Digital literacy in this study functions as a variable mediator that effectively influences the use of AI to improve critical thinking. The benefits or use of AI and its influence on critical thinking depend on the ability to reflect on information. The negative impact of the use of AI

on critical thinking can be overcome with digital literacy or good digital literacy can minimize the negative impact of critical thinking. Combined with this research, it will be composed of the development of learning methods that utilize AI to improve critical thinking and become an input in education and learning to utilize AI appropriately. The limitation of this research is that to improve critical thinking, it is necessary to involve other variables that are non-technological such as learning strategies, teachers, curriculum, and environment.

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