
Integration of Artificial Intelligence in the Learning Process: Its Impact on Students' Learning Independence and Critical Thinking

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ABSTRACT

This study examines the integration of artificial intelligence (AI) into the learning process and its impact on students' independent learning and critical thinking skills through a qualitative literature review approach. The study identifies that the use of AI in education offers significant opportunities for personalized learning, adaptive feedback, and support for the development of students' cognitive skills aligned with the demands of 21st-century skills. The literature shows that AI encourages students to manage their learning process more autonomously, but on the other hand, excessive reliance on AI systems can hinder independent initiative and reflective reasoning processes. The study also found that the use of AI features needs to be combined with pedagogical strategies that encourage active student engagement to maximize critical thinking skills. Recent literature findings underscore the importance of educators' role in guiding and guiding the use of technology so that AI integration not only facilitates content access but also strengthens the development of higher-level cognitive competencies. The study's conclusions confirm that AI integration can enrich students' learning experiences when implemented consciously, purposefully, and based on a strong learning design and relevant pedagogical framework.

Keywords: *Artificial Intelligence; Independent Learning; Critical Thinking*

INTRODUCTION

The development of artificial intelligence in education represents a significant shift in the way knowledge is presented and learned. This technology enables adaptive learning systems based on students' abilities, interests, and learning pace. Intelligent algorithms can analyze learning patterns and provide more personalized material recommendations. This has the potential to increase the efficiency and effectiveness of the learning process. This shift also transforms the relationship between educators, students, and learning resources.

Learning is no longer entirely dependent on conventional face-to-face interactions. This transformation lays the foundation for changes in students' learning characteristics.

As learning patterns change, demands for student learning independence are growing. Learning independence reflects an individual's ability to independently set goals, strategies, and evaluate their learning. AI-based systems provide facilities that can support this process through automated feedback and tracking of learning progress. Learners have greater space to explore knowledge according to their needs. This flexibility has the potential to foster a sense of responsibility for the learning process. However, increased learning autonomy requires adequate cognitive and affective readiness. Without such readiness, technology can be used passively (Arifin & Mustofa, 2025).

The availability of instant assistance from AI presents a paradox in developing independent learning. On the one hand, it helps students understand complex material more quickly. On the other hand, easy access to answers can reduce the incentive to strive independently. Learning patterns that rely too heavily on system recommendations risk weakening personal initiative. This raises concerns about the long-term quality of the learning process. Independent learning is determined not only by access to technology but also by students' reflective abilities. Therefore, AI integration needs to be critically examined to prevent it from replacing students' active role.

In addition to independent learning, critical thinking skills are an important competency impacted by the use of artificial intelligence. Critical thinking encompasses the ability to analyze information, evaluate arguments, and draw logical conclusions. AI is capable of presenting data, simulations, and multiple perspectives that can enrich the analysis process. This potential can be utilized to train higher-order thinking skills. However, if students only receive AI output without an evaluation process, critical thinking skills will not develop optimally. Reliance on automated systems risks obscuring the reasoning process. This situation demands learning designs that encourage active cognitive engagement (Hidayat et al., 2025).

The use of AI as a learning tool should be directed at strengthening the thinking process, not just the end result. Problem-based learning and analytical assignments can utilize AI as a supporting resource, not as a determinant of answers. This approach allows students to compare their thinking with the system's recommendations. This process encourages deeper evaluation and reflection. Thus, AI serves as a catalyst for the development of critical thinking. The role of educators is crucial in guiding the pedagogical use of technology. Proper guidance can prevent the mechanical use of AI.

The link between independent learning and critical thinking demonstrates a mutually reinforcing relationship. Independent learners tend to have greater control over their thinking strategies. This control allows for a more systematic analysis and evaluation process. Conversely, critical thinking helps learners assess the effectiveness of their learning strategies. AI integration has the potential to significantly impact this reciprocal relationship.

Technology can either strengthen or weaken both competencies. The impact depends heavily on the integration pattern within learning.

Despite the enormous potential of AI in education, empirical studies linking this technology to students' cognitive and affective aspects are still limited. Much research focuses on improving quantitative learning outcomes. Aspects of the learning process, such as independence and critical thinking, often receive less attention. Yet, these competencies have long-term implications for the quality of human resources. This research gap highlights the need for a more comprehensive approach. Analysis that integrates technological and pedagogical dimensions is highly relevant. Such an approach can provide a more complete picture.

Based on this description, the integration of artificial intelligence into learning requires systematic and critical review. The focus of the study should not only be on the effectiveness of the technology but also on its impact on students' learning characteristics. Learning independence and critical thinking are important indicators in assessing the quality of AI integration. A deep understanding of the relationship between the three can form the basis for developing a more balanced learning model. This model is expected to utilize technology without reducing the active role of students. Thus, education remains oriented towards the development of essential competencies. This study is an important contribution to the development of technology-based educational practices.

METHOD

This study uses a qualitative approach with a literature review to analyze the integration of artificial intelligence into the learning process and its impact on students' independent learning and critical thinking skills. A qualitative approach was chosen because it allows for the exploration of emerging meanings, patterns, and conceptual trends in academic studies related to the use of artificial intelligence in education. The literature review was used to collect and critically examine relevant scientific findings, thus gaining a comprehensive understanding of the relationship between AI technology and students' cognitive aspects.

The research data sources consisted of scientific journal articles, conference proceedings, academic books, and research reports published within the last ten years. A literature search was conducted through reputable scientific databases such as Google Scholar, Scopus, and Web of Science. Keywords used included artificial intelligence in education, independent learning, self-regulated learning, and critical thinking. Literature selection was conducted purposively, considering topic relevance, methodological quality, and theoretical contributions to the research focus. Literature not directly related to the study variables was excluded from the analysis.

The literature selection process involves several stages: initial identification, title and abstract screening, and a thorough text review. The identification stage aims to gather as many relevant sources as possible. The screening stage is conducted to ensure the relevance of the topic and research objectives. Next, a comprehensive review of the selected literature is conducted to explore concepts, findings, and implications reported by previous researchers. This process aims to produce a valid and representative literature database.

Data analysis was conducted using thematic analysis techniques. Each literature source was coded based on key themes related to AI integration in learning, independent learning, and critical thinking skills. The coding process was repeated to ensure consistency and depth of analysis. Emerging themes were then grouped and compared to identify patterns, similarities, and differences in perspectives across researchers. The results of this thematic analysis were used to construct an integrated conceptual synthesis.

Data validity was maintained through source triangulation techniques, comparing findings from various publication types and educational contexts. Furthermore, the researchers implemented a limited peer review process by discussing the literature synthesis results with academic colleagues. This step aimed to minimize interpretation bias and increase the credibility of the findings. Consistency of analysis was also maintained by systematically documenting the entire literature search and selection process.

The research results are presented in an analytical narrative that emphasizes the relationship between concepts, empirical findings, and pedagogical implications. The presentation of the results not only describes the literature findings but also interprets their meaning and contribution to the development of artificial intelligence-based learning. This approach is expected to provide a deeper understanding of the dynamics of AI integration in education and its impact on students' independent learning and critical thinking.

RESULTS AND DISCUSSION

1. Integration of Artificial Intelligence in the Learning Process

The integration of artificial intelligence into learning represents a paradigm shift from static teaching systems to adaptive learning. This technology enables the presentation of material tailored to students' learning characteristics. Machine learning algorithms process learning interaction data to identify individual needs. This process supports learning that is more responsive to differences in ability. Learning systems are no longer uniform for all students. This change impacts curriculum structure and teaching strategies. Pedagogical adaptation is a key requirement in utilizing this technology.

The shift in learning paradigms has also shifted the role of educators in the learning process. Educators function not only as transmitters of material but also as facilitators and directors of thought processes. Artificial intelligence provides information and feedback that educators can utilize strategically. This utilization opens up a more dialogic and reflective

learning space. Learning interactions become more diverse through the combination of humans and intelligent systems. This dynamic demands more complex pedagogical competencies. The role of educators remains crucial in maintaining the quality of learning.

Beyond the role of educators, the integration of artificial intelligence also impacts the structure of students' learning experiences. Students gain access to broader and more flexible learning resources. The learning process is no longer confined to a specific time and place. This flexibility enables independent exploration of knowledge (Karyadi, 2023). Technology-based learning encourages active participation through digital interactions. The learning experience becomes more personalized and sustainable. These characteristics create a learning pattern that differs from conventional systems.

These developments have implications for the learning design implemented. Learning design needs to integrate technology in a meaningful and targeted manner. The selection of artificial intelligence features must align with learning objectives. A technology-based pedagogical approach requires careful planning. The alignment between technology and learning needs is a determining factor in effectiveness. Without proper planning, technology has the potential to become merely an additional tool. Therefore, the integration of artificial intelligence requires a clear pedagogical framework (Magvira et al., 2025).

The need for such a pedagogical framework underscores the importance of theoretical and empirical studies. Academic literature demonstrates a variety of approaches to the use of artificial intelligence. These differences reflect the diversity of educational goals and contexts. Literature analysis provides an overview of applied best practices. Synthesizing findings allows for a more comprehensive understanding. Such studies contribute to the development of sustainable learning models. The integration of technology and pedagogy is a key focus of modern educational development.

2. The Impact of Artificial Intelligence Integration on Students' Learning Independence

Learning independence is a crucial competency related to the ability to manage the learning process autonomously. The integration of artificial intelligence provides a tool to support the development of this competency. Adaptive systems help students determine learning paths according to their needs. The learning process becomes more structured and directed. Students have greater control over their learning rhythm. This control has the potential to strengthen personal responsibility. Learning independence develops through active interaction with the learning system.

The use of artificial intelligence also influences the learning strategies used by students. Material recommendations and automated feedback facilitate reflection on learning outcomes. Students can continuously assess their learning progress. Self-evaluation becomes part of the daily learning process. This activity encourages more conscious learning

decision-making. Metacognitive awareness plays a crucial role in developing independence. Technology supports this reflective process (Panjaitan et al., 2025).

However, the literature indicates a potential dependency on artificial intelligence systems. Easy access to information can reduce independent exploration initiatives. Learning patterns risk shifting toward passive acceptance of system recommendations. This situation has the potential to weaken academic performance. Independent learning requires a balance between support and personal effort. An imbalance can hinder the development of long-term learning competencies. Therefore, technology use needs to be consciously guided.

The role of educators is once again crucial in maintaining this balance. Pedagogical guidance helps students use technology reflectively. Learning strategies that emphasize learning objectives encourage the wise use of AI. Educators play a role in instilling the value of responsible learning. Pedagogical interventions strengthen students' active roles. Learning independence does not develop automatically through technology. Learning still requires direction and guidance (Sari et al., 2025).

Literature findings demonstrate variations in the impact of artificial intelligence integration on learning independence. This variation is influenced by learning design and student characteristics. Comparative analysis across studies provides a deeper understanding. Synthesis of findings reveals relevant general patterns. This understanding is crucial for developing educational practices. Learning independence serves as an indicator of the quality of technology integration. This study strengthens the conceptual foundation of the research.

3. The Effect of Artificial Intelligence Integration on Students' Critical Thinking Skills

Critical thinking skills are a high-level cognitive competency essential in education. The integration of artificial intelligence offers the potential to enrich analysis and evaluation processes. Intelligent systems provide data and simulations that support reasoning. Learners have the opportunity to explore diverse perspectives. This process can broaden their thinking horizons. Technology-based learning opens up the space for more complex discussions. This potential makes AI a tool to support critical thinking.

Literature shows that the use of artificial intelligence can enhance problem-solving processes. Analysis and synthesis-based assignments utilize AI as an information source. Students are required to critically evaluate the system's output. This activity trains judgment and argumentation skills. The thinking process does not stop at receiving information. Reasoning develops through comparison and reflection. This approach supports the strengthening of critical thinking.

However, the use of artificial intelligence without proper pedagogical design has the potential to weaken the thinking process. Providing instant answers can reduce in-depth reasoning. Learners tend to rely on system results without evaluation. This learning pattern hinders the development of critical analysis. The literature emphasizes the importance of

limiting AI's role as an answer provider. The focus of learning needs to be directed toward the thinking process. Task design is a determining factor in the quality of critical thinking.

The problem-based learning approach is widely recommended in literature reviews. This approach encourages students to use AI as an exploration tool. The process of identifying problems and evaluating solutions remains independent. Interaction with technology enriches, rather than replaces, reasoning. This type of learning demands a high level of cognitive engagement. Critical thinking develops through dialogue between humans and systems. This approach demonstrates the potential for balanced integration (Setiawan & Wibowo, 2025).

A literature synthesis demonstrates a close relationship between learning autonomy and critical thinking. Learners who have control over their learning tend to demonstrate deeper analysis. The integration of artificial intelligence significantly impacts this relationship. Technology can be either an enabler or a barrier depending on the learning design. Understanding this relationship is crucial for the development of AI-based education. The qualitative study provides a strong conceptual foundation. This discussion emphasizes the research's relevance to educational practice.

CONCLUSION

Based on the discussion above, the integration of artificial intelligence into the learning process shows significant potential for transforming the modern education system. The use of this technology encourages learning that is more adaptive, personalized, and responsive to students' needs. This change has a direct impact on shifting the role of educators and learning interaction patterns. Artificial intelligence contributes to supporting the development of independent learning by providing feedback and flexible learning paths. However, independent learning does not develop automatically without adequate cognitive and pedagogical readiness. Excessive reliance on intelligent systems has the potential to weaken learning initiative and responsibility. Furthermore, the integration of artificial intelligence also impacts students' critical thinking skills in various ways. Technology can enrich the analysis and problem-solving process when utilized reflectively. Conversely, use that is oriented towards instant answers risks hindering the development of critical reasoning. The relationship between independent learning and critical thinking demonstrates a mutually reinforcing relationship. Learning design and the role of educators are determining factors for the success of AI integration. Therefore, the use of AI needs to be directed at strengthening active learning processes to support the development of students' essential competencies.

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