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THE IMPACT OF AI TECHNOLOGY ON EARLY CHILDHOOD EDUCATION

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ABSTRAK

Pemanfaatan teknologi kecerdasan buatan (AI) dalam pendidikan anak usia dini memberikan peluang untuk menciptakan pembelajaran yang lebih kreatif, interaktif, menyenangkan, dan sesuai dengan kebutuhan anak. Namun, penerapannya juga menghadirkan berbagai tantangan, seperti berkurangnya interaksi sosial, risiko privasi data, keterbatasan kompetensi guru, akses internet, serta biaya, sehingga diperlukan pengawasan dan penerapan yang tepat oleh guru dan orang tua. Penelitian ini bertujuan untuk melihat dampak penerapan Teknologi AI dalam Pendidikan Anak Usia Dini. Peneliti mengumpulkan sumber data dari berbagai literatur yang kredibel dan relevan. Pencarian data menggunakan kata kunci dampak, teknologi AI, dan pendidikan anak usia dini. Data yang dikumpulkan oleh peneliti disaring sesuai dengan kata kunci yang telah diidentifikasi. Data dianalisis secara tematik dan disajikan dalam kesimpulan sesuai dengan kata kunci. Hasil penelitian menunjukkan dampak positif dan negatif dari penggunaan Teknologi AI. Dampak positif dari penggunaan AI tentu saja memudahkan guru dalam belajar, dan beberapa teknologi AI dapat meningkatkan kognisi dan daya kritis anak usia dini, selain memungkinkan mereka untuk melatih aspek sosial-emosional mereka. Temuan yang negatif adalah pengalaman anak usia dini mengalami pengaruh adaptif yang terus menggunakan teknologi AI, yang mengakibatkan penurunan kecerdasan fisik dan emosional. Hambatan dan tantangan yang diidentifikasi dalam penelitian ini adalah guru yang kurang kompeten dan fasilitas serta infrastruktur yang tidak memadai. Oleh karena itu, guru terus mengikuti peningkatan kompetensi mereka, yang nantinya akan mendukung perkembangan anak usia dini.

Kata Kunci: Dampak, teknologi AI, Pendidikan Anak Usia Dini

ABSTRACT

The use of artificial intelligence (AI) technology in early childhood education offers opportunities to create more creative, interactive, enjoyable, and child-centered learning. However, its implementation also presents various challenges, such as reduced social interaction, data privacy risks, limited teacher competency, internet access, and costs. Therefore, proper supervision and implementation by teachers and parents are essential.This research aims to see the impact of implementing AI Technology in Early Childhood Education. Researchers collect data sources from various credible and relevant literature. The data search used the keywords impact, AI technology, and early childhood education. The data collected by the researcher is filtered according to the identified keywords. The data were analyzed thematically and presented in conclusions according to keywords. Data were systematically collected from Scopus-indexed journals and academic repositories between February 2 and February 14, 2024, resulting in a total of 20 final sources being selected. The results of the study show the positive and negative impacts of the use of AI Technology. The positive impact of the use of AI certainly makes it easier for teachers to learn, and some AI technologies could improve early childhood cognition and critical power, in addition to enabling them to train their

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social-emotional aspects. The finding was adverse in that early childhood experiences adaptive influences that continue to use AI technology, resulting in decreased physical and emotional intelligence. The obstacles and challenges that were identified in this study were incompetent teachers and inadequate facilities and infrastructure. For this reason, teachers continued to follow the improvement of their competencies, which would later support early childhood development.
Keywords: Impact, AI Technology, Early Childhood Education

INTRODUCTION

The presence of artificial intelligence (AI) technology provides opportunities for innovation in the world of early childhood education. AI technology provides new spaces for teachers to engage in creative, innovative, and fun learning. Notably, AI enables teachers to tailor learning materials to the specific needs of each young child. Interactive AI technology keeps young children interested and motivated to learn. Furthermore, children are likely to appreciate the dynamic learning media provided by AI technology. Mobile learning will increase the engagement and learning outcomes of early childhood (Lee-Cultura dkk., 2022).

The use of AI technology certainly offers numerous benefits for early childhood education. However, behind the use of AI technology, AI technology also has negative impacts that need to be considered. One concern involves behavioral changes resulting from AI usage when there is a lack of supervision by teachers and families. AI technology can reduce the amount of human interaction in educational settings, which is crucial for the social and emotional development of early childhood (Cardin & Wolowski, 2021; Rizvi, 2023). Adaptive behavior can impact early childhood. This includes a lack of social interaction with peers, and physical and mental disorders in children (Shehu, 2019). On the other hand, one of the risks of using AI is that the privacy of early childhood data becomes open and uncontrolled. Therefore, the use of AI technology must be balanced with strict supervision by parents and teachers.

In addition to the impacts arising from the use of AI technology in early childhood education, the limited integration of AI technology into the education curriculum is also a major challenge. Many teachers have yet to integrate AI into their teaching materials. Furthermore, they lack the competency to effectively use this technology in their learning. Another factor influencing the adoption of AI technology is the lack of equitable internet access required for AI-based learning. Of course, significant funding is required for the integration of AI-based learning. Although a number of studies have discussed the benefits and risks of using AI in education, previous studies tended to address these aspects separately. The lack of comprehensive integration of discussions on the positive and negative impacts, obstacles, and challenges of using AI in the context of early childhood education indicates a research gap that needs further study.

This gap highlights the importance of research that systematically maps and synthesizes findings on the use of AI in early childhood education, both in terms of benefits and risks, as well as barriers and challenges to its implementation. A comprehensive study is needed to provide a more complete picture of the opportunities and consequences of AI use, as well as to provide a basis for teachers, parents, and policymakers in developing appropriate, safe, and developmentally appropriate uses of AI for early childhood. Therefore, this study aims to identify and analyze the positive and negative impacts of using AI technology, as well as to map the obstacles and challenges in its application in early childhood education based on the results of previous research.

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RESEARCH METHODS

This research is a literature study. Literature studies collect relevant information about the research theme (Siregar & Fahmi, 2022). Information was gathered systematically Scopus-indexed journals, and academic repositories between February 02 and February 14, 2024. Data collection was executed using specific keywords: implementation, AI technology, impact, and early childhood education. The inclusion criteria required literature published in English, within the last 6 years (2019–2024), and focusing directly on AI implementation in early childhood education.

After screening titles, abstracts, and full texts, 101 items were excluded due to irrelevance to early childhood contexts, duplicate records, or not meeting language/time criteria. Ultimately, 20 final sources were selected for thematic analysis. The collected data was processed through data editing, thematic grouping, in-depth interpretation, and drawing conclusions (Mukmin & Nuraini, 2024). Table 1 below presents the literatura article distribution.

Table 1. Literature Article Distribution

Year	Positive Impact of AI	Negative Impact of AI	Teacher Obstacles & Challenges	Count
2019	1	-	-	1
2022	2	1	1	4
2023	1	5	3	9
2024	2	-	4	6
Total	6	6	8	20

RESULT AND DISCUSSION

Result

1. The Positive Impact of the Use of AI Technology in Early Childhood

AI technology in early childhood education could provide a more personalized and given learning experience. Interest in using AI was due to the fact that AI technology could analyze the needs of early childhood and create interactive materials or media according to early childhood needs (Lee dkk., 2024). With interactive learning, early childhood was encouraged to learn in a new and fun way. AI technology can create games and educational activities that can explore early childhood curiosity to make the learning process fun and stimulate the development of early childhood cognitive and social skills (Teresa dkk., 2023)

Early childhood cognitive skills could be built through AI and developed through storytelling activities, virtual experiments and collaborative projects. These activities could build early childhood creativity and critical power (Kuchkarova dkk., 2024). For example, interactive storytelling uses AI technology to provide space for deep and engaging interactions in early childhood. This AI technology allows children to explore narratives more interactively, fostering imagination and analytical reasoning. An app that supports early childhood interaction in interactive storytelling is storybuddy.xyz/home, which allows teachers and children to create related questions and form a story (Zhang dkk., 2022). In addition to interactive stories, AI-based virtual experiments can present *educational games* that use movement or sound. This AI technology can increase early childhood interest in learning in the classroom (Tian & Cui, 2022) One is https://quivervision.com/, which can move early childhood works to life after being given colour.

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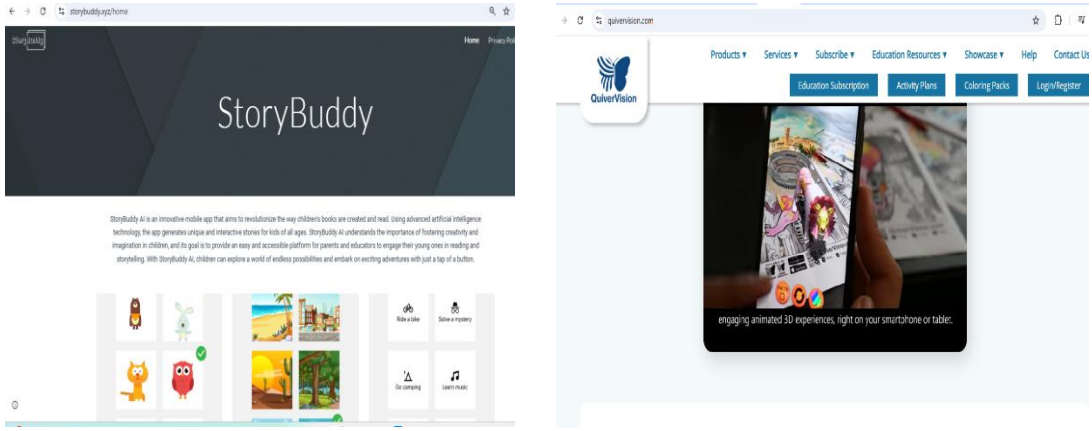

Figure 1. AI Technology Applications That Can Help Children In Development Cognitive

In addition to the cognitive aspect, AI technology could develop early childhood social-emotional. The AI technology that could be used is Social Emotional Artificial Intelligence (SEAI). SEAI has shown the potential to promote empathic skills among children, which is essential for social cooperation and ethical behaviour. One of the SEAI applications that can support early childhood social-emotional development is https://buddy.ai/. Buddy AI is an app that uses a chatbot that allows early children to interact. The working system of AI with a social chatbox analyses early childhood speech and behaviour and provides appropriate feedback according to the needs of the children. This response encouraged children to interact and express their feelings through the application (Tsai dkk., 2019)

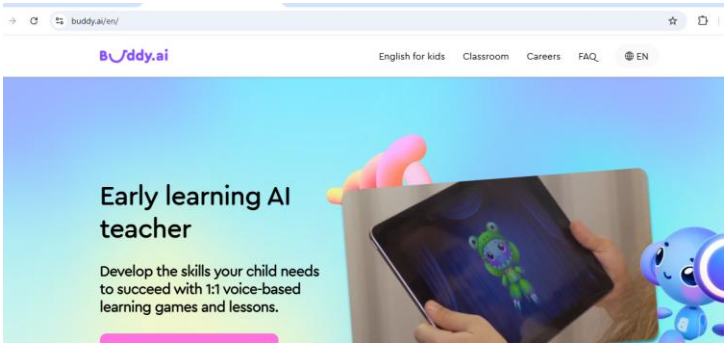

Figure 2. AI Buddy.ai technology can develop early childhood social-emotional

2. The Negative Impact of AI Technology on Early Childhood

Children who often use AI technology could become dependent on early childhood. Because of its appearance and convenience, AI technology can make children more dependent on AI. The dependence on the use of AI is shown by early childhood using AI technology for a long time, especially those that are Virtual Real or VR on their respective gadgets. Early childhood who spend more time using gadgets show a tendency to alienation and behavioural deviations, allowing for more time using gadgets (Joseph dkk., 2022). Murimi (2023) added that AI-powered technology can make children more interested and allow them to use AI technology for longer. AI technology will impact increasing additive behaviour caused by excessive use.

Adaptive behaviours that negatively impact include attention problems, sleep disturbances, and behavioural problems such as aggression and irritability (Suleman dkk., 2023) In addition, exposure to the use of AI media in early childhood will impact early

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childhood cognitive and emotional aspects. Children who use digital media to access AI technology tend to experience high depression and reduced emotional intelligence, which has an impact on their lack of ability to interact socially in the real world (Rega dkk., 2023). Franze et al. (2023) added that early childhood children who use AI technology will prefer to interact with AI rather than their peers, impacting their social skills and emotional intelligence. AI technology certainly impacts the difficulty of becoming a direct interaction.

Not only from the cognitive-social-emotional aspect, excessive use of AI will trigger physical disorders in children. Children who often use AI technology tend to be too lazy to do physical activities. Except there is AI technology that allows activities using the physical. One of the concerns about using AI technology is open privacy in early childhood. Early childhood tends to be unaware of the use of AI and that AI technology can indirectly store sounds, locations, and habits. Irresponsible people can misuse the data. Crescenzi-Lanna (2023) added that AI technology can collect and store large amounts of data, including voice recordings, location data, and usage patterns, which can be used to integrate learning experiences but also pose privacy risks.

3. Obstacles and Challenges for Teachers Using AI Technology for Early Childhood Education

The use of AI technology has become rapid after the launch of ChatGPT Zero on November 20, 2022 integration in the world of education since the beginning of 2023 (Putri Rosmalia, 2023). However, with the various conveniences offered by AI technology, early childhood education teachers face obstacles and challenges, including the lack of integration of AI technology in schools' early childhood education curriculum. AI has not been integrated into the curriculum; teachers have not yet had demands for using AI in early childhood Education.

Limited demands are a big challenge for PAUD teachers when using AI technology in the classroom. One of the challenges is that many teachers only partially understand AI and its potential applications in education. This limited knowledge can hinder their ability to integrate AI devices into their teaching practices effectively. Ahmed et al. (2024) added that the lack of familiarity and technical difficulties in using AI in the classroom is a big challenge for teachers.

In addition to teachers still not used to AI technology, facilities and infrastructure are also limited. Inadequate infrastructure and Internet access hinder AI technology applications in early childhood education. Internet access is a means that strongly supports the implementation of the optimal use of AI technology (Chamami dkk., 2024). One of the factors that affect infrastructure limitations, according to Wang (2023), is financing for the implementation of very high internet infrastructure and maintenance and sustainable renewability. This makes internet access uneven for the use of AI technology. To face the obstacles and challenges above, developing the competencies of early childhood education teachers using AI technology is important. The development of the competencies of early childhood education teachers is expected to provide new skills for teachers. These skills are expected to enable teachers to find and use AI technology in learning (Wu, 2024). In addition to developing early childhood education teachers' competencies, it is also necessary to improve supporting facilities and infrastructure. Supporting facilities and infrastructure are internet provision in early childhood schools and smart TVs. Internet access is essential for effectively applying AI technology in early childhood education environments to integrate seamless AI technology into learning (Jiang, 2022). Smart TVs can also support using AI-based educational applications that require visual and interactive interfaces (Alomyan, 2024; Zhao, 2023). Of course, the internet and smart

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TV will require significant financing, so schools must find funding or partnerships to manage the high costs associated with AI implementation.

Discussion

The development of Artificial Intelligence (AI) technology has brought about significant changes in the world of education, including early childhood education (PAUD). AI is beginning to be used as an interactive learning medium that can help children learn through images, sounds, educational games, and learning systems tailored to their needs. The use of AI in PAUD is considered capable of creating a more engaging and enjoyable learning environment, thereby making children more active in the learning process. Furthermore, AI also helps teachers deliver material more creatively and innovatively (Noviyanti dkk., 2023) (Nurnaningsih & Salehudin, 2025)

The application of AI in early childhood education has various positive impacts on children's learning development. AI technology can enhance children's critical thinking skills, creativity, and curiosity through interactive learning media. AI-based learning systems can also provide personalized learning experiences tailored to each child's abilities and needs. Research shows that the use of AI can increase student engagement and facilitate children's understanding of learning materials through engaging visualizations and animations (Supratiwi, 2025) (Prayitno dkk., 2026).

In addition to impacting students, AI technology also benefits early childhood education (PAUD) teachers. AI can assist teachers in compiling learning materials, creating interactive media, conducting evaluations, and developing creative ideas for learning activities. The presence of AI makes teachers' administrative work more efficient, allowing them to focus more on supporting children. Several studies have also shown that the use of AI can increase teacher productivity in creating innovative learning in the classroom. (Supratiwi, 2025)

However, the use of AI in early childhood education also has negative impacts that need to be considered. Excessive use of technology can lead to children becoming dependent on gadgets and reduce direct social interaction with peers and teachers. Furthermore, young children still need guidance in using technology to prevent them from accessing content that is inappropriate for their age. Several studies have also shown that teachers' limited skills in operating AI and a lack of technological facilities are obstacles to implementing AI in schools (Lameras & Arnab, 2021).

Based on these various studies, it can be concluded that AI technology has both positive and negative impacts on early childhood education. AI can be an effective, interactive, and innovative learning tool when used wisely and according to children's needs. However, the use of AI still requires supervision from teachers and parents to ensure children's social, emotional, and character development is maintained. Therefore, striking a balance between technology use and direct interaction is crucial in implementing AI in early childhood education in today's digital era.

CONCLUSION

The conclusion from the results of this study shows the positive and negative impacts of the use of AI technology. The positive impact of using AI is of course that it makes it easier for teachers to learn, and some AI technologies can improve the cognition and critical thinking of early childhood, in addition to enabling them to train their social-emotional aspects. A negative finding is that early childhood experiences adaptive influences from continuing to use AI technology, which results in a decline in physical and emotional intelligence. The obstacles

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and challenges identified in this study were less competent teachers and inadequate facilities and infrastructure. Therefore, teachers continue to monitor their competency development, which will ultimately support the development of early childhood.

Suggestions that can be given based on research results, the use of AI technology in early childhood education needs to be done wisely, directed, and still under the supervision of teachers and parents. Teachers are advised to improve their competence in utilizing AI technology through continuous training and professional development so that AI can be used as a learning support medium, not as a substitute for direct interaction between teachers and children. AI usage must also be tailored to the characteristics and developmental stages of children, particularly by balancing cognitive and socio-emotional stimulation with physical activity to minimize the negative effects of excessive technology use. In addition, educational institutions and policymakers need to increase the availability of supporting facilities and infrastructure, including adequate access to technology, so that AI implementation can take place effectively and equitably. Further research is recommended to examine in more depth the long-term impacts of AI use on the cognitive, social-emotional, and physical development of early childhood and to develop guidelines for AI use that are appropriate to the needs and characteristics of early childhood education.

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