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SYSTEMATIC REVIEW

An In-Depth Look At Artificial Intelligence In Education

Una Mirada Profunda Sobre La Inteligencia Artificial En La Educación

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ABSTRACT

Technological developments have had a significant impact on various sectors that continue to innovate, including education, one of which is Artificial Intelligence. Artificial Intelligence is the science and engineering of creating intelligent machines, particularly in creating intelligent computer programs or applications that function like human intelligence. This transformation responds to the challenges of 21st-century learning needs that demand flexibility, efficiency, and technological relevance. This study uses a descriptive qualitative method with a Systematic Literature Review approach. The data sources were taken from 30 scientific publications published from 2020 to 2025, taken from the Scopus, IEEE Xplore, and Google Scholar databases. The research was conducted by collecting data in several stages, namely: first, identification; second, article selection; third, data extraction and article synthesis. The results of the study found five conclusions. First, there was an increase in personalized learning. Second, there was efficiency in educational administration. Third, AI still had weaknesses in terms of ethical and privacy challenges. Fourth, there was a gap in infrastructure and human resources. Fifth, there was an increase in decision-making through learning analytics.

Keywords: Artificial Intellegence; Systematic Literatur Review; Educational; Technology.

RESUMEN

Los desarrollos tecnológicos han tenido un impacto significativo en diversos sectores que están en constante innovación, incluida la educación, uno de los cuales es la Inteligencia Artificial (IA). La IA es la ciencia y la ingeniería de crear máquinas inteligentes, en particular en el desarrollo de programas o aplicaciones informáticas inteligentes que funcionen como la inteligencia humana. Esta transformación responde a los desafíos de las necesidades de aprendizaje del siglo XXI que exigen flexibilidad, eficiencia y relevancia tecnológica. Este estudio utiliza un método cualitativo descriptivo con un enfoque de revisión sistemática de la literatura (SLR). Las fuentes de datos se tomaron de 30 publicaciones científicas publicadas entre 2020 y 2025, extraídas de las bases de datos Scopus, IEEE Xplore y Google Scholar. La investigación se llevó a cabo recopilando datos en varias etapas: primero, identificación; segundo, selección de artículos; tercero, extracción de datos y síntesis de artículos. Los resultados del estudio encontraron cinco conclusiones. Primero, hubo un aumento en el aprendizaje personalizado. Segundo, hubo eficiencia en la administración educativa. Tercero, la IA todavía presentaba debilidades en cuanto a desafíos éticos y de privacidad. Cuarto, existía una brecha en infraestructura y recursos humanos. Quinto, hubo un aumento en la toma de decisiones a través de la analítica del aprendizaje.

Palabras clave: Inteligencia Artificial; Revisión Sistemática de la Literatura; Educación; Tecnología.

INTRODUCTION

Technological developments have had a significant impact on various sectors. Technology is very helpful in various jobs, providing convenience and effectiveness in completing tasks. Technology is a process that can increase added value. This process uses or produces a product, which is not separate from other existing products and therefore becomes an integral part of a system.[1] There are many types of technology that are often used by workers and students to find solutions to problems, one of which is Artificial Intelligence (AI).

Artificial Intelligence is one of the technological intelligences that is often used in various countries, especially in supporting education, as seen in the results of the Statista Consumer Insight survey which shows that the country that most often ranks first in terms of AI usage is Nigeria with 47 %, while Indonesia ranks fourth with 41 % in terms of enthusiasm for AI. Initially, AI was only used to automate industrial processes and data analytics. Developed countries such as the United States, South Korea, Finland, and Singapore have integrated AI into their national education policies, especially for personalized learning and student performance prediction. However, rapid development has been seen since the 2010s until now, with AI entering the field of education through learning analytics, intelligent tutoring systems, and adaptive learning platforms.[2] AI is the science and technique of creating intelligent machines, especially in creating intelligent computer programs or applications that function like human intelligence.[3] AI first appeared in 1956 at the Dartmouth conference, and experts have continued to conduct research to further develop AI.

The integration of Artificial Intelligence (AI) in education has marked a paradigm shift in how knowledge is delivered and acquired. Traditional methods are being supplemented or replaced by intelligent systems that can adapt to individual students' learning patterns. AI-supported platforms are increasingly being used in online learning, curriculum development, administrative management, and student engagement. In line with Industry 4.0 and Education 4.0, the education sector must embrace AI innovation to remain relevant and effective. Innovations from this technology raise several issues that need to be examined in terms of pedagogical impact, data privacy, administrative efficiency, and unequal access to AI. This is evidenced by research conducted by Widodo, et al. which found results related to the application of AI in personalized learning. This study concluded that artificial intelligence (AI) has significant potential to improve personalized learning in education, providing clear benefits for students and teachers. AI has been proven effective in providing personalized learning experiences according to the pace, needs, and preferences of students.

This study aims to analyze the use of AI intelligence in education systems by providing a comprehensive overview with qualitative data on the impact of AI on modern education systems, exploring how AI can be integrated into education to support personalized learning, and identifying the benefits and challenges involved. This review aims to answer research questions and serves to explore the enthusiasm for a new technology.

METHOD

Type of Research

This study uses a systematic literature review (SLR) method and the PRISMA system. This method is used to analyze this study carefully and transparently review relevant literature. The PRISMA framework provides standardization in collecting and analyzing data, which can improve the reproducibility and reliability of the study.[4] This method was chosen to examine trends, benefits, and challenges in the implementation of artificial intelligence (AI) in education. This method was chosen because the study focuses on collecting, analyzing, and synthesizing information from various reputable scientific sources. This research is descriptive qualitative in nature, using the Systematic Literature Review (SLR) technique.

Data Sources

The author worked diligently to explore articles related to AI intelligence that contribute to education as a whole. This study used primary data from source literature studies, including academic journals and relevant case studies, through a systematic literature study of 30 scientific publications published between 2020 and 2025. The literature study was taken from the Scopus, IEEE Xplore, and Google Scholar databases. Scopus was used to find reputable Q1 and Q2 journals related to AI and education research. Meanwhile, IEEE Xplore was used to obtain the latest publications related to AI technology and its implementation, and Google Scholar was used to expand the scope related to articles and access open-access publications.

Review Strategy

After collecting the initial results, the titles and abstracts were screened based on relevance, followed by a review of the full text to ensure they met the inclusion criteria. In this study, articles analyzed in English or Indonesian that discussed the implementation, challenges, or impact of AI in education were included. Studies focusing on non-educational applications of AI or those that were methodologically unclear were excluded or not used in the research. This process resulted in 30 articles that met the inclusion criteria and were analyzed in depth to identify patterns, challenges, and opportunities related to the integration of AI in education.

Research Process

The research was conducted by collecting data in several stages, namely: first, conducting identification to determine keywords and databases and collecting relevant articles based on initial searches. Second, continuing with selecting articles according to inclusion criteria, focusing on the application of AI in education and having empirical results or theoretical studies. Third, extracting data, namely collecting important information from articles. Finally, the fourth stage involved synthesizing the articles by grouping the findings, such as personalized learning, administrative efficiency, ethical and privacy challenges, infrastructure and human resource readiness, learning analytics, and predictive modeling.

After collecting the data, the data was analyzed using Thematic Content Analysis, which included the following procedures: first, grouping articles based on topic; second, categorizing findings according to the research focus; third, comparing the research results from the articles to find global trends, impacts, and issues related to AI; and finally, compiling a final synthesis in the form of conclusions and implications for the development of AI-based education.

RESULT

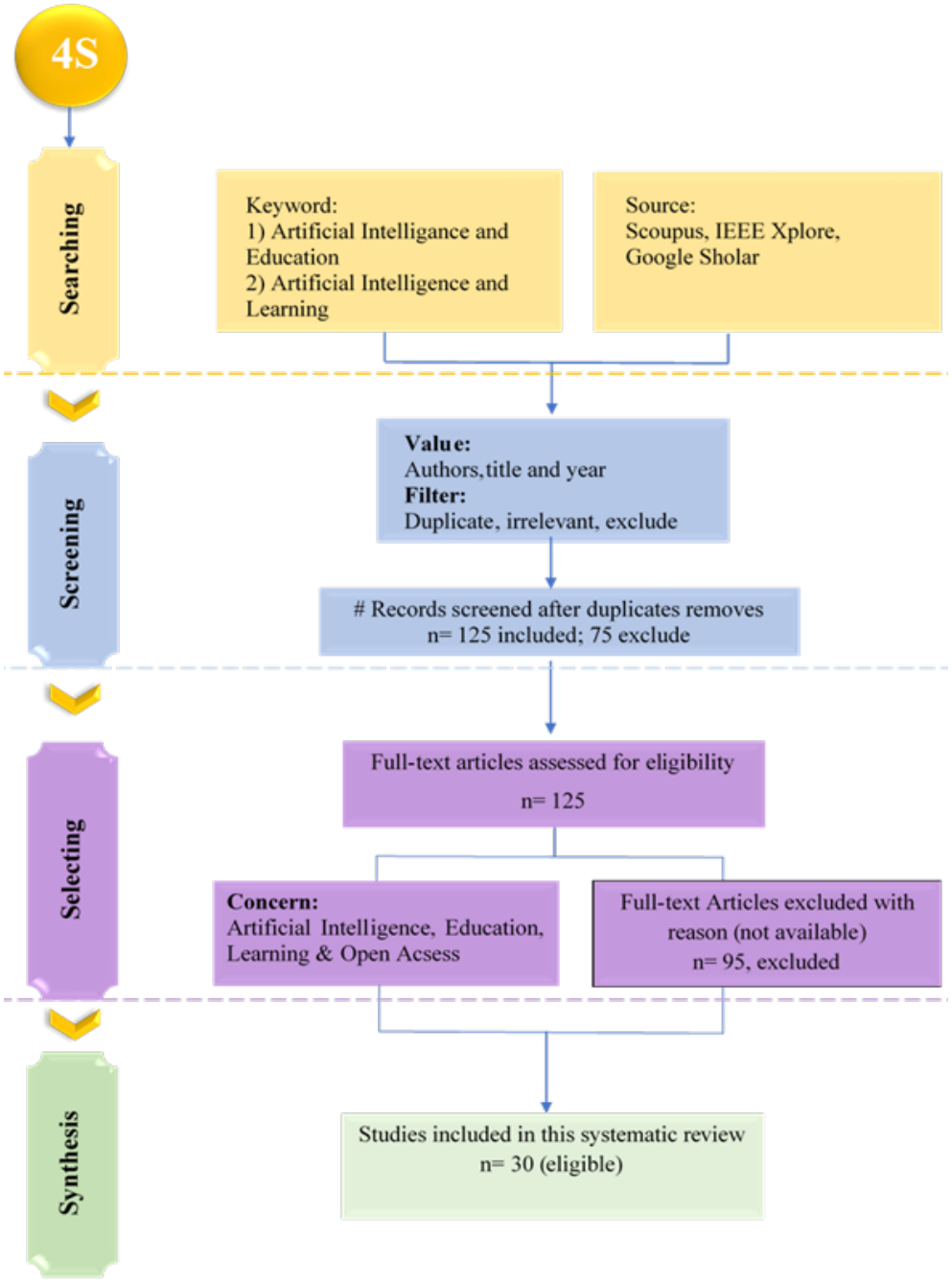

Figure 1. The PRISMA Flow Diagram

The results of the study were obtained from 30 scientific articles published from 2020 to 2025 sourced from reputable databases such as Scopus, IEEE Xplore, and Google Scholar. The analysis was conducted using a Thematic Content Analysis approach to identify the articles. The PRISMA framework provides a standardized process for collecting and analyzing data, enhancing the reproducibility and reliability of the study [36]. The four stages of the process (4S): searching, screening, selecting, and synthesizing, which involve collecting, filtering, and analyzing data based on its relevance to the topic of study, As shown in figure 1.

Searching

The search process in this study began with the identification of keywords. Identification was carried out using several keywords, namely Artificial Intelligence and Education, Artificial Intelligence and Learning. To ensure the accuracy of the research, this study searched for articles published from 2020 to 2025 taken from the Scopus, IEEE Xplore, and Google Scholar databases. A search was conducted on the Scopus database, yielding 15 articles that met the inclusion criteria. Eight articles were found in the IEEE Xplore database and seven articles on Google Scholar. The total number of articles that met the inclusion criteria was 30.

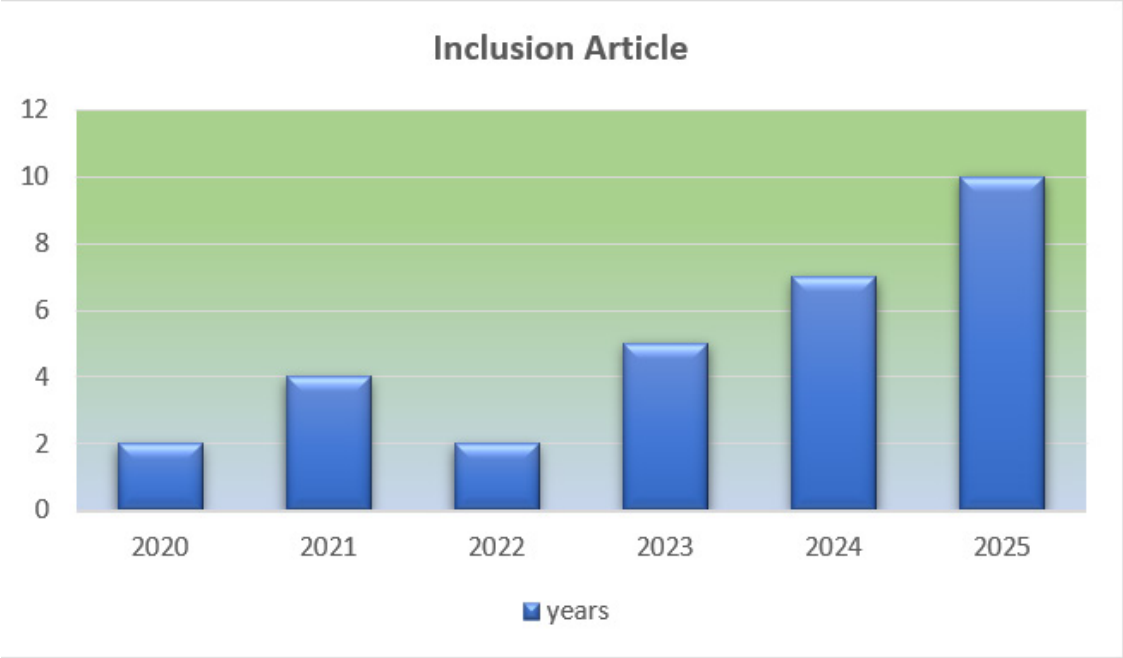

Figure 2. Articles included

Screening

During the title, abstract, and author screening stage, the first step was to filter the data based on duplicates, irrelevance, and exclusions. This screening aimed to ensure that the articles to be synthesized were relevant and met the criteria set for inclusion in the final analysis. This screening process can improve the accuracy of the review's validity by ensuring that only studies of high quality and relevant to the research question are included. During the screening process, 125 articles were found to be eligible and 75 articles were excluded. The excluded articles were duplicates, irrelevant, or did not meet the predetermined inclusion criteria.

Selection

This selection stage was conducted to choose studies suitable for inclusion in the research, which was very important to ensure the reliability and validity of the literature found. Based on the screening, 125 articles were selected based on their focus on artificial intelligence, education, learning, and open access. Based on all 125 articles, 95 articles were excluded based on their focus. This selection process resulted in the final data used in the study, as it was more relevant and reliable, thereby enhancing the credibility and generalization of the review findings.

Article Synthesis

The synthesis process was carried out to ensure that this systematic review was comprehensive and provided an easily understandable and clearly reliable understanding of the current state of AI application in education based on 30 articles that met the inclusion criteria. This process involved extracting and analyzing data from each article to identify key discussions. The conclusion of this synthesis process involved a critical evaluation

of the evidence presented in the existing research. The state of this research is the focus of this study. Data extraction was carried out to systematically collect and retrieve key information from various literature sources, then analyze and synthesize it to produce comprehensive findings. The data extraction process in this study can be seen in figure 3.

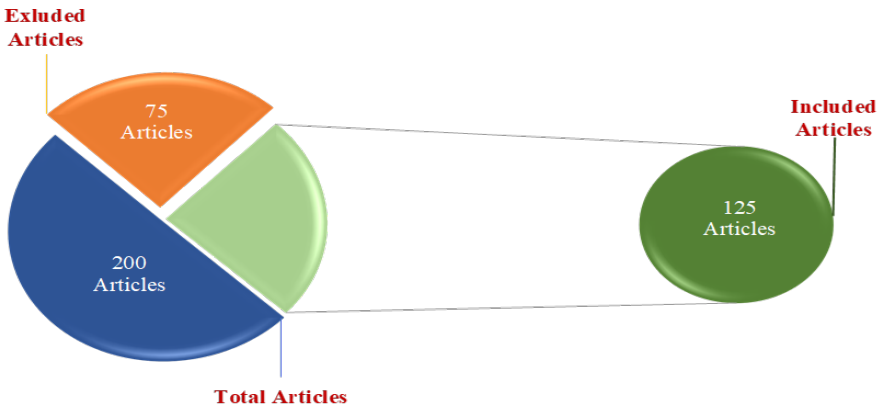

Figure 3. Article Findings Diagram

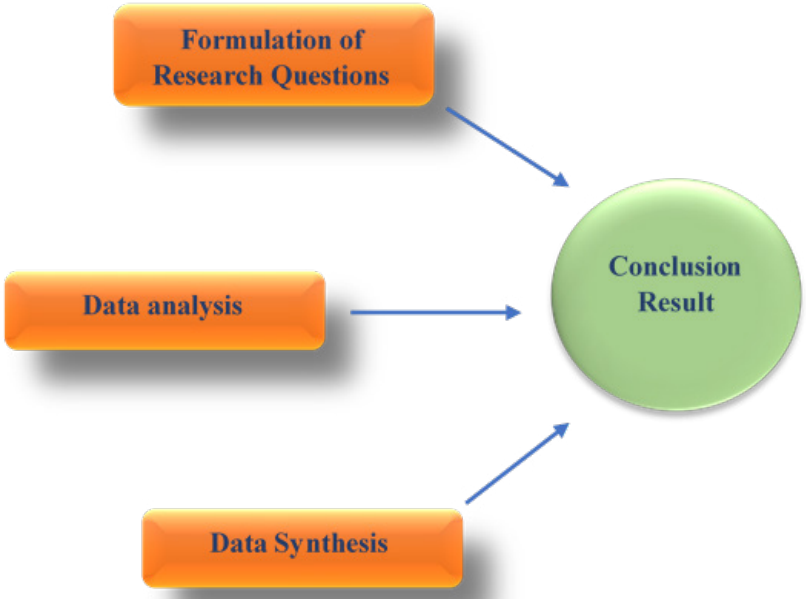

Figure 4. Data Extraction Process Diagram

The synthesized articles can be seen below

Table 1. List of 30 articles by year

No	Year	Articles
1	2020	Chen, Lijia, et.al; Ritcher, Olaf Zawacki, et.al
2	2021	Tahiru, fati, Zhai, Xuesong, et.al, Bozkurt, Aras, et.al.; Hong, Yingxiu, et.al
3	2022	Pham, Son T.H & Paulina M. Sampson; Bearman M, et.al.
4	2023	Harry, Alexandra; Nguyen, Nathan D.;
5	2024	Abbes, Feriel, et.al.; Almasri, Firas; Cristou, Prokopis A.; Williamson, Ben; Samala, Agariadne Dwinggo, et.al. Vishnumolakala, sai Krishna, et.al; Huang, Guimin & Xinxian liang
6	2025	laudzi, Lebohang Victoria & Joleen Hamilton; Tasdelen, Osman & Daniel Bodemer; Pavithra, d, et.al; Filiz, Ozan et.al.; Bellot, Andrea Roxana;Fitzek, Sebastian & Alina Bârgăoanu; Vacs, Dan Kohen, Maya Usheer dan Marc Jansen; Zha, shenghua, et.al; Dewan, umama, et.al. Langa, Makhulu relebogile & Michael Nthabiseng Moeti

Exploring the use of AI in education

Based on several processes and analyses conducted, several research results were found from the previously established problem formulation, including:

Improved Personalization of Learning

Based on the synthesis of the articles, it was found that AI integration can create more personalized learning with several adjustments such as materials, methods, and learning speeds tailored to individual needs. These results are in line with research conducted by Mulaudzi, et al.[5], which states that AI intelligence in education offers significant opportunities for personalized and adaptive learning, especially in an educational framework. Artificial intelligence has become part of everyday life. AI technology can be used in learning as a personal aid, and it has also changed the way we learn, Tahiru[6].

The improvements that have occurred in personalized learning have the potential to revolutionize the way we learn and teach, making it more personal, engaging, and efficient, Harry[7]. However, despite the promise of personalized approaches to learning, educators face significant challenges in creating personalized educational content.[8] In line with this, according to Nguyen[9], the AI approach in education includes personalization for students in improving educational resources. The review of AI improvements aims to provide a personalized learning experience and improve the quality of the entire learning experience.[10]

The evaluation of AI in education emphasizes its role in delivering personalized content by taking into account adaptive curriculum design and data-driven insights.[11] Filiz et al.[12] found that AI has efficiency, interactivity, and adaptability that can provide personalized learning support and learning planning. AI can be used to adapt, customize, and personalize curricula and content according to student needs, thereby improving the overall learning experience and quality of learning Chen et al.[13]. AI can support learning and creative exploration in education to ensure effective and responsible integration.[14] There has been a significant increase in students' understanding of AI Zha et al.[15]. The assumption that AI used in education will perform as expected is not strongly supported. Despite the enthusiasm surrounding AI-based teaching and learning, its impact on education remains minimal, although some changes are evident, particularly in students' independent learning. [16] Personalized learning is also caused by students spending a lot of time in online classes since the Covid-19 virus outbreak, which has led many students to spend time on online platforms and requires them to be able to learn independently. Students often use AI as a learning aid.[17]

Educational Administration Efficiency

AI plays a role in optimizing administration. Efficiency in educational administration can reduce the administrative burden on educators so that they can focus on pedagogical activities and learning innovation. In addition, AI plays a role in administration, such as automatic assessment, academic data management, monitoring student attendance and student performance. This is in line with the results of research conducted by Harry[7], which states that AI can provide personal support to students, automate administrative tasks, and offer new opportunities for interaction. Another benefit of using AI in education is its ability to automate administrative tasks.[18]

The use of artificial intelligence in educational institutions is beneficial for administrative tasks that have been automated and other tasks that are still in the process of automation, providing more time for educators to interact with students, Tahiru[6]. According to Chen et al.[13], teachers can perform various administrative functions such as reviewing and assessing student assignments more effectively and efficiently, thereby achieving higher quality in their teaching activities. In addition, research conducted by, Ritcher et al.[19] presenting the results of AI synthesis can support academic services, institutional services, and administrative services.

Ethical and Privacy Challenges

Artificial intelligence (AI) provides many benefits in various fields, but the application of AI can lead to ethical issues, particularly related to the protection of personal data and the potential for algorithmic bias in AI systems. In line with the results of research conducted by Tahiru[6], this also shows that privacy, trust, ethics, and socioeconomic issues must be considered in the implementation of AI in education. The ethical implications of AI in education go beyond technical considerations and are related to broader social impacts, such as privacy protection and social justice Almasri[20]. AI has weaknesses related to ethical issues in the use of data to support AI.[9]

In line with Bellot[21], they say that it is related to the ethics of AI use and the potential for bias and limitations related to data privacy. Risks include dependence on AI and threats related to originality, highlighting the need for ethical guidelines such as critical evaluation training Fitzek & Alina[22]. The rapid development of AI has introduced various ethical issues, including academic dishonesty and abuse Mulaudzi & Joleen[5]. Significant challenges have emerged, including technical issues, curriculum incompatibility, privacy, and ethical issues Filliz et al.[12]. In line with this, according to Vishnumolakala et al.[23], there are potential weaknesses in AI, such as a lack of emotional intelligence, the risk of excessive dependence on technology, and privacy issues.

A review of AI shows that it has great potential for education, but the risks and limitations that may arise also need to be taken into account.

Infrastructure and Human Resource Gaps

The uneven implementation of AI is related to access to technology and digital literacy, which are obstacles in many educational institutions. Limited infrastructure and a lack of teacher competence in utilizing AI can cause a significant gap in implementation. This is in line with the opinion of Pham & Paulina[24] that there is a growing gap between the rapid development of AI and the application of technology in education, so it is necessary to address this gap in building technological leadership in preparing teachers to face the development of AI in the world of education. AI can be used to accelerate labor-intensive tasks and help close the knowledge gap Nguyen[9]. There is a significant gap in examining the broad and long-term impacts of AI use in education, a gap that highlights the urgent need for in-depth investigation.[25] The gap between technology and pedagogy is being addressed by educators using artificial intelligence (AI).[26] AI can also inspire students to enter the world of research, where AI can systematically organize, improve, and offer personalized recommendations for projects Vishnumolakala et al.[23]. However, research conducted by Dewan et al.[27] shows that integrating and engaging with generative AI is essential to encourage productive interactions between teachers and students around AI technology. Generative AI offers new possibilities in the learning process, where the role of teachers will be affected and the way students learn could potentially be disrupted Huang & Xinxin[28]. The gap can be filled by proposing an integration model that emphasizes AI Langa & Michael[29]. This gap positions AI as a factor that decentralizes the role of educators and leads to machine staff, corporations, and students.[30]

Improving Decision Making Through Learning Analytics.

Decision-making through learning analytics can be supported by AI by providing predictive data that can help educators identify student learning difficulties, contributing to more adaptive and strategic learning management. These results are in line with research conducted by Chen et al.[13] that AI has human-like intelligence with cognitive, learning, adaptive, and decision-making abilities. AI can provide better data analysis, enabling educators to make data-driven decisions Harry[7]. Along with the advancement and application of AI, it is possible to make informed decisions regarding the application and impact of AI on education in a sustainable manner Nguyen[9].

Bozkurt[31], et al, Also revealed an increase in decision-making, stating that AI is a means to improve each other's abilities in terms of goal setting, perception, action, and decision-making. This knowledge gap encourages teachers, policymakers, and education administrators to make decisions based on incomplete and limited information Almasri[20]. Based on the results of research obtained from analyzing eligible articles, according to researchers, AI is a phenomenon that has both positive and negative impacts depending on the user. Based on the researchers' observations, the widespread use of AI in education can provide new experiences for students in improving personalized learning. With the learning system changing since the outbreak of COVID-19, AI has become a great support in helping students learn. However, AI poses challenges in terms of privacy. This is evident in the fact that all user information will be stored in the AI used. AI in education can be maximized by providing guidance to students on how to use it. This can be done by explaining the limitations of its use.[32]

CONCLUSION

The study aims to determine the potential impact of AI use in education by conducting an in-depth review. AI has great potential in education to become a supporting tool in learning. The appropriate use of AI is essential for providing effective and high-quality learning. AI is a tool that offers attractive possibilities for the world of education, with many aspects of AI that can be tailored to the needs of the education sector. The potential of AI in education can improve personalized learning, where AI can help students explore the information they need for learning. In addition, AI can facilitate education administration by making it easier for administrators to complete educational tasks more quickly. There are certainly challenges in using AI, such as the lack of data security and privacy in its use.

AI may be the answer to integrating technology into education, but of course there are challenges that need to be considered in its use. AI has many chatbots that can provide recommendation systems and are understandable, but the answers provided by AI need to be revalidated. Based on this, it can be said that the accuracy of the answers provided by AI cannot be trusted 100 %. Even so, AI has advantages as a supporting tool, but it cannot replace human interaction and support in education. The use of AI in education needs to be reconsidered in line with current educational needs. Dependency and security are among the challenges in using AI in education.

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CONFLICT OF INTEREST

There is no conflict of interest.

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