Analysis of the Application and Impact of Artificial Intelligence in Elementary School Learning: A Literature Review

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Abstract

This article aims to analyze the application and impact of Artificial Intelligence (AI) in elementary school learning through a literature review. The study follows four stages of literature review: theme determination, literature database search and selection, literature analysis and synthesis, and organization of review findings. The primary focus of the literature review is on the application and impact of AI in elementary-level education. Literature searches utilize databases such as Google Scholar, Springer, and Elsevier. The review findings indicate that the use of AI in elementary education includes adaptive learning, automatic feedback systems, educational chatbots, and tools for analyzing student learning progress. Furthermore, the study shows that AI impacts the effectiveness of learning, increases student motivation, enhances student engagement, and strengthens digital literacy for both students and teachers.

Keywords artificial intelligence, elementary school learning, literature review

A. Introduction

The advancement of technology in the digital era has impacted various aspects of life, including education. One of the innovations that continues to evolve in supporting the learning process is the application of Artificial Intelligence (AI). AI has the potential to create a more adaptive, responsive, and student-centered learning environment (Liriwati, 2023; Gligorea et al., 2023). It provides opportunities for students to explore various topics related to the material, encouraging more active and engaged learning. Furthermore, AI promotes the use of technology in learning, which can facilitate the strengthening of students' digital literacy (Diantama, 2024).

At the elementary education level, AI implementation offers several benefits, such as learning tailored to the needs of individual students (Maghsudi et al., 2021). AI can support personalized learning according to students' interests and abilities, presenting lessons suited to each student's learning style and pace. Additionally, AI can improve the effectiveness of teaching and learning processes conducted in the classroom (Fitri & Dilia, 2024). AI also assists teachers in managing classrooms and conducting more accurate assessments (Oktavianus et al., 2023).

Hence, AI plays a role in impacting various aspects of learning, including processes, students, and teachers.

Currently, the use of AI in elementary school education is on the rise. This has led to various research initiatives focusing on the application of AI in elementary education, such as studies that emphasize teacher assistance in using AI (Kumala et al., 2024; Franz et al., 2023). Other research focuses on the impact and benefits for students and other outcomes related to AI use in elementary school learning (Siagian & Sofiyah, 2024). Moreover, the appropriate application of AI can help deliver content tailored to each student's level of understanding and learning speed, supporting the development of cognitive skills and digital literacy from an early age.

However, despite numerous studies showing AI's potential benefits in education, its application in elementary schools faces several challenges. These challenges include the readiness of technological infrastructure, teachers' ability to utilize AI effectively, and ethical and privacy issues related to the use of student data in AI-based systems. Additionally, there is a need for more in-depth research on the long-term impact of AI on elementary education, given that this technology is still relatively new and rapidly evolving. Based on these considerations, this article reviews the application of AI and its impact on learning in elementary schools.

B. Literature Review

Artificial Intelligence (AI) is an innovation that impacts various fields, including education. AI has the potential to transform traditional learning into an experience that is more dynamic and personalized. Research shows that AI can facilitate the adaptation of educational content based on students' needs and learning pace. Furthermore, AI can analyze students' learning achievements in real-time, providing feedback that aligns with their specific weaknesses and needs. AI offers an adaptive approach to learning, accommodating differences in students' learning styles and speeds. Thus, the use of AI can create an inclusive learning environment (Liriwati, 2023; Maghsudi et al., 2021).

However, the use of AI requires careful oversight to ensure content accuracy. Additionally, supervision of AI usage must continue to promote ongoing student engagement. Teachers should also be equipped with adequate knowledge and training to use various AI platforms, ensuring that technology complements rather than completely replaces traditional teaching practices (Oktavianus et al., 2023; Harsya et al., 2024).

In another aspect, the use of AI in elementary schools faces several challenges. These challenges include the readiness of technological infrastructure, teachers' ability to adopt and integrate AI into learning, and ethical issues related to data privacy. Moreover, some studies emphasize the importance of a deep understanding of AI's long-term impact on students' cognitive and social development. Thus, while AI presents numerous opportunities that bring innovation to learning, careful planning and consideration are needed to address the various challenges faced by students, teachers, and schools (Diantama, 2024; Franz et al., 2023).

C. Research Method

This study employs a literature review with five main stages: theme determination, literature search, literature selection, analysis and synthesis, and organizing the writing (Latip & Faisal, 2021). The main topic of this literature review is the implementation of AI in elementary education and its impact on students, teachers, and learning processes. The literature search was conducted using databases such as Google Scholar, Springer, and Elsevier. The selection of articles was based on relevance to the theme, publication within the last ten years, and the completeness of journal information. The analysis and synthesis focused on the themes of AI implementation and its impact on learning. The final stage involved organizing the writing with a focus on discussing and reviewing the research findings.

D. Discussion

Application of Artificial Intelligence (AI) in Elementary School Learning

The implementation of Artificial Intelligence (AI) in elementary school learning has demonstrated various methods and strategies that benefit the learning process for both teachers and students. The following are some key applications of AI in elementary education:

Adaptive Learning

One significant application of AI in elementary education is through adaptive learning systems. AI can analyze students' learning patterns and adjust the characteristics of the teaching material in real time based on the students' needs and abilities (Mambu et al., 2023). This system provides challenges suited to each student's pace and understanding level, making the learning process more effective and engaging. However, employing AI for adaptive learning requires careful preparation of teachers, students, and supporting infrastructure. Teachers must be equipped to design AI-based lessons, from understanding the tools and planning to classroom

implementation. Additionally, students should be adequately prepared to engage effectively in AI-driven learning environments (Fricticarani et al., 2023).

Virtual Assistants and Educational Chatbots

AI-powered virtual assistants help students understand learning materials outside of school hours or when teachers are not available. Chatbots can quickly answer student questions, provide additional explanations, or even assist with specific assignments. However, using educational chatbots requires monitoring to ensure students do not rely entirely on their responses. In the educational context, chatbots can be tools for developing critical thinking and analytical skills by encouraging students to process information critically (Harsya et al., 2024). These tools allow students to access instant support, reducing their dependence on teachers during class (Oktavianus et al., 2023).

Student Performance Analysis

AI can be used to automatically analyze student performance in elementary education. It gathers and analyzes data on students' progress and the challenges they face during the learning process (Gusli et al., 2023). This information helps teachers identify students' strengths and weaknesses, allowing them to provide targeted feedback and design effective follow-up strategies. Platforms like Kahoot and Quizizz offer features for analyzing student achievement, making it easier for teachers to tailor their teaching approach to each student's needs (Kumala et al., 2024**).**

Automated Feedback

Another application of AI at the elementary level is in providing automated feedback. AI simplifies the process of giving feedback to students (Anas & Zakir, 2024). The system can automatically grade assignments or homework and provide detailed, specific feedback. This not only speeds up the assessment process but also helps students understand their mistakes and make improvements quickly. Platforms such as Quizizz and Kahoot are effective for providing formative assessments in class, allowing students to receive instant feedback on their performance.

Impact of Artificial Intelligence (AI) on Elementary School Learning

The literature review reveals that AI implementation in elementary education has a positive impact on the learning process and student outcomes. The following are some of the impacts of AI use in elementary education:

More Personalized and Effective Learning

AI creates a personalized learning environment where content and teaching approaches are tailored to each student's pace, needs, and learning style. This enhances learning effectiveness, improving comprehension and fostering various critical thinking skills. AI-based platforms assess students' abilities in real time and provide relevant feedback, supporting differentiated instruction and maximizing student outcomes (Maghsudi et al., 2021). This personalized approach aligns with differentiated learning practices, with AI as a supportive tool for learning and assessment (Saputra et al., 2024).

Increased Student Engagement and Motivation

AI also contributes to creating a more engaging and interactive learning environment (Asbara et al., 2024). Features such as gamification, automated feedback, and simulation-based experiences encourage students to actively participate in the learning process, increasing their motivation and engagement (Oktavianus et al., 2023). AI facilitates collaboration and interaction between teachers and students, as well as among students themselves, making learning more collaborative and dynamic**.**

Strengthening Digital Literacy for Students and Teachers

In the digital era, AI plays a crucial role in equipping students with digital literacy skills from an early age (Suhendro, 2022). Students not only learn academic content but also develop skills related to technology, enhancing their ability to use digital tools effectively (Diantama, 2024). The use of AI should be accompanied by training in various platforms, ensuring optimal use to support learning. Thus, AI gradually becomes a means of developing digital literacy for both students and teachers.

E. Conclusion

The literature review findings show that AI is utilized in elementary education for adaptive learning, providing personalized learning environments that cater to each student's characteristics and needs. AI also serves as a tool for automated feedback, analyzing student progress, and educational chatbots. Additionally, AI use has multiple impacts, including increased student engagement, more effective learning processes, heightened student motivation, and enhanced digital literacy for both students and teachers.

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