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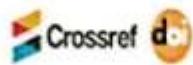
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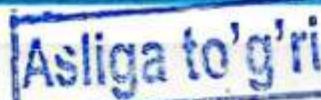
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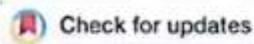


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Prospects for The Use of Artificial Intelligence Technologies in The Inclusive Education Process

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Abstract: This article explores the opportunities and prospects of applying artificial intelligence (AI) technologies in the inclusive education process. It analyzes the effectiveness of AI-based educational tools for students with special educational needs and their significance in the development of inclusive education systems. The article provides practical examples of the use of adaptive learning systems, speech recognition and synthesis technologies, AI-powered recommendation systems, virtual assistants, and other innovative solutions. The study reveals the potential of AI technologies to enhance academic performance, individualize the learning process, and strengthen the social integration of students with special educational needs. It also discusses existing barriers to the implementation of these technologies and ways to overcome them.

Keywords: Inclusive education, artificial intelligence, special educational needs, adaptive learning systems, speech recognition, data analysis, virtual assistants, personalized learning, digital transformation.

Introduction: One of the most important tasks of the modern education system is to ensure access to quality education for all students, including those with various special educational needs. The goal of inclusive education is to create equal educational opportunities while taking into account the individual characteristics and needs of each student. In this process, modern technologies — especially artificial intelligence (AI) technologies — can play a significant role. AI is a set of technologies based on mimicking human cognitive activity through computer systems that can learn independently, analyze data, and make decisions. In

recent years, AI technologies have begun to be widely used in education, a process that accelerated during the COVID-19 pandemic due to the increased need for distance learning. AI systems are capable of performing a variety of functions such as assessing student knowledge levels, personalizing learning materials, and automating administrative tasks for teachers.

The use of AI technologies in inclusive education is considered a highly promising direction, as these technologies can create a customized learning environment tailored to the individual characteristics of students with special needs. This article examines the main directions, current practices, and future prospects of applying AI technologies in the inclusive education process.

AI-Based Adaptive Learning Systems

Adaptive learning systems are systems that tailor learning materials based on each student's individual learning style, knowledge level, and needs. AI-based adaptive learning systems analyze data collected during the learning process — such as student interactions, learning dynamics, and difficulties — to help shape optimal learning paths for each student.

In the context of inclusive education, adaptive learning systems offer the following opportunities:

- 1. Creating individualized learning plans.** AI algorithms can identify a student's strengths and weaknesses, detect gaps in knowledge, and offer materials accordingly. This is especially important for students with autism spectrum disorders, dyslexia, or attention deficit hyperactivity disorder (ADHD).
- 2. Adjusting content complexity.** AI systems can automatically adjust the difficulty of materials according to the student's level, ensuring that each student works within their "zone of proximal development."
- 3. Offering various learning formats.** AI systems can present the same material in different formats (text, audio, video, interactive) to match each student's preferred learning style.

For example, platforms like DreamBox and Knewton are based on adaptive learning principles and use AI algorithms to suggest materials tailored to individual needs. The "Digital Mathematics" system also has a specially adapted version for students with disabilities, including screen-reader-friendly interfaces for visually impaired students and visual cues/subtitles for hearing-impaired students.

Speech Recognition and Synthesis Technologies

One of the most effective applications of AI is in speech recognition and synthesis technologies. These offer

the following possibilities in inclusive education:

- Speech-to-text conversion.** AI-based systems (e.g., Google Speech-to-Text, Microsoft Azure Speech) can transcribe teacher or peer speech into text in real time, helping hearing-impaired students follow the lesson content.
- Text-to-speech.** AI systems can read written materials aloud in a natural voice, useful for students with visual impairments or reading difficulties like dyslexia.
- Sign language interpretation.** AI-based video analysis systems can recognize sign language and convert it into text or speech, and vice versa. This helps improve communication between hearing-impaired students and their teachers.

Applications like Speechify and NaturalReader provide text-to-speech capabilities, allowing visually impaired students to listen to study materials. Google Live Transcribe converts speech to text in real time, supporting full participation of hearing-impaired students during lessons. Innovative projects like SignAll are developing technologies to automatically translate sign language into text, significantly expanding communication opportunities for hearing-impaired students in educational settings.

AI-Powered Recommendation Systems

AI-based recommendation systems can help identify additional learning materials, exercises, and resources for students with special educational needs. AI algorithms can also suggest the most effective teaching methods and strategies for teachers working with these students.

The Century Tech platform, for example, uses AI to recommend personalized learning materials based on students' learning styles and progress. The Smart Sparrow system provides tools for teachers to create adaptive learning materials, enabling the development of custom-tailored educational programs for students with special needs.

Virtual Assistants and Chatbots in Inclusive Education

In the field of inclusive education, AI-based virtual assistants and chatbots play an important role by offering continuous support, psychological help, and guidance to students with special needs, making the learning process more efficient.

One key advantage of AI-based virtual assistants is their 24/7 availability and the ability to promptly respond to students' questions. This is particularly valuable for students who require additional explanations or who prefer to ask questions at their own pace and on their own schedule.

These assistants can also provide emotional support. By analyzing text input, they can monitor students' moods and emotional states, send motivational messages, and alert educators or specialists when serious concerns are detected. This provides an added layer of support for students with autism spectrum disorders or social-emotional challenges.

Virtual assistants help organize and guide the learning process by assisting with content comprehension, giving instructions for assignments, and supporting planning and learning organization — becoming essential teacher aides.

Challenges in Implementing AI Technologies in Inclusive Education

Despite the promising outlook, implementing AI in inclusive education faces several serious challenges ranging from technical and financial issues to ethical and legal considerations.

Firstly, most educational institutions lack the technical infrastructure and financial resources needed for full AI integration. In developing countries and remote regions, schools often face shortages in computer equipment, high-speed internet, and essential software, deepening the digital divide and increasing inequality among students with disabilities.

Additionally, many teachers lack the skills and knowledge required to effectively use AI technologies. Limited motivation, time, and resources hinder their ability to integrate AI tools. Professional development programs often do not cover modern digital tools or do so only superficially.

AI systems collect and analyze large volumes of student data, including personal information, learning behaviors, and performance metrics. This raises important concerns about privacy, especially for students with special needs whose data may be particularly sensitive.

Moreover, AI systems are still developing and may produce errors or limitations. Inaccurate predictions or inappropriate recommendations by algorithms can have negative consequences for students. AI systems developed for special education may not fully account for the unique needs of these learners, potentially reducing the effectiveness of the educational process.

Ethical concerns also arise: Who should make key decisions in education — the teacher or the AI system? AI algorithms can unintentionally reinforce existing inequalities or even introduce bias, leading to discrimination against certain groups of students.

CONCLUSION

The use of AI technologies in inclusive education has the potential to significantly expand educational

opportunities for students with special needs. AI-driven adaptive learning systems, speech technologies, recommendation engines, virtual assistants, and data analytics tools can transform inclusive education, making it more individualized, effective, and accessible. A comprehensive approach is essential to ensure successful implementation, including improving technical infrastructure, providing teacher training, protecting student data, and developing ethical guidelines. Such efforts can help ensure that AI technologies are used effectively to provide quality education and promote full societal integration for students with special needs.

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