PROCEEDINGS OF THE 2nd AAICE 2025
Volume 2, Number 1, 2025, pp. xx-yy.
FITK Universitas Alma Ata, Yogyakarta-Indonesia, October, 2025

Integrating Artificial Intelligence into Education: A Systematic Literature Review on Smart, Innovative, and Creative Learning

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Abstract. The rapid development of Artificial Intelligence (AI) has significantly influenced the education sector and changed the teaching and learning process to meet the demands of the 21st century. Along with the increasing need to create a smart, innovative, and creative learning environment, it is important to understand how AI can be effectively integrated into various educational contexts. This study uses a systematic literature review method to analyze recent research on the integration of AI in education. A qualitative approach was used to identify, review, and synthesize relevant studies to map the latest developments, potential applications, and emerging trends. Thematic analysis shows the contribution of AI in three dimensions of learning: intelligent learning that emphasizes personalization and adaptive instruction; innovative learning through the use of intelligent tutoring systems and AI-based analytics; and creative learning that encourages ideation and problem solving with the help of generative AI technology. The review results show that AI plays an important role in creating a dynamic and engaging learning environment. However, there are a number of challenges, including ethical issues, digital literacy gaps, and the readiness of educators to adopt AI-based technologies. This study provides insights for educators, policymakers, and researchers by mapping the opportunities and obstacles in the application of AI in education. Further research is expected to develop ethical frameworks and inclusive strategies to support sustainable educational innovation.

Keywords: Artificial Intelligence, Education, Smart Learning, Innovative Learning, Creative Learning

1. INTRODUCTION

The rapid development of Artificial Intelligence (AI) has affected various sectors, with education being one of the most impacted fields. AI has changed the way learners access information, the way educators design learning, and the way educational institutions evaluate learning outcomes. As we enter the era of the Fourth Industrial Revolution, the need for smart, innovative, and creative learning environments is increasing [1]. AI offers great potential for improving personalization, adaptive learning, and higher-order thinking skills, which are essential for 21st-century education ([2]

According to recent reports from Allied Market Research [3] and Data Bridge Market Research [4], the global market for artificial intelligence in education (AIED) is showing significant growth trends. Allied Market Research projects that the AIED market value will reach approximately USD 88.2 billion by 2032 with a compound annual growth rate (CAGR) of 43.3%, while Data Bridge Market Research estimates that the market value will reach USD 30.4 billion with a CAGR of 35.9% over the same period. These findings confirm the increasing role of AI in supporting innovation and personalization of learning at the global level. This growth indicates an increase in investment in AI-based educational technologies

such as intelligent tutoring systems, adaptive platforms, and generative AI tools. However, the level of adoption is still uneven across the globe.

According to OECD [5], around 20% of secondary school teachers still feel they need additional training, even though around 60% of teachers have participated in digital education training over the past year. This condition shows that most teachers are not yet fully confident in utilizing digital technology, including artificial intelligence (AI) applications, to support effective and ethical learning processes. Although the potential of AI in education has been widely discussed, most previous studies have focused on specific areas, such as intelligent tutoring systems, learning analytics, or ethical issues in educational AI. There is still a research gap in understanding how AI can comprehensively support the dimensions of *intelligent, innovative,* and *creative* learning within a single conceptual framework. In addition, there are still few studies that synthesize the relationship between these dimensions to form a holistic future learning ecosystem.

A number of recent studies in Indonesia also confirm that the gap in literacy and readiness for AI-based technology is still evident. A study conducted by Zaki & Ulya [6] shows that teachers have a fairly high level of pedagogical readiness, but still vary in terms of technological readiness. The study emphasizes the importance of professional training and ongoing support for educators to be able to adapt to digital transformation. On the other hand, Khosibah et al [7] found that artificial intelligence (AI) literacy among early childhood is beginning to grow, but its distribution is not yet evenly spread across all regions. Meanwhile, research by Hamida et al. [8] shows the positive potential of adaptive technology in tailoring learning for students, including those with special needs. These findings reinforce the view that the integration of AI in Indonesian education still requires more inclusive mentoring strategies and policies.

These local studies confirm that issues such as educator readiness, access to infrastructure, and ethical or socio-cultural constraints are not merely theoretical but real challenges. Therefore, this study aims to conduct a Systematic Literature Review (SLR) on the integration of AI in education for the period 2018-2025, focusing on three dimensions of learning: intelligent learning that emphasizes personalization and adaptivity; innovative learning that optimizes intelligent tutoring systems and AI-based analytics; and creative learning that utilizes generative AI to enhance ideation and problem-solving. This study aims to (1) map the latest developments and applications of AI in these three dimensions; (2) identify emerging trends and challenges; and (3) offer ethical and inclusive strategies to support sustainable educational innovation.

2. METHOD

This study uses a Systematic Literature Review (SLR) approach to synthesize the latest research results on the integration of Artificial Intelligence (AI) in education, with a focus on smart, innovative, and creative learning. This review follows the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines to ensure transparency and repeatability of the research process. Articles were collected from various major academic databases such as Scopus, Google Scholar, and several SINTA-indexed national journals, using the keywords *"Artificial Intelligence," "education," "smart learning," "innovative learning,"* and *"creative learning."* The search covered publications from 2018 to 2025, including *peer-reviewed* journal articles written in English and Indonesian.

Overall, 35 articles were identified in the initial literature search. After removing duplicates and screening based on the relevance of titles and abstracts, 26 studies remained for full analysis. Of these, 15 studies met the inclusion criteria and were analyzed further. The inclusion criteria included: (1) research that explicitly discussed the integration of artificial intelligence (AI) in the context of education; (2) presented empirical and conceptual findings; and (3) was related to at least one of the three dimensions of learning studied, namely intelligent, innovative, or creative. The exclusion criteria included: studies that focused solely on the technical aspects of AI development without relevance to education; articles that were not available in full text; and duplicate publications. This procedure was applied to ensure that the literature reviewed was consistent with the research objectives and provided valid and contextual insights into the educational implications of AI integration.

The selected studies were then analyzed using a thematic analysis approach to identify the main themes and trends in the literature. This analysis followed a six-stage framework developed by Braun & Clarke [9] namely: (1) recognizing and understanding the data, (2) creating initial codes, (3) searching for themes, (4) reviewing themes, (5) defining and naming themes, and (6) compiling an analysis report. From the analysis results, three main themes were obtained, namely intelligent learning, innovative learning, and creative learning. Each theme was analyzed to see how AI technology is utilized in supporting adaptive instruction, intelligent feedback systems, and generative-based creativity development in the context of education. This thematic synthesis allows for mapping the relationship between AI application, pedagogical strategies, and student learning outcomes

3. RESULT AND DISCUSSION

Based on an analysis of 15 articles that met the inclusion criteria, the integration of Artificial Intelligence (AI) in education shows a significant upward trend in various learning contexts. These studies cover primary to higher education levels, with a focus on the application of AI to support intelligent, innovative, and creative learning. In general, these studies highlight how AI is used to improve learning effectiveness, personalize learning experiences, and develop 21st-century skills in students.

3.1. Result

AI-based learning environments redefine the concept *of smart learning* by enabling personalized and adaptive instruction. A number of studies emphasize that *machine learning-supported* intelligent learning systems are capable of analyzing student behavior and adjusting material delivery in real-time ([10] This personalization increases student engagement and learning outcomes by adjusting the material to each individual's learning style and pace. This framework shows that AI is not merely a technological complement, but a transformative force in creating learner-centered, data-driven education systems.

AI-based technology has become a catalyst for *innovative learning* by supporting interactive, data-driven, and continuously evolving instructional design. *Intelligent Tutoring Systems* (ITS) and *Learning Analytics* platforms enable teachers to gain real-time insights into student progress and difficulties, allowing for timely pedagogical interventions [11]. In addition, artificial intelligence (AI)-based assessment tools are now increasingly being used to provide automatic feedback to students. This technology not only helps reduce the administrative burden on teachers in the assessment process, but also encourages the implementation of more sustainable and data-driven formative assessments.

In the Indonesian context, the integration of AI in education is beginning to emerge through various initiatives carried out by the government, one of which is through a program to develop deep learning, coding, and artificial intelligence modules within the framework of the *Merdeka Belajar* (Freedom of Learning) policy. The Directorate of Primary Education Teachers [12] emphasizes that this step is part of efforts to strengthen the digital transformation of education and increase teachers' capacity to deal with technological changes in the 21st century. This initiative marks a shift from content-centered learning to innovation-centered pedagogy that emphasizes creativity, flexibility, and data-driven decision making.

The emergence of generative Artificial Intelligence such as ChatGPT, Gemini.AI, DALL·E, and various other creative platforms has redefined how creativity is developed in education. Through a variety of AI-based tools and platforms, students can explore, visualize, and build their own knowledge through multimodal interactions. This technology enables the integration of text, images, audio, and visual-conceptual representations into a comprehensive and interactive learning experience. A study published by Cheung et al. [13] shows that the use of generative AI tools in science education helps students express ideas more visually and conceptually, thereby fostering critical and creative thinking skills. In line with this, Burriss et al [14] found that multimodal AI provides space for teachers and students to experiment with various forms of digital composition, enriching the ways they express ideas. Meanwhile, Jia & Tu [15] emphasize that AI's ability to provide immediate feedback and support the

reflective process can create an adaptive and collaborative learning environment. These three findings indicate that the presence of AI does not merely replace the role of conventional learning technology, but also transforms the way of thinking and interacting in the learning space to be more dynamic and innovation-oriented.

In addition, AI-based creative environments encourage self-expression and idea collaboration, which are important competencies in 21st-century education. In Indonesia, several pilot programs in the arts and language education have begun to integrate *AI-assisted storytelling* and *visual generation,* demonstrating its potential in improving creative literacy among students. Marrung et al. [16] show that the application of AI-assisted *digital storytelling* in vocational learning can attract students' interest in learning while fostering creative thinking skills through interactive audio-visual media. Meanwhile, research by Kartika Ratri et al. [17] shows that the use of AI-based animated videos in Indonesian language learning in elementary schools can help students understand the context of stories in a more concrete and enjoyable way. These two findings confirm that the integration of AI technology in the context of arts and language education not only enriches the learning experience but also opens up new opportunities for the development of literacy and creative expression at various levels of education.

Although AI has transformative potential in education, there are several challenges that must be addressed. Teachers may face difficulties in effectively integrating AI without adequate training, while students in underserved areas have limited opportunities to take advantage of AI-based learning. Ethical issues also arise with the use of generative AI, such as plagiarism, content misuse, and intellectual property rights violations. Addressing these challenges requires comprehensive policies, professional development programs for educators, and inclusive strategies to ensure equitable access and responsible adoption of AI.

Overall, the reviewed literature highlights that Artificial Intelligence has a transformative role in education by fostering intelligent, innovative, and creative learning environments. AI enhances personalization through adaptive learning systems, supports innovation through *intelligent tutoring* and analytics, and promotes creativity through generative AI tools. However, challenges related to ethics, digital literacy, and equity of access remain significant. Effective AI integration requires not only technological infrastructure, but also comprehensive teacher training, inclusive policies, and ethical guidelines. These findings emphasize the importance of strategic planning and policy alignment to ensure that AI-based educational innovation is sustainable, equitable, and pedagogically meaningful. Future research should focus on longitudinal studies, inclusive strategies for diverse learners, and frameworks for the responsible use of AI in schools.

AI for Smart Learning

Research results show that Artificial Intelligence contributes significantly to the development of smart learning environments that emphasize personalization and adaptivity. AI-based smart learning systems improve the personalization of instruction and assessment through adaptive algorithms that analyze student performance and learning patterns [18]. These systems enable teachers to provide individualized feedback and tailor learning paths to students' needs. Several studies also indicate that AI can improve formative assessment through automated feedback and performance predictions, allowing teachers to identify learning gaps more quickly ([19]

In Indonesia, research shows that AI-based platforms such as intelligent tutoring systems and adaptive learning applications are beginning to increase engagement and learning efficiency in elementary classrooms. Zaki & Ulya [6] found that teachers' pedagogical and technological readiness in adopting AI plays an important role in the effective implementation of adaptive learning systems that are able to adjust to students' ability levels. In addition, other local initiatives also show that the application *of learning analytics* can support the implementation of differentiated learning, both in online and hybrid environments. Adil Dwijaksana et al. [20] show that *learning analytics* technology is capable of mapping students' learning patterns, enabling teachers to provide more appropriate and contextual interventions. This kind of implementation reflects the trend towards *smart classrooms* that combine real-time analytics and adaptive pedagogy to support more effective learning experiences. Thus, the use

of AI in basic education in Indonesia is beginning to show a positive impact on increasing the personalization and efficiency of the learning process.

AI for Innovative Learning

Another important theme is the role of AI in promoting innovative learning practices. AI-based tools, such as virtual assistants, predictive analytics, and intelligent simulations, enable the emergence of new pedagogical models that go beyond conventional learning. For example, *machine learning* algorithms can analyze student behavior to recommend personalized learning paths or predict academic risks [21]. In Indonesia, the use of AI-based chatbots and digital assistants has begun to be explored as a means to increase student participation and independence in online learning. Research by Juanta et al. [22] shows that the use of chatbots as learning assistants can strengthen student motivation and engagement through adaptive conversation-based interactions. Similar findings were also revealed by Slamet [23]who highlighted how AI-based virtual assistants can facilitate two-way communication between teachers and students, while also helping to manage learning that is more independent and responsive to individual needs.

In addition, the integration of AI in gamification-based learning applications has been proven to increase learning motivation and encourage sustained student engagement. Through an approach that combines game elements such as points, challenges, and direct feedback, learning becomes more interactive and enjoyable, while also being in line with the development of 21st-century competencies that emphasize collaboration, creativity, and independent learning. Research by Azizah et al. [24] shows that the application of AI technology with gamification elements significantly strengthens students' motivation, independence, and conceptual understanding. In line with this, a study by Alenezi [25] confirms that AI-based gamification can transform the learning experience into a more meaningful one by providing autonomy and real-time feedback to students. Such innovations demonstrate how AI can act as a catalyst for active and independent learning that encourages more meaningful learning engagement.

AI for Creative Learning

The third theme highlights AI's ability to enhance creative learning through generative and collaborative technologies. AI-based creative platforms, such as *text-to-image generators* and collaborative writing tools, enable learners to explore ideas, problem-solving, and content creation in new ways [26] These tools encourage creativity by providing adaptive suggestions, facilitating experimentation, and reducing the fear of failure that often arises in creative activities.

Generative AI technologies such as ChatGPT, DALL·E, and Canva-AI open up new opportunities in creative learning by allowing students to practice ideation, storytelling, and visual design [27]. In Indonesian classrooms, the use of generative AI technology is becoming more widespread, especially in creative writing and digital art projects. Through the use of tools such as the *Generative AI for Creative Writing (GENESI5)* platform, students are trained to express their ideas and imagination through a combination of text, visuals, and other multimodal elements that enrich their work [28] This innovation not only improves digital literacy and collaboration skills, but also fosters students' confidence in creating original content relevant to the Society 5.0 era. In line with this, research by Salam et al. [29] shows that the application of AI-assisted learning in digital reading and writing activities can develop linguistic creativity and broaden the way students understand and interpret literary works in a more interactive way.

The application of AI-assisted learning platforms has the potential to foster students' creativity by helping them visualize abstract concepts and develop more innovative project outcomes. Research by Riskiani et al. [30] shows that the integration of AI technology in learning enables students to understand complex material through interactive visual representations, thereby encouraging deeper engagement and exploration of ideas. In Indonesia, Alhubilah & Abdurahman [31] found that the use of generative AI tools such as ChatGPT and Canva AI in language and arts learning can enhance students' imagination and confidence. This shows that when used ethically and pedagogically, AI can support creativity as a higher-order cognitive skill, not just technological innovation. Overall, the integration of AI in education

supports a paradigm shift towards personalized, data-driven, and creativity-oriented learning. Smart and innovative learning emphasizes adaptability and engagement, while creative learning highlights the collaboration between humans and AI in building new knowledge.

3.2. Discussion

However, the application of AI in education still faces a number of challenges, particularly related to ethical use, digital literacy, and teacher readiness. Anita et al. [32] emphasize that low digital literacy among teachers and students is a major obstacle in maximizing the potential of AI to improve the quality of learning. In addition, Amaliah Kasman et al. [33] highlight the need for technical skills and pedagogical readiness to optimally utilize AI, while Revalya Nadya et al. [34] identify five main challenges in the application of AI in education, including the potential decline in learning motivation and dependence on technology, which can affect students' creativity and critical thinking skills. Overcoming these obstacles is key to ensuring that AI integration truly supports inclusive and sustainable educational innovationOther paragraphs

4. CONCLUSION

This systematic literature review shows that Artificial Intelligence (AI) has a transformative impact on education by enabling intelligent, innovative, and creative learning. AI-based tools facilitate personalized instruction, support innovative pedagogical strategies, and enhance creative thinking skills through generative applications. However, challenges such as ethical issues, digital literacy gaps, and unequal access need to be addressed to ensure fair and responsible implementation. Policymakers and educators are advised to develop comprehensive guidelines, provide professional development for teachers, and design inclusive AI-based learning environments

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