

The Use of Artificial Intelligence Technology in Learning for Children with Special Needs

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ABSTRACT

In the era of the industrial revolution 4.0 and rapid development towards the era of society 5.0, the use of digital technology has become an important aspect in various fields of life, including in the world of education. This study aims to analyze the Utilization of Artificial Intelligence Technology in Learning for Children with Special Needs. The research method used is a literature review. The results of the study show that the use of Artificial Intelligence (AI) technology in learning for children with special needs has a significant positive impact, especially in creating a more personal, adaptive, and interactive learning approach according to the needs of each student. AI is able to help teachers analyze students' abilities and learning progress in real-time, as well as provide learning materials and methods that are tailored to each child's learning style. In addition, this technology can also increase students' motivation and independence in learning through the use of AI-based applications or devices that are user-friendly and easy to access. Thus, the application of AI is an innovative solution in creating an inclusive and effective learning environment for children with special needs.

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1. INTRODUCTION

In the era of the industrial revolution 4.0 and rapid development towards the era of society 5.0, the use of digital technology has become an important aspect in various fields of life, including in the world of education. One of the most prominent technological innovations in recent years is Artificial Intelligence (AI) (Nursalim, Judijanto, & Asfahani, 2022). This technology has the ability to imitate human thinking and behavior through systems designed to solve problems, learn from experience, and adapt automatically. The use of AI has reached many aspects of the learning process, including inclusive education for children with special needs. Children with special needs (ABK) are individuals who have special characteristics physically, intellectually, socially, emotionally, or a combination of all, which causes them to need a different and more personal educational approach (Qu, 2022). Therefore, the

presence of AI technology offers great potential to provide more adaptive, personal, and effective learning for ABK, so that they can achieve their maximum potential (Rumere, Sugiyanto, & Sulistyaningrum, 2022). Education for children with special needs has faced various challenges, such as limited specially trained educators, lack of facilities and infrastructure that support individual learning, and teaching methods that have not been able to optimally address the diversity of student needs. AI can be a solution to some of these problems through its adaptive ability to facilitate personalized learning (Specialists, Nurses, West, & Care, 2019). This technology is able to analyze learning styles, levels of understanding, and even student emotions, then present the most appropriate learning materials or approaches in real time. For example, AI-based applications can help children with autism spectrum disorders build social skills through interactive conversation simulations or visualizations of social situations. Blind children can be assisted with AI-based tools that convert text to voice or even guide movement in the school environment. Even children with learning disabilities such as dyslexia can be assisted with software that can read text and provide adjustments in the delivery of material (Judijanto, Asfahani, & Krisnawati, 2022). The application of AI technology in inclusive education also allows teachers to focus more on social and emotional interactions with students because some administrative and assessment tasks can be done automatically by the system. Teachers can also monitor student development more accurately through data generated by the AI system that analyzes student learning progress and obstacles (Al-Najjar, Jawad, & Saber, 2018). This certainly supports a data-based learning process, where every educational decision is made based on objective and accurate information. The use of AI is not intended to replace the role of teachers, but rather to strengthen the effectiveness of their role in creating a friendly, supportive, and responsive learning environment to the needs of each child (Sahabuddin, Liskawati, & Syamsiah, 2023).

The implementation of AI technology in the education of children with special needs is not without challenges. Among them are the limitations of technological infrastructure in schools, especially in remote areas, the lack of digital literacy of educators, and issues of ethics and privacy of student data. In addition, not all AI technologies on the market are designed inclusively and in accordance with local needs. Therefore, collaboration between the government, technology developers, academics, and education practitioners is the main key so that AI technology can truly be used optimally and on target in supporting education for children with special needs (Nurahma, Prasetyo, & Hasnin, 2024).

With all its potential and challenges, the use of AI technology in learning for children with special needs is a strategic step towards a more equitable, inclusive, and meaningful education. This technology must be positioned as a tool to strengthen the process of humanizing education, not as a substitute for social relations between teachers and students. Therefore, an in-depth study of the benefits, challenges, and best practices in implementing AI for the education of children with special needs is very important to be carried out, to ensure that every child - regardless of their condition - gets a decent and quality learning opportunity (Rahmanti, Ningrum, Riansyah, Pradnyana, & Rahma, 2024).

This study aims to analyze the Utilization of Artificial Intelligence Technology in Learning for Children with Special Needs. This technology can also increase students' motivation and independence in learning through the use of AI-based applications or devices that are user-friendly and easy to access. Thus, it is hoped that with this article, the application of AI will become an innovative solution in creating an inclusive and effective learning environment for children with special needs.

2. METHODS

This study uses a literature review approach or library study with a qualitative descriptive method, which aims to analyze and synthesize various relevant scientific literature regarding the use of Artificial Intelligence (AI) technology in learning for children with special needs. Data collection techniques are carried out through systematic searches of secondary sources such as scientific journals, academic books, proceedings, research reports, and official documents from credible institutions obtained through databases such as Google Scholar, ScienceDirect, SpringerLink, and PubMed, with inclusion criteria in the form of publications discussing the topic of using AI in education for children with special needs, published in the last 10 years, and relevant to the context of inclusive education. The data obtained were

analyzed using content analysis techniques, namely by classifying, reviewing, and synthesizing information from various sources to identify main themes such as the benefits of AI, types of technology used, impacts on students and teachers, implementation challenges, and development recommendations. The results of the analysis are presented narratively to provide an in-depth and comprehensive understanding of the issues being studied (Faradeila et al., 2024).

3. FINDINGS AND DISCUSSION

3.1. *The Role of Artificial Intelligence for Children with Special Needs*

Artificial Intelligence (AI) technology has brought significant transformations in the world of education, including in supporting the learning of children with special needs (ABK) who have faced various obstacles in their learning process. Children with special needs need a teaching approach that is more personal, flexible, and in accordance with their individual characteristics, considering that they have differences in cognitive, social, emotional, and physical aspects. In this context, the role of AI is very strategic because of its ability to present adaptive and responsive learning to the needs of each student. AI technology is able to facilitate the automatic preparation of teaching materials based on students' learning styles, analyze the speed of understanding, and respond to students' emotional reactions in the learning process. For example, in children with autism spectrum disorders, AI can be used in the form of social simulation applications that train communication and social interaction skills gradually and repeatedly, which have proven effective in improving children's social adaptation abilities. Applications such as Replika or CompanionBot which are AI-based have been adapted for autism needs by providing safe and controlled conversation scenarios (Mayasari, Dewantara, & Yuanti, 2023).

In addition, AI also provides support for students with sensory disabilities. Blind children, for example, can be helped by text-to-speech technology that converts written material into sound, or by using AI-based smart glasses that can identify objects around them and read the writing directly. On the other hand, children with dyslexia or reading disabilities benefit from AI software that can recognize reading errors, correct pronunciation, and repeat material at a rhythm that suits the student's abilities. Software such as Ghotit Real Writer and Kurzweil 3000 that are powered by AI have been shown to help improve the confidence and learning outcomes of students with learning difficulties. The advantages of AI technology are also evident in its ability to record and analyze student learning patterns in real time, so that teachers or assistants can obtain accurate data on student learning progress, areas that are still difficult to understand, and the most appropriate intervention strategies. This makes it easier for teachers to conduct regular assessments without having to always make time-consuming manual observations. AI in the education of children with special needs also plays a role as an interesting and not boring learning medium. Many learning applications are designed with interactive visual displays and audio visuals that stimulate student cognition (Faisal & Kisman, 2020). Children with concentration disorders, such as ADHD, are more easily attracted and focused on learning through applications that present material in the form of AI-based educational games, because they can provide challenges and direct feedback. AI is not only able to increase learning motivation, but also strengthen students' independence in accessing and repeating material according to their respective learning speeds. This supports the principle of inclusive education that places students as active subjects in the learning process. Technologies such as Machine Learning allow AI systems to learn the unique patterns of each student, and adjust teaching approaches based on previous learning outcomes. Thus, the learning experience becomes more personal and meaningful for students with special needs (Ulfah, 2024).

In addition to the direct benefits to students, AI technology also helps teachers in designing and managing learning. AI can be used to create structured learning plans, recommend learning strategies that are appropriate to student profiles, and even help evaluate learning outcomes with a high level of accuracy. Teachers no longer only act as conveyors of information, but more as facilitators who accompany students' learning processes. With the help of AI, teachers' time that is usually spent on

administrative tasks can be diverted to building stronger interpersonal relationships with students. Collaboration between technology and educators is the key to the success of AI integration in education, especially in supporting the individual needs of children with special needs that have not been met in conventional learning systems. Therefore, the use of AI in the education of children with special needs not only improves the quality of learning, but also strengthens inclusivity, equal access, and empowerment of students in achieving their best potential (Khosibah, Rahmaningrum, & Kusumawardani, 2025).

3.2. Challenges of Implementing Artificial Intelligence Technology in Inclusive Education

Although Artificial Intelligence (AI) offers tremendous potential in improving the quality of education for children with special needs (ABK), its application in an inclusive education environment is not free from various complex challenges, both technically, socially, economically, and ethically. One of the main challenges is the limited technological infrastructure in schools, especially in areas that are still digitally lagging behind. Many schools do not yet have adequate hardware and software to support AI-based learning systems. In addition, unstable internet connectivity and high operational costs are major obstacles to optimally integrating technology into the ABK learning process. This results in a digital divide that widens the gap between schools that are able to access advanced technology and those that are not, making it difficult to achieve the goals of inclusive education (Khosibah et al., 2025). The next challenge lies in the low digital literacy of educators. Teachers as the main actors in the learning process often do not have adequate knowledge and skills in using and managing AI technology. Although some teachers are accustomed to using basic digital devices, the use of AI requires a more complex understanding, such as how adaptive systems work, the use of machine learning algorithms, and AI-based data evaluation. Lack of training and technical assistance makes teachers reluctant or have difficulty integrating AI into teaching and learning activities. In fact, the success of AI implementation is highly dependent on the ability of teachers to utilize the technology as an aid, not as a replacement for their role.

In addition, the economic aspect is also a significant challenge. Procuring AI-based technological devices, such as speech recognition software, visual aids, or educational robots, requires a lot of money. Not all schools or educational institutions have sufficient budgets to access and maintain this technology. Moreover, expenses are not only limited to purchasing devices, but also include the cost of teacher training, device maintenance, and periodic system updates to stay relevant to the latest technological developments. As a result, many schools have to rely on government assistance or private partners, which in reality cannot always be relied on sustainably (Yohakim & Jufriansah, n.d.).

Ethical challenges are also a major concern in the implementation of AI, especially related to the protection of personal data of students with special needs. AI works by collecting, storing, and analyzing individual data to adjust effective learning approaches. However, in the context of special needs, the data collected often includes sensitive information such as medical history, psychological conditions, and certain levels of intelligence. If not managed carefully, misuse of this data can lead to discrimination, labeling, or privacy violations that endanger children's rights. In addition, AI algorithms are not completely free from bias, because the training data used may reflect certain preferences or tendencies that are not inclusive. For example, a speech recognition system may not be accurate when used by children with speech disorders, or a visual learning application may not be optimal for children with visual impairments (Pratama & Husadani, 2025). The availability of truly inclusive AI technology is also still very limited. Many AI-based learning platforms are developed with the assumption that all students have the same basic abilities in reading, writing, or understanding verbal instructions. In fact, children with special needs have a variety of characteristics and very specific needs, so they require a system that can be adapted very flexibly. The lack of involvement of special education experts in the technology design process results in many applications that do not match real needs in the field (Nurmala, Reza, Hutagalung, Pattiasina, & Malintang, 2024). In addition, technology

developers often focus more on technical aspects than on a humanistic and empathetic pedagogical approach.

The challenges of implementing AI in inclusive education are also related to school culture and social acceptance of the use of technology. There are still many teachers, parents, and even education stakeholders who view AI as something foreign, complicated, or even threatening to the existence of humans as educators. Concerns that AI will replace the role of teachers or reduce social interaction between students and educators are often psychological barriers that slow down the adoption of this technology (Raparthi, Dodda, & Maruthi, 2020). On the other hand, a misconception about AI can also lead to excessive expectations, so that when implementation does not go smoothly, this technology is considered a failure (Anwar, 2024).

In the Indonesian context, these challenges require a holistic and collaborative approach. The government needs to play an active role in providing regulations, budgets, and training that support the ethical and effective implementation of AI (Prabowo, Supriyono, Noor, & Muluk, 2021). Educational institutions must build a culture of innovation and digital readiness through ongoing training programs for teachers and support staff. Technology developers must also involve special education practitioners from the beginning of the design process so that the resulting products are truly in accordance with the needs of children with special needs. By addressing these challenges systematically, the implementation of AI in the education of children with special needs is not only possible, but also has the potential to be an instrument of major transformation towards a more equitable, inclusive, and humane education.

3.3. Development Strategy and Recommendations for the Implementation of AI

The application of Artificial Intelligence (AI) technology in learning for children with special needs (ABK) brings new hope to the world of inclusive education. However, to realize the great potential of AI, a mature and sustainable development strategy is needed. One of the main steps is to improve teacher competence through intensive training and mentoring. Most teachers in inclusive schools do not yet have the technical skills to operate AI-based devices or applications, so they tend to avoid using them. Therefore, training programs must be designed to not only introduce the functions and benefits of AI in education, but also equip teachers with practical skills to use the technology in real contexts. This training can include the use of AI-based learning applications, student data analysis through artificial intelligence systems, and the application of adaptive learning strategies. In addition, training needs to be tailored to the different characteristics of ABK, so that teachers are able to translate technology into appropriate pedagogical approaches (Fitriani, Zakir, Gusli, & Lestari, 2024).

In addition to teacher training, the development of an inclusive technology-based curriculum is also an important strategy. The curriculum must not only be flexible and adaptive to the needs of individual students, but must also integrate the use of technology as part of the teaching and learning process. This kind of curriculum allows students to learn according to their own pace and learning style, assisted by AI technology that can adjust the material in real-time. For example, a curriculum for students with learning disabilities can accommodate the use of applications that visualize abstract concepts to be more concrete and easy to understand. This inclusive and technology-based curriculum must also be accompanied by relevant assessment indicators, namely indicators that consider aspects of student development comprehensively, not only cognitive aspects, but also social and emotional. In the context of system development, collaboration between schools, technology developers, and the government is essential. Schools as educational institutions can be laboratories for best practices in the application of AI technology, while technology developers have the capacity to create systems that suit the needs of inclusive education (Di Vaio, Palladino, Hassan, & Escobar, 2020). The government, in this case the Ministry of Education and related agencies, plays a role in creating regulations, providing incentives, and facilitating cross-sector cooperation. This collaboration can be realized through a pilot project that integrates AI in the teaching and learning process in inclusive schools, then measures its impact systematically. From this program, empirical data and findings can be the basis for developing

national-scale policies that are based on evidence (evidence-based policy). In addition, the involvement of universities and research institutions is also important in evaluating the effectiveness of AI implementation and providing input for further development (Hikmawati, Sufiyanto, & Jamilah, 2023).

Another strategy that is no less important is strengthening data protection policies and the ethics of using AI in the context of education. Children with special needs are vulnerable groups whose rights and privacy must be strictly protected. Therefore, the AI system used must meet the principles of data security, algorithm transparency, and fairness in access (Sain, Asfahani, & Krisnawati, 2022). The government needs to establish technical and ethical standards that govern the collection, storage, and use of student data, and oversee the implementation of these principles by developers and technology service providers. The ethics of using AI also include the importance of maintaining the role of teachers as primary educators who establish human relationships with students, not just technology operators. AI should be seen as a tool that strengthens a humanistic learning approach, not replacing essential social interactions in the education process (Zhang & Aslan, 2021).

Another strategic recommendation is to encourage the development of local technology that is appropriate to the cultural context and needs of Indonesian children. Many AI-based applications are currently designed in a global context without considering the language, local values, or specific needs of students in Indonesia (Raparathi et al., 2020). Therefore, it is important to encourage local innovators and educational technology (edutech) startups to develop AI-based solutions that are contextual, easy for teachers to use, and can be integrated into the national education system. In this case, support from research institutions and technology incubators is needed so that product development is not only innovative, but also relevant and has a direct impact on the quality of education (Rahmanti et al., 2024).

With these strategies, the use of AI in the education of children with special needs can be carried out in a focused, ethical, and inclusive manner. Each strategy requires synergy between stakeholders, both at the policy, practice, and technology levels. Only with multi-sector collaboration can AI be truly utilized as an instrument of educational transformation that opens up equal and meaningful learning opportunities for all children, including those who have faced obstacles in the conventional education system. AI is not just about advanced technology, but about creating fairness and empathy in an increasingly digital world of education.

4. CONCLUSION

The use of Artificial Intelligence (AI) technology in learning for children with special needs has a significant positive impact, especially in creating a more personal, adaptive, and interactive learning approach according to the needs of individual students. AI is able to help teachers analyze students' abilities and learning progress in real-time, as well as provide learning materials and methods that are tailored to each child's learning style. In addition, this technology can also increase student learning motivation and independence through the use of AI-based applications or devices that are user-friendly and easy to access. Thus, the application of AI is an innovative solution in creating an inclusive and effective learning environment for children with special needs.

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