

SYSTEMATIC LITERATURE REVIEW: AN ANALYSIS OF THE ROLE OF ARTIFICIAL INTELLIGENCE IN PERSONALIZING LEARNING TO DEVELOP ELEMENTARY SCHOOL STUDENTS' COMPETENCIES

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Abstract. This study aims to analyze the role of Artificial Intelligence in personalized learning and its contribution to the development of elementary school students' competencies. This study employs a qualitative approach using the Systematic Literature Review (SLR) method, drawing on eight scientific articles retrieved from Google Scholar over the past five years. The research stages include literature identification, selection, evaluation, and synthesis. The results show that Artificial Intelligence supports more adaptive and personalized learning by tailoring instructional materials to students' learning needs. Artificial Intelligence also contributes to enhancing student engagement, learning outcomes, and 21st-century competencies such as digital literacy and critical thinking. However, its implementation still faces challenges, including teacher readiness, infrastructure, and the digital divide.

Keywords: artificial intelligence, personalized learning, systematic literature review

INTRODUCTION

Basic education today faces the challenge of accommodating the diversity of each student's abilities, interests, and learning needs. Teaching practices that remain uniform fail to optimally meet students' individual needs (Dewi, 2024). This situation has the potential to hinder the development of 21st-century competencies, such as critical thinking, creativity, communication, collaboration, and digital literacy—which are increasingly essential in the era of smart technology. In fact, elementary education plays a vital role as the foundation for building the competencies students need to face future challenges and keep pace with ever-changing technological developments.

The main cause of these challenges is the continued dominance of a one-size-fits-all approach to learning, which has yet to accommodate differences in each student's abilities, interests, and learning pace (Melesse & Belay, 2022). In practice, teachers often face time and resource constraints that prevent them from providing learning services tailored to students' individual needs (Rani Van Schoors et al., 2023). This situation results in a learning process that is less than optimal in supporting the holistic development of students' potential.

A mismatch between learning strategies and students' individual needs can lead to low engagement in learning, gaps in academic achievement, and underdeveloped key competencies needed for the future (Casteleijn & Franzsen, 2024). Students who struggle academically are at risk of falling behind, while those with higher abilities often do not receive appropriate academic challenges. As a result, students' competency development is not maximized, and education goals focused on human development are difficult to achieve optimally.

An innovation with the potential to address these challenges is the use of Artificial Intelligence for personalized learning. Artificial Intelligence enables the learning process to be tailored to each student's characteristics, needs, and developmental level by providing more adaptive learning materials, feedback, and recommendations. Therefore, a comprehensive study is needed to

understand the role of Artificial Intelligence in personalized learning in elementary education. The objective of this study is to analyze the use of Artificial Intelligence in personalized learning systematically and to identify its contribution to the competencies of elementary school students.

METHODS

This study employs a qualitative approach using the Systematic Literature Review (SLR) method. According to Booth et al. (2022), an SLR is a systematic, transparent, and structured method for identifying, evaluating, and synthesizing research relevant to a specific topic. The research data were obtained from scientific articles indexed in Google Scholar and published within the last five years, in line with the study's focus on examining the role of Artificial Intelligence in personalized learning and its contribution to the development of elementary school students' competencies. The research stages included article identification, selection based on inclusion and exclusion criteria, evaluation of article quality, and synthesis of findings to examine the role of Artificial Intelligence in personalized learning and the development of elementary school students' competencies. For further details, please refer to Figure 1.

Figure 1. Technical stages of research



RESULTS

Based on the analysis, eight relevant journal articles were identified on the role of artificial intelligence in personalized learning in elementary education. This study is expected to provide a more comprehensive understanding of the contribution of artificial intelligence in supporting the development of elementary school students' competencies.

No.	Research & Year	Research Result
1	(Dianita, 2026)	AI improves personalized, adaptive, and inclusive learning, increasing engagement, achievement, and learning effectiveness, but it faces challenges related to teacher readiness, ethics, and infrastructure.
2	(Revenaya, 2025)	AI supports adaptive and interactive learning in primary education and contributes to improved student learning outcomes.
3	(Rahmah & Setyaningsih, 2026)	AI enables personalized learning by tailoring content to students' needs, though privacy concerns and teacher readiness limit its implementation.

4	(Arriola-mendoza & Valerio-ureña, 2024)	Effective AI integration in elementary schools requires teacher competence, infrastructure support, and ethical data governance.
5	(Yusuf, 2025)	AI enhances learning effectiveness and personalization, but the digital divide and implementation barriers remain significant challenges.
6	(Heung et al., 2025)	AI literacy is essential for elementary students to understand and engage with AI technologies effectively.
7	(Majid Memari, 2025)	AI improves STEM learning outcomes through intelligent tutoring systems and adaptive learning, but gaps exist in implementation and equity.
8	(Kristjan-Julius Laak, 2025)	AI-based personalized learning bridges learning gaps but still shows misalignment with broader educational goals and classroom realities.

DISCUSSION

Based on an analysis of eight relevant articles, it was found that Artificial Intelligence plays a significant role in supporting personalized learning in elementary education. Artificial Intelligence enables the learning process to become more adaptive by tailoring content, learning pace, and individual student needs. Findings from Dianita et al. (2026) indicate that Artificial Intelligence enhances personalized, adaptive, and inclusive learning, which leads to increased student engagement and improved learning outcomes. Similarly, Revenaya (2025) found that AI supports interactive and adaptive learning, thereby contributing to improved academic achievement among elementary school students.

The implementation of Artificial Intelligence in personalized learning enables learning systems to tailor content to students' needs. This is supported by Rahmah & Setyaningsih (2026), who state that Artificial Intelligence can adapt learning materials to students' characteristics, although challenges such as data privacy and teacher readiness persist. Furthermore, Arriola-Mendoza & Valerio-Ureña (2024) emphasize that the successful implementation of Artificial Intelligence in elementary schools depends heavily on teacher competence, infrastructure availability, and ethical policies governing data use.

Regarding benefits and challenges, Yusuf (2025) found that artificial intelligence can enhance learning effectiveness and support personalization. However, its use still faces the digital divide and implementation barriers. This indicates that although artificial intelligence has great potential, equitable access to technology remains a major challenge in elementary education.

The development of students' competencies is also a key aspect of using Artificial Intelligence. Research by Heung et al. (2025) emphasizes the importance of AI literacy among elementary school students to help them understand and use the technology effectively. This is supported by research by Majid Memari (2025), which shows that Artificial Intelligence, through intelligent tutoring systems, can improve students' STEM learning outcomes, although gaps remain in its implementation.

Research by Kristjan-Julius Laak (2025) concludes that although Artificial Intelligence can bridge the learning gap through personalization, a disconnect remains between modern educational goals and classroom implementation practices. Overall, the synthesis results indicate that Artificial

Intelligence makes a positive contribution to personalized learning and the development of elementary school students' competencies. However, its success is heavily influenced by teacher readiness, infrastructure, and supportive educational policies.

CONCLUSION

Based on a systematic literature review of 8 relevant articles, it can be concluded that artificial intelligence plays a crucial role in supporting personalized learning in elementary education. Artificial intelligence enables the learning process to become more adaptive by tailoring content, learning pace, and individual student needs, thereby enhancing student engagement and academic outcomes. In addition, AI also contributes to the development of elementary school students' competencies, particularly digital literacy, AI literacy, and 21st-century skills. However, the implementation of Artificial Intelligence in elementary education still faces several challenges, including teacher readiness, infrastructure limitations, the digital divide, and ethical and data privacy issues. Overall, Artificial Intelligence has great potential to improve the quality of learning in elementary schools if implemented appropriately and sustainably.

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