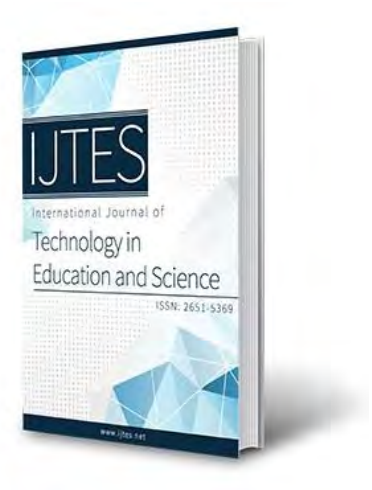

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To cite this article:

Alkan, A. (2024). The role of artificial intelligence in the education of students with special needs. *International Journal of Technology in Education and Science (IJTES), 8*(4), 542-557. https://doi.org/10.46328/ijtes.569

IJTES International Journal of Technology in Education and Science
2024, Vol. 8, No. 4, 542-557 https://doi.org/10.46328/ijtes.569

The Role of Artificial Intelligence in the Education of Students with Special Needs

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Article Info

Article History

Received:
21 April 2024
Accepted:
11 September 2024

Keywords

Artificial intelligence
Special needs
Ethics

Abstract

Artificial intelligence (AI) based education represents a significant transformation in the field of education of our age. Artificial intelligence (AI) technology has great potential to enrich the learning experience of special needs students, provide support to teachers, and reduce inequalities in education. Artificial intelligence (AI) technologies can be used to more effectively understand the learning needs of special needs students and provide customized learning experiences for them. Expert systems, adaptive tutorial systems, dialogue-based systems, learning analytics and educational data mining are widely used AI systems developed to increase productivity in educational environments, facilitate achievement of learning goals, provide instant feedback and enrich student interaction. Assessing the learning inclinations, strengths, and weaknesses of students with special needs enables AI to provide tailored learning content and resources that cater to their individual requirements effectively. In this article, tried to present a road map to teachers and researchers by examining the role of AI-based technologies in the education of special needs students, the AI-based technologies that can be used, and the issues to be considered when choosing these technologies.

Introduction

Today, as in every field affected by technology, it has become a necessity for education to keep up with this progress. Thanks to technological advances, access to education has become easier and its inclusiveness has increased. Technological tools offer students the chance to develop their creative thinking and innovation abilities. It also provides personalized learning options to guide students' learning processes more effectively, thus enabling students to learn in a way that better suits their learning pace, preferences, and needs.With the rapid development of technology in the 21st century, the use of technology in the education of individuals has become inevitable (Öztop & Özerbaş, 2019; Talan, 2021). The presence of students with various learning abilities in educational institutions is the result of individual differences. Some student groups may need special education. Ataman (2011) defined special education as an education offered to children with special needs that differ from general learning needs. According to this definition, special education is an educational process that helps students reach their highest capacities in accordance with their abilities and provides skills that enable them to overcome obstacles and integrate into society. The definition of special education emphasizes the importance of education to develop individuals into independent, productive participants.

One of the groups that need special education is special needs students. The identification of special needs students is a preventative model that creates educational plans for special needs learners, providing a positive atmosphere in the classroom and eliminating negative situations. The preventive model, which is a classroom management approach that teachers can use, involves taking precautions by detecting possible indiscipline and negative behavior of students in advance. Special education interventions require detailed planning of educational activities, preparation in advance and having a vision (Yaka et al., 2006).In the study conducted by Ataman (2004), it was emphasized that special needs children should not be left to their own fate. In addition, it was stated that different approaches were adopted in the education of special needs students, and it was stated that these approaches could generally be divided into categories such as acceleration, grouping and enrichment.

Special needs learners need to be provided with an environment that plays an important role in the development of their potential and is compatible with their educational needs. The rapid development of technology helps solve difficulties in education and provides people with new learning opportunities. Effectively utilizing technology in education is an extremely critical step for a more inclusive and equitable future of education (Arhipova and Sergeeva, 2015). The use of technological tools and equipment offers new options to address various problems in education and gives students the chance to create different learning environments. If these students realize their full potential, they can contribute significantly to the development of society and humanity. The use of appropriate technological tools and equipment in educational environments is important in terms of supporting learning. In this way, more sensory organs are involved in the learning process, abstract concepts become concrete, and active learning is achieved by increasing the student's participation in activities (Çilenti, 1979; Yalın, 2009). Artificial intelligence (AI), one of the current technologies that can be used in the education of special needs students, can support special needs students in various ways to reveal and develop their potential.

Artificial Intelligence (AI) possesses the power to play important roles in the educational processes of special needs students. These roles include understanding learning needs and providing personalized educational materials, ensuring early diagnosis and intervention of special abilities, and optimizing the difficulty level by adapting learning materials to individuals' abilities. It can also provide benefits for mentoring to develop creative problem-solving skills, encouraging collaboration and communication by bringing together individuals with similar interests, and customized mentoring services for career development. In this way, AI can help special needs students to fully realize and contribute to their potential. While increasing the contribution of AI to the education of special needs students, it is also necessary to take into account the ethical problems that may arise and take the necessary precautions. This study aims to examine the role of AI technologies in the education of special needs students and the advantages of AI-based technological tools that can be used. The article aims to develop a more conscious approach by focusing on how AI-based educational tools can affect the learning experience of special needs students and what issues should be taken into consideration when using these technologies in the education of special needs students.

History and Role of Artificial Intelligence in Education

Artificial Intelligence (AI) can be defined as the use by machines of the characteristics of human intelligence,

namely the ability to think logically and predict the future. The goal of AI development is to employ it in domains necessitating human-like cognitive capabilities and in intricate endeavors aimed at lightening the load on individuals (Xue and Wang, 2022). The imitation of human thinking by AI processes aids in solving complex problems and adapting to changing conditions (Obschonka and Audretsch, 2020; Özsosyal, 2003).

AI is a technology that has been used for a long time historically. The first "teaching machines" served to facilitate learning by providing individual guidance to students and providing immediate feedback. However, these machines were not capable of adaptation. In the 1950s, teaching machines led to the development of adaptive teaching machines, described as the Self-Adaptive Keyboard Instructor (SAKI), which adapts to the student's performance and organizes tasks accordingly. Different versions of SAKI led to the development of Computer-Aided Instruction (CAI) systems throughout the 1960s and 1970s. However, due to cost and availability barriers, CAI systems have not been widely accepted. In 1970, artificial intelligence was first integrated into CAI in a doctoral thesis; this was called Intelligent Tutoring Systems (ITS). Computer-Aided Instruction (CAI) systems development was a significant turning point. One of the oldest Dialogue Based Tutoring Systems (DBTS) was developed in the 1980s for medical education. This system used one-on-one didactic dialogues to provide first-year medical students with information on cardiovascular physiology and was named CIRCSIM. This was designed to help students learn about regulating blood pressure. The more recent history of AI in education includes the concept of Exploratory Learning Environments (ELE). Exploratory Learning Environments (ELE) enables students to actively create their own knowledge by exploring and managing in the learning environment. Learning Apps and chatbots provide students with instructional materials and activities to support individualized and self-paced learning (Holmes et al., 2019; Randhawa & Jackson, 2020; Tonbuloğlu,2023).

In education, which has gained momentum since the 1990s, AI has been used to better understand students' individual learning needs and provide customized learning experiences. Artificial Intelligence-based learning management systems have been developed to monitor student performance, improve learning processes, and provide personalized feedback to students. Additionally, tools such as AI-enabled teaching materials, virtual classrooms, and learning aids are used to increase students' interactions and enrich their learning experiences. These technological advances have enabled the adoption of a more effective and efficient approach to education.

Pushing the limits of traditional education models, AI makes learning processes more personalized and effective, providing students with individual learning opportunities not only in terms of materials but also in addressing students' emotional states (Luckin et al., 2016). Artificial Intelligence has an important role in the future of education, and education systems need to adapt to this change to take full advantage of this potential. Various forms of artificial intelligence (AI) systems find application across diverse educational contexts. With AI presenting a broad spectrum of possibilities in education, research on its impact within this realm has seen a notable uptick (Chen et al., 2020). For instance, natural language processing mechanisms can enhance language instruction, while intelligent tutoring systems cater to individualized learning needs, particularly in special education settings. Furthermore, educational data mining techniques facilitate performance prognostication (Su & Yang, 2022). Kharbat, Alshawabkeh & Woolsey (2021) categorized AI-based technologies in educational settings encompassing machine learning, artificial neural networks, natural language processing, intelligent

personal assistants, deep learning, Bayesian networks, and intelligent pedagogical agents. Table 1 provides an encapsulation of AI-based technologies deployed in educational domains.

Table 1. Artificial Intelligence-based Technologies used in Education

AI-based Technologies	Description
Machine Learning	Machine learning stands as the overarching domain empowering computers to mimic human learning patterns, deriving solutions from data analysis. Harnessing extant data, machine learning endeavors to furnish problem-solving capabilities akin to human cognition. An illustrative application involves employing machine learning algorithms for discerning emotional states through facial data analysis.
Artificial neural networks	Artificial neural networks represent a machine learning framework drawing inspiration from biological neural systems. Primarily, these networks excel in handling intricate data architectures and identifying recurring patterns. Their efficacy spans diverse domains including image classification, linguistic analysis, speech recognition, predictive modeling, and autonomous driving.
Natural Language Processing	Natural language processing (NLP) denotes the field facilitating computers to comprehend, interpret, generate, and manipulate human language. This domain finds fruitful application in diverse realms, including text comprehension, lexical semantics, syntactic analysis, semantic relation extraction, ambiguity resolution, text categorization, translation tasks, and sentiment assessment.
Intelligent Personal Assistant	Intelligent personal assistants stand as AI-based tools crafted to aid individuals in their daily routines, furnishing insights, executing operations, and engaging with users. Leveraging technologies like natural language comprehension, text analysis, voice identification, and machine learning, these systems endeavor to grasp and decipher user utterances, facilitating seamless interaction and task execution.
Deep Learning	Deep learning serves as a machine learning technique grounded in intricate architectures such as artificial neural networks and deep neural networks. Its versatility spans various domains, including image classification, speech identification, linguistic comprehension, sentiment assessment, object detection, translation tasks, strategic gaming, and autonomous navigation.
Bayesian Networks	Bayesian networks employ probability theory to depict causal links among variables, visually presenting these connections. Renowned for their ability to model real-world scenarios riddled with uncertainty, Bayesian networks leverage their graphical framework and grounding in probability theory to offer valuable insights into complex problems.
Intelligent Pedagogical Agents	Intelligent pedagogical agents stand as AI-based tools tailored for educational settings. These agents aim to deliver personalized instruction, bolster learning endeavors, and aid educators. They excel in evaluating students' learning prerequisites and competencies, furnishing tailored learning resources, monitoring progress, analyzing performance metrics, offering constructive feedback, pinpointing areas for improvement, and intervening when necessary.

The ability of Artificial Intelligence to identify students' strengths, create special learning plans that will strengthen their weak points, and evaluate students' performance and provide feedback are helpful elements in meeting students' personal education needs. Kelleher & Tierney (2018) state that AI systems can offer individualized learning plans according to students' individual needs, interests and abilities. In addition to these elements, advantages such as planning the educational experience that students need based on past education data and preparing the necessary teaching content for students make AI more advantageous than other technologies used in the education process (Noe, 2009).

Artificial Intelligence-based tools help students better understand abstract concepts by providing them with concrete experiences and provide students with meaningful experiences. Employing AI tools allows teachers to work more effectively and efficiently. Through AI-based tools, teachers can monitor student progress more closely, adjust lesson plans and curricula accordingly, and help them analyze exams. Artificial Intelligence (AI) systems can support teachers by recommending departments where students can continue their education according to their grades and helping them choose courses (How & Hung, 2019; Neha, 2020; Savaş, 2021). According to the research of Gökçearslan, Tosun & Erdemir (2024), the use of AI-based chatbots increases the learning motivation of students and contributes to the development of language skills, as well as advantages such as reducing cost and workload for educators. The research highlights the positive effects of artificial intelligence-based chat bots in learning environments and shows the benefits that arise for students and educators.

Demir (2019) emphasizes the importance of all stakeholders in the education system having the ability to work in harmony regarding the use of AI systems. Osetskyi et al. (2020) stated the advantages and disadvantages of the use of AI by stakeholders in Table 2 as follows:

Table 2. The Advantage and Disadvantage of Using Artificial Intelligence to All Interested Stakeholders

Stakeholders	Advantage	Disadvantage
Educational Organization	Authentication of identity, remote proctoring for examinations, continuous skill development, safeguarding student privacy.	Doubts regarding the effectiveness of the new system, challenges in assessing students' work during evaluations, apprehensions about maintaining order in the classroom, risk of system failure or potential cyberattacks.
Students	Tracking the educational journey, incorporation of emerging technologies, inclusivity	Challenges in teacher-student communication, issues with motivation.
Teachers and lecturers	Efficiency in student management and content creation. Quick feedback loop, monitoring student progress. Enhances and magnifies teachers' capabilities	It could contribute to elevating the professional skills of teachers. Can serve as a substitute for educators.
Parents	Offers immediate response. Opens doors to tailored learning experiences and assistance for children diagnosed with autism. Might become increasingly attainable for families with limited financial resources.	Absence of communication and engagement leads to dehumanization.

Artificial Intelligence (AI) technologies in the education system combine various advantages and disadvantages. While there are advantages such as monitoring student progress, providing quick feedback to teachers, and providing individualized learning opportunities, there are also negative aspects such as lack of trust in new systems, potential problems in assessing student performance, concerns about maintaining classroom discipline, and risks of system crashes or attacks. These technologies can also ease teachers' workload while increasing teachers' levels of professional competence. While there are advantages such as real-time feedback and greater accessibility to low-income families, negative effects such as lack of communication and reduced interaction can also be observed.

Artificial Intelligence Applications in the Education of Special Needs Students

Artificial Intelligence (AI) applications used in education have become important tools that transform traditional learning environments into modern learning environments and help students discover their potential. For special needs students who need individual education in line with their abilities, Artificial Intelligence-based applications offer these students a differentiated and enriched education opportunity. Kupreko (2020) also states that customized training processes can be offered to individuals with AI-based algorithm models. Additionally, in research conducted by Fahimirad & Kotamjani (2018), the researchers stated that AI can help in providing early solution suggestions for students with different learning speeds. Arslan (2020) states that AI systems used in the field of education can be categorized as expert systems, intelligent tutor systems and dialogue-based systems (Arslan, 2020). Adıgüzel et al. (2023) also stated that smart teaching systems, automatic evaluation systems and adaptive learning platforms have become popular in education. The use of learning analytics and educational data mining is becoming widespread due to the advantages they provide in education. Artificial Intelligence systems used in education are as follows:

Expert Systems

The field of AI, which focuses on developing software that requires expertise and high performance, has created expert systems, a type of software that forms the basis of knowledge engineering, with its unique principles, tools and methods (Öz & Baykoç, 2004). Expert systems are computer-based systems based on knowledge and experience in a particular field of expertise. These systems are designed to model the knowledge typically held by human experts and make decisions using that knowledge. They are knowledge-oriented systems that are developed by transferring actions based on human knowledge and experience to a computer environment and seek solutions to problems without requiring expert support (Türker & Taşkın, 1991). These systems consist of three basic components: knowledge base, inference engine and user interface. The knowledge base is the part where knowledge, rules and propositions in the field of expertise are stored. The inference engine is used to draw conclusions and make decisions using information from the knowledge base. The user interface is designed to enable users to use the system interactively.

Expert systems are used in many different fields such as medicine, engineering, finance and consultancy. For example, a medical expert system can be used to diagnose a disease based on specific symptoms, or an engineering

expert system can be used to determine the steps necessary to solve a particular problem. When creating expert systems, the aim is to transfer the knowledge of experts in a certain field to the computer. Expert systems make information more accessible and optimize decision-making processes, thus providing some of the human expertise through computers.

Expert systems, which are interactive and reliable computer-based decision-making systems that use intuition including learned experiences along with facts to address complex decision-making problems, are also used in distance education. Expert systems afford structures that expand the knowledge base and improve decision-making mechanisms with the completely personalized feedback it offers to students in distance education and the answers it obtains through problems. An example of an expert system that is widely known and developed in this field is MYCIN, which Professor Feigenbaum and his team from Stanford University designed for use in the diagnosis and treatment of bacterial diseases in the medical field. When doctors want to use this system, they answer various questions such as general information and analysis results asked by the system through an interface called DEC-20. Additionally, if there is unknown data, the response "currently unknown" is also added to the system. The system recommends diagnosis and treatment with missing data using a three-stage process such as perception, understanding and action like an expert (Arslan, 2020; Holmes et al., 2019; Wagner, 2017).

Expert systems can be used to better understand the learning needs of special needs students and provide them with appropriate learning experiences. Analyzing the characteristics of special needs students, such as their learning preferences, strengths and weaknesses, can provide customized learning experiences that suit their individual needs. A thorough analysis can create an enriched environment by providing materials appropriate to the student's needs. With these systems, students' learning progress can be monitored and the development of special needs students can be followed more closely and guidance can be provided. Expert systems support teachers in creating customized learning plans based on students' learning styles, interests, and strengths. For example, in a situation where a student has difficulty solving mathematical problems, expert systems can guide the student step by step to solve the problem or offer alternative solutions.

Adaptive Tutoring Systems

They are systems that ensure understanding of the subjects by providing students with a personalized learning experience. Baker et al (2019) define student-oriented AI tools as "intelligent teaching systems", "adaptive", "personalized" or "differentiated" learning platforms and software that respond to students' individual needs in receiving and understanding information. These software can provide personalized learning experiences by identifying students' strengths and weaknesses. Utilizing adaptive learning software results in learning content that can be adapted to each student's specific needs. As a result, each student is ensured to obtain information in the most appropriate way for his or her learning style, and this is a factor that increases participation and learning results (Cheng & Lai, 2020). The best examples of AI studies that are considered adaptive tutoring systems are systems called SCHOLAR, WHY, BUGGY, SOPHIE and LISP Tutor (Küçükali & Coşkun, 2021). These systems can organize learning content according to students' needs, automatically provide feedback, promote collaboration among students, and identify student knowledge gaps, abilities, and shortcomings.

For example, an AI platform that provides adaptive learning for special needs students can present students with more challenging math problems after identifying their math strengths. On the other hand, it can provide students who have difficulty with language skills with materials to improve more basic language skills. This platform can also continuously monitor students' progress. An AI platform can determine which subjects students are successful in and which subjects they need more work on. By providing teachers with this information, it can enable them to better respond to students' individual needs. Artificial Intelligence (AI) platforms can provide interactive and customized feedback to students. For example, by analyzing a problem that the student has solved incorrectly, it can provide clues as to where the student went wrong and provide clues for the correct solution. Students can therefore understand their mistakes and learn the steps needed to reach the correct solution.

Dialogue-Based Tutorial Systems

Dialogue-based teaching systems are AI-based systems that interact with students. Interactive systems enrich the learning experience by communicating with students in natural language. They use natural language processing and machine learning techniques to answer students' questions, evaluate learning progress, guide the learning process, and provide support to students when necessary. Interactive systems can offer customized learning experiences based on students' needs and levels. Additionally, these systems can increase students' motivation to learn by making the learning process more effective and interactive. AutoTutor and WatsonTutor can be given as examples of AI studies called dialogue-based tutorial systems (Arslan, 2020; Küçükali & Coşkun, 2021).

Dialogue-based tutoring systems support learning by interacting with students in natural language. Tutoring systems ask students questions, evaluate their answers, and provide additional information or feedback when necessary. For special needs students, this type of system can offer content that suits the student's interests and learning style. When a student wants to learn a topic related to mathematics, the dialogue-based tutorial system can interact with the student and help him or her understand the topic more deeply.

Learning Analytics and Educational Data Mining

Learning analytics and educational data mining employ akin methodologies to enhance educational standards through the analysis of pedagogical data. Nonetheless, while learning analytics prioritizes the creation of flexible learning frameworks, furnishing students with feedback, and visual representation; Educational data analysis focuses on automating specific results with the data at hand. Educational data analysis aims to predict student behavior by developing models for students, improve knowledge fields, research pedagogical methods to support learning processes, and design more effective teaching systems (Baker & Yacef, 2009; Polat, 2021; Yakupoğlu, 2018). To enhance the efficacy of learning settings and scrutinize data encompassing student achievements, class attendance, and question participation to anticipate potential academic setbacks, scholars have recently pivoted towards domains adjacent to AI, including educational data mining and learning analytics (Badal & Sungkur, 2023; Chen & Zhai, 2023; Dekker, Pechenizkiy & Vleeshouwers, 2009; Guleria & Sood, 2023; İbrahim & Rusli, 2007; Karabatak, 2008; Meskens & Superby, 2007; Mishra, Kumar & Gupta, 2014; Vandamme et al., 2021).

Ethical Concerns for Students with Special Needs in Artificial Intelligence-Based Education

While the positive change-making impact of AI is widely accepted, concerns about the ethical issues that may arise are also increasing. Ethical rules have long been of vital importance in human life. Essentially, they build a bridge between right and wrong and, accordingly, they emphasize concepts such as desire, duty, freedom, conscience, virtue, and satisfaction. Three different approaches stand out in the literature on AI ethics. First, there is the definition of moral rules that can be applied to machines, or the utilization of normative moral rules that can be drawn from traditional moral philosophy. Moral rules should be chosen carefully to avoid creating any ambiguity or controversy. Another approach is for the machine to understand right and wrong on its own, without externally determined rules. In this approach, evolutionary techniques such as genetic algorithms or methods such as game theory can be used. A third approach that stands out in the literature is that the machine is initially equipped with a certain set of rules and changes these rules by learning them over time (Ağırman, 2018; Çelebi & İnal, 2019).

Intelligent teaching systems, automatic classification, adaptable learning platforms and data-based decision-making processes have begun to be rapidly adopted in AI education. However, these technological advances also raise ethical questions. The ethical implications of applying AI in education include issues such as privacy, fairness, transparency, accountability, and the broader impacts of AI on educational outcomes. Collecting large amounts of student data and analyzing them by AI systems increases data privacy, security and misuse risks. Moreover, the use of AI algorithms in decision-making processes such as student placement or teacher evaluation can introduce biases or reinforce existing inequities if not carefully designed or monitored (Leta & Vancea, 2023).

In recent years, AI-based education systems have led to revolutionary changes in the field of education. The use of these technologies offers a number of advantages, such as being able to better respond to students' individual needs, enabling teachers to guide students more effectively, and generally improving the quality of education. However, with the use of these technologies, it also raises ethical concerns, especially for special needs students. Students with special abilities often present needs and characteristics that differ from standard educational practices. With the increase in applications for these students in AI-based education, issues such as student privacy, justice and equality of opportunity come to the fore. For example, collecting and analyzing data from special needs students may raise concerns about the privacy and confidentiality of these students. Additionally, it may be controversial whether AI-based educational practices provide equal opportunities to every student. Some students may be disadvantaged in their access to or ability to use technology, which can raise issues of fairness and equal opportunity.

Holmes et al. (2021) stated that the ethical dimension of learning with AI should also include elements in the context of educational ethics such as teaching preferences, useful information criteria, teacher-student relationship, personal development expectations, student active participation, supervision, diversity, justice, participation and accuracy of evaluation. The researchers assert that informing all stakeholders of education about AI and ethics will prevent possible problems that may arise. As society moves towards an age driven by AI, an

updated curriculum in schools is increasingly necessary (Department for Education, 2023). Floridi et al. (2019) also emphasize that a complete information ethics framework should be established for the use of artificial intelligence in education. Dabbagh et al. (2024) also state that a dynamic and evidence-based approach is needed.

Various ethical guidelines regarding AI technologies have been published in recent years. The European Commission published the *Ethical Principles Guide for Trustworthy Artificial Intelligence Systems* on April 8, 2019, and declared that trustworthy artificial intelligence systems should be legally, morally and technically sound and strong. Similarly, UNESCO member states adopted the first global agreement on AI ethics on 24 November 2021. In addition to these guidelines, the European Union has created a commission to make AI safe, transparent, ethical and neutral by passing laws covering artificial intelligence to prevent irresponsible use that could cause serious harm to society (Agarwal & Mishra, 2021; Hagendorff, 2020). Artificial Intelligence competition and advances, especially between China and the USA, have a strategic impact on a global scale (Johnson, 2021). Artificial Intelligence-based developments between these two great powers have brought the topic of AI to the fore in the education systems of the European Union and European Commission member countries. Moreover, in the last two years, many countries have begun to strive to include AI in educational programs (Annoni et al., 2018).

AI-based education, concerns for special needs students should be taken into account to create an ethical framework for special needs students. The ethical and responsible use of technology aims to enhance students' educational experiences as well as protect their rights and well-being. The primarily expressed ethical concern is the concern regarding the issue of privacy and data protection (Buttarelli, 2018). Artificial Intelligence-based education systems collect, store and process students' personal data. This may raise student privacy and data security concerns. In particular, sensitivity should be exercised regarding the collection and use of emotional or private information.

When using AI technologies to evaluate students' performance, it is important to ensure a fair and objective evaluation process. Since special needs students have different learning styles and needs, all students must be treated equally and fairly during the evaluation process. Additionally, AI systems can learn and reflect biases and discrimination in data sets. This situation may increase the risks of discrimination and injustice in the education of special needs students. In particular, biases of AI systems must be reduced to ensure that students from minority groups have access to equal opportunities. Machine learning, system biases is a potential problem in AI usage. For example, there are findings that gender bias in recruitment through algorithmic systems or racial biases are perpetuated through machine learning (CDEI, 2019; Raso, 2018). Bostrom & Yudkowsky (2018) also stated that developing AI algorithms that are transparent to auditing will become increasingly important. It is also important for teachers to manage technology effectively and meet students' emotional and social needs. Teachers should use AI tools supportively and adapt them to the individual needs of students. Additionally, teachers need to pay attention to the ethical use of AI systems. Teachers must think carefully about issues such as data privacy, bias and fairness and ensure that these technologies are used fairly for everyone. In addition, it is important for teachers to learn how to integrate AI technologies effectively. Educators can use AI tools to enrich the classroom learning experience and support students' learning processes. However, in this integration process, teachers need to

constantly update themselves and adapt to technology. In this way, the use of AI in education can be carried out more efficiently and effectively.

Discussion and Conclusion

In this article, the role of AI-based education in the education of special needs students, ethical concerns that special needs students may face, and potential solutions to these concerns are discussed. While the role of AI in education is increasing, it is especially important to focus on the education of special needs students. Artificial Intelligence (AI) plays an important role in education in areas such as providing individualized learning experiences, monitoring student progress, and identifying student-specific needs. AI platforms can offer powerful tools to personalize students' learning experiences, monitor their progress, and intervene according to their needs. Studies in the literature that artificial intelligence applications increase student success have been increasing rapidly in recent years. Azamatova et al. (2023) used an experimental design with a pre-test post-test control group in their study where they investigated the effects of digital tools and artificial intelligence applications on the success, motivation and retention of university students, based on the project-based teaching approach in foreign language courses. As a result of the research, it was stated that digital tools and artificial intelligence applications not only contributed positively to the success and motivation of students, but also ensured the permanence of what was learned. Solak (2024) also investigated the experiences of language learners and teachers in using ChatGPT in the language learning and teaching process. As a result of the research, it was stated that ChatGPT and artificial intelligence are considered useful tools for language learning and teaching, although they present some difficulties that can be overcome with the advancement of technology. Mabuan (2024)'s research findings also contribute to the existing literature on the integration of artificial intelligence technology in English Language Teaching (ELT) and offer practical recommendations for educators who want to benefit from the potential of ChatGPT in language teaching. In his research, Karaman (2024) tried to determine whether students' mathematical achievements improved by using ChatGPT, one of the chatbot tools, to prepare lesson plans in primary school mathematics courses. As a result of the research, it has been shown that teaching mathematics according to lesson plans prepared using ChatGPT in primary schools is effective in academic success. Another study stated that students' use of ChatGPT in mathematics learning had a positive effect and increased their participation (Serhan & Welcome, 2024). Kapucu et al. (2024) used the deep learning method, one of the machine learning algorithms, in their study in which they aimed to predict the academic performance of students in science courses and to determine the importance of independent variables affecting students' academic performance in science courses. As a result of the study, they predicted the students' final science scores with 90% accuracy. Studies also show that both teachers and students are interested in artificial intelligence. It can be said that there is a tendency to work towards ChatGPT in the field of artificial intelligence in the literature. It can be said that studies in this field are needed to actively use artificial intelligence in the field of education, not only ChatGPT but also other artificial intelligence tools. For example; Expert systems, which work based on specialized knowledge bases on a particular subject, can help students learn in depth on a particular subject, such as dialogue-based tutorial systems, in the education of special needs students. Dialogue-based tutorial systems and expert systems are powerful AI tools that can be used in the education of special needs students. Tutorial systems have significant potential to offer learning experiences tailored to students' individual needs and to make the learning process more effective.

Learning analytics and educational data mining can also be used to improve the quality of education by analyzing student-related data in the education of students. While learning analytics can create adaptable educational platforms in line with the strengths and weaknesses of special needs students, different information can be obtained by revealing patterns and relationships hidden in the existing educational data of special needs students with educational data mining. This information can provide teachers with valuable guidance to better respond to students' individual needs. However, some ethical problems also arise with the use of these technologies. For example, AI-based systems have the potential to violate the confidentiality of personal data. To address these concerns, collaboration and open communication between educators, technologists, and ethicists are essential. Additionally, ethical principles need to be considered in detail in the design and implementation of AI applications. Artificial Intelligence systems that protect students' privacy and operate in a fair and transparent manner should be developed. In order to best develop the potential of special needs students in AI-based education, it is important to adhere to ethical values and student-centered approaches. Artificial Intelligence-based technologies can therefore serve the goals of justice and equity in education.

Recommendations

The following suggestions can be made for researchers focusing on special needs students in AI-based education. First of all, existing ethical principles need to be reviewed and updated. Updated processes must address critical issues such as student privacy, data security, fairness, and equity. Additionally, great care should be taken in the collection and use of data regarding special needs students; these processes must be developed to protect student privacy and confidentiality. The accuracy and impartiality of algorithms is also a priority issue; Therefore, the use of AI algorithms for special needs students should be carefully examined in a way that treats each group of students fairly. Diversification of educational materials and tools can better respond to the different learning styles and needs of special needs students. The training of teachers and guidance specialists is of great importance in these processes; They should be supported by ongoing training that includes ethical issues, using technology effectively, and understanding the unique needs of special needs students. Finally, standards and benchmarks must be established for the effective evaluation and continuous improvement of AI-enabled educational practices. Awareness campaigns should also be organized in tandem with standards and benchmark revisions to increase social acceptance, highlighting the potential benefits of AI technology as well as the ethical and social responsibilities AI possesses.

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