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# Role of Artificial Intelligence in Enhancing Educational Access for Learners with Disabilities

**Prashant Tiwari**

Research Scholar, Department of Computer Science, Mansarovar Global University, Sehore, M.P., India.

## ABSTRACT

A game-changer in the field of education, artificial intelligence (AI) provides novel approaches to removing long-standing obstacles that disabled students encounter in their pursuit of a high-quality education. With an emphasis on AI's uses in adaptive multimedia material, customized learning, and assistive technology, this research investigates how AI might improve educational access for students with disabilities. Customized educational delivery that accommodates various cognitive, sensory, and physical demands is made possible by AI-driven technologies including speech recognition, computer vision, natural language processing, and machine learning-based recommendation systems. The research emphasizes the ways adaptive assessment platforms, text-to-speech and speech-to-text systems, automatic captioning, intelligent tutoring systems, and other similar technologies help students with disabilities with understanding, participation, and independence. Data privacy issues, algorithmic bias, infrastructural constraints, the necessity for regulatory backing and teacher training are some of the obstacles to AI adoption that the research delves into. The paper highlights the potential of AI to enhance inclusive, egalitarian, and accessible learning environments by synthesising contemporary academic literature and developing educational practices.

*Keywords: Artificial Intelligence, Education, Applications, Tools, Disabilities.*

## I. INTRODUCTION

Education is essential for personal development, community engagement, and economic empowerment; it is also recognized globally as a fundamental human right. Some of the biggest problems that students with special needs have in regular schools include a strict curriculum, hard-to-get learning resources, not enough personalized attention, and not enough support services. As a result, occasionally academic success and social inclusion are blocked. In recent years, artificial intelligence (AI) has become a game-changer in education, offering new ways to satisfy the needs of children with impairments. Artificial intelligence is changing special needs education for the better by making it more accessible, focused on the learner, and open to everyone via the use of adaptive technology, data-driven customization, and smart automation.

One of AI's biggest successes is making it easier for students with sensory impairments to go about. Students with visual or hearing impairments may have trouble with traditional teaching methods that rely heavily on visual or auditory cues. Artificial intelligence has made text-to-speech (TTS) and speech-to-text (STT) technologies more easier to use. Text-to-speech technology has made it possible

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for students who have trouble seeing to easily get to textbooks, digital resources, and online assessments. On the other side, STT tools can help students who are hard of hearing because they turn spoken language into text. Microsoft's Seeing AI app, which gives real-time audio descriptions of things, people, text, and surroundings, can help vision impaired kids feel more confident in school and in social situations. Real-time captioning and live transcription services have also been added to platforms like Google Meet and Microsoft Teams. This means that students who are deaf or hard of hearing can now attend virtual classrooms, which used to be a major barrier to education because of communication issues.

Artificial intelligence has made it possible for intelligent teaching systems and social robots to help children with autism spectrum disorder (ASD) improve their social, emotional, and communication abilities in new ways. Many youngsters with autism have problems recognizing body language, initiating and sustaining eye contact, and talking to their classmates. AI robots like Milo and NAO were made to help with these problems. The planned and interactive activities that these robots provide students are like real-life social situations, so they may practice greeting people, talking to them, and figuring out how they feel. Robots are a great way for people with autism to learn since they are reliable, safe, and don't judge people, unlike people. AI algorithms that let these robots adapt to varying learning speeds, preferences, and behavioral reactions make it feasible to personalize therapies to boost self-confidence, independence, and emotional control.

Dyslexia, dysgraphia, and dyscalculia are learning disabilities that need to be found and treated right away. Students with these disorders usually do poorly in school and have low self-esteem since they are typically discovered too late. Artificial intelligence's better ability to see patterns and interpret data has made early detection much better. One tool that utilizes AI and eye-tracking to look at reading patterns and find early indicators of dyslexia is Lexplore. These technologies give teachers precise, data-driven information that lets them make rapid changes that are tailored to each student's needs. Early identification not only improves academic performance, but it also helps people avoid the psychological and emotional effects of failing in school for a long time.

Also, students with mobility problems or neurological illnesses like cerebral palsy have gained a lot from improvements in AI-powered speech recognition and assisted writing technologies. Many kids have trouble writing and typing because of physical limitations, which makes it hard for them to accomplish activities and say what they mean. With speech recognition software like Dragon NaturallySpeaking, students may write essays, do homework, and look up information on the internet using voice commands. This technology removes physical barriers to learning, so students may now participate in class discussions on the same level as their peers. AI-powered tools for predictive text and grammar correction work with voice input to help people write better. This encourages independence, self-reliance, and confidence in schoolwork.

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AI goes beyond only helping students directly; it also gives teachers more power and makes inclusive teaching methods stronger. Smart learning platforms like DreamBox and Carnegie Learning use AI to keep track of students' progress, find trends in their performance, and fill in any gaps in their knowledge. Teachers may utilize these results to make lesson plans that are tailored to each student, change how they teach, and better meet the requirements of students with special needs. AI-powered analytics assist reduce the amount of work that instructors have to do, giving them more time to mentor students and create classes that are tailored to their needs. This lets classrooms work with a larger spectrum of students' talents and ways of learning.

During the COVID-19 pandemic, schools all around the world used remote and hybrid learning models. This showed how important AI is in special needs education. A lot of students with disabilities relied on in-person support services, therefore they were among of the most vulnerable during this transformation. AI-powered virtual learning systems helped reduce this gap by making learning tools easier to use, adapting to students' needs, and allowing for real-time customization. For students with special needs, tools like adjustable font sizes, screen readers, voice navigation, and AI-based teaching made sure they could keep learning. Programs that were part of the Global Accessibility Awareness campaign revealed how important AI-powered solutions were for keeping education open to everyone throughout this historic global disaster.

Real-world examples show how AI is changing special education in several countries in a revolutionary way. DyslexiaKey is an AI-powered tool that helps Swedish students who have trouble writing by giving them suggestions based on the context, predicting words, and correcting spelling mistakes in real time. Using these tools makes it much easier to write and minimizes mental stress. Social robots are being utilized more and more in Japanese classrooms to help kids with autism spectrum disorder (ASD) improve their social and emotional skills. This shows that AI-assisted learning is becoming more common in regular schools. These stories from around the world show how easy it is to scale and change AI solutions to fit diverse cultures and schools.

AI is having an effect on special needs education that goes beyond just helping children do better in school. It is also helping to create more welcoming communities and a love of learning for everyone. In their annual reports on accessibility and inclusion, big tech companies like Microsoft have frequently stressed how important AI-powered assistive devices are for giving people with disabilities more control. Costa Rica's example of how to employ AI strategically in national education systems to overcome access gaps might also help disadvantaged countries. These initiatives illustrate that AI can do more than simply make computers smarter. It can also help bring about social fairness and progress that includes everyone.

## II.    REVIEW OF LITERATURE

Alkan, Ayse. (2024) One major development in modern education is the use of artificial intelligence in classrooms. There is great potential for artificial intelligence (AI) technology to assist educators, level the playing field in the classroom, and enhance the educational experience for students with

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special needs. Using AI technology, we can better determine what students with special needs need to study so that we can provide them with individualized learning plans. The educational system has benefited greatly from the development of AI systems that aim to increase efficiency, facilitate student achievement of learning objectives, provide immediate feedback, and foster better interpersonal skills. Learning analytics, educational data mining, adaptive instructional systems, dialogue-based systems, and expert systems are all examples of such systems. Artificial intelligence (AI) can develop individualized learning resources for children with special needs by identifying their strengths, areas of weakness, and preferred study methods. By examining the relevant AI-based technologies, the role they play in the education of children with special needs, and the factors to be considered when choosing these technologies, this article hopes to provide researchers and educators some direction.

Khan, Md. (2024) People with disabilities stand to gain much from the revolutionary potential of artificial intelligence (AI), which is already having far-reaching effects on society. Although AI has immense promise, it also comes with some drawbacks. One of these problems is the ethical worry that technology might worsen prejudice against already-vulnerable populations. This research delves further into the pros and cons of AI for those with impairments, focusing on algorithmic biases in particular. Discrimination and unjust treatment may be sustained by these biases because of their influence on decision-making and social systems. In view of these difficulties, the article investigates possible remedies to make AI accessible to everyone, including people with physical impairments.

Shuford, Jeff. (2023) Among the many ways in which artificial intelligence (AI) is changing the world, one way it is helping people with disabilities is by making their lives easier. Still, there are dangers associated with AI that outweigh its benefits. For example, there are ethical concerns that might lead to further prejudice against already-vulnerable groups. With an emphasis on algorithmic biases, this essay examines the pros and cons of AI from the perspective of persons with disabilities. These prejudices have the power to shape social structures and impact decision-making, which means they may keep discrimination and unjust treatment alive and well. The paper explores possible solutions to these problems and makes sure that AI can help everyone, regardless of impairment, despite these obstacles.

Akinwalere, Susan & Ivanov, Ventsislav. (2022) Several global surveys have identified AIEd as one of the burgeoning areas of educational technology. Even though AI has been available for almost 30 years, many still don't understand how to make it truly useful in the classroom and how it can change the way college students learn. Examining the potential benefits and drawbacks of AI in the context of higher education is the primary goal of this article. The article delves into the ways new technology are changing education by looking at how they affect both students' and institutions' pedagogical practices. In an effort to provide everyone with access to high-quality education, this article compiles several case studies of AI being used in the classroom. As a first step, the article examines the potential of AI to enhance educational results by providing concrete instances of how AI might facilitate the use of data by educational institutions to promote more access and better quality of higher education. The report goes on to discuss the possible dangers, advantages, and obstacles of implementing AI in

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educational environments. Lastly, we offer some suggestions for AI in the classroom, with an eye on starting conversations about the benefits, drawbacks, and overall impact of AI on education in the context of long-term sustainability.

Göçen, Ahmet & Aydemir, Fatih. (2020) There has been a recent uptick in research into the potential effects of artificial intelligence (AI) on classroom instruction and school administration, leading many experts to predict significant shifts in these sectors' traditional roles. With that said, the study's overarching goal is to investigate the potential outcomes of AI's introduction to the classroom and the insights it may provide into the educational landscape of the future. The study used phenomenology, a qualitative research approach, to gather and analyze the perspectives of people from many walks of life. New goods, benefits, and challenges will be introduced to schools and instructors by the entrance of AI in education, according to the research. The results highlight several recommendations for AI application and potential issue avoidance. The majority of participants appear to have a good impression of AI, however educators and researchers have pointed out certain negative aspects of this technology that might affect the future of education. While engineers view AI as a tool to improve education for everyone, lawyers and jurists are more concerned with the legal aspects of AI in the classroom and potential future issues.

## III. HOW CAN AI HELP STUDENTS WITH DISABILITIES?

Educators and academics throughout the globe are beginning to acknowledge the immense potential of AI in the field of special education.

Improved accessibility, efficacy, and individualization of special education services are all things that this new technology has the potential to bring about. Let me give you some examples of how AI may help with special schooling.

### Personalized Learning

Through the provision of individualized learning pathways, AI holds the promise of revolutionizing the educational experience. The use of sophisticated algorithms and machine learning allows AI to assess the unique learning styles, aptitudes, and challenges of each student, allowing for personalized lesson plans. Individualized instruction is frequently necessary for individuals with special needs, and this method can help them do just that. Students may learn at their own speed with the support of AI-powered technologies like intelligent tutoring systems, which offer individualized lessons and comments. Additionally, they are able to pinpoint the student's weak spots and modify the course content accordingly. Helping children with special education attain their maximum potential, this degree of customization can lead to a more interesting and productive learning experience.

### Assistive Technology

The advancement of assistive technology for special schooling can likewise be greatly aided by AI. Technologies such as voice recognition software and prostheses driven by artificial intelligence have the potential to significantly improve the quality of life and educational opportunities for children with

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impairments. Software that can real-time transcribe voice into text is one use of AI that might aid students with hearing impairments in following along in class. Similarly, software driven by AI can transcribe text into audio, which aids the learning process for pupils who are visually impaired. New technological advancements are facilitating schooling for individuals with special needs and giving them greater agency in their own learning.

## Improved Accessibility

AI has the potential to significantly enhance special education accessibility, allowing students with impairments easier access to instructional resources. For students with visual or hearing impairments, artificial intelligence (AI) might one day transform standard textbooks into audiobooks or digital texts with resizable fonts. Educators can also benefit from predictive analytics enabled by AI in spotting possible learning barriers and intervening promptly. Artificial intelligence (AI) can analyze student performance and behavior data to identify at-risk kids and provide solutions to assist them climb back up the academic ladder. Improved learning results and a more welcoming classroom climate are possible consequences of this proactive strategy.

## IV. ARTIFICIAL INTELLIGENCE APPLICATIONS IN THE EDUCATION OF SPECIAL NEEDS STUDENTS

The use of artificial intelligence (AI) in the classroom has grown in recent years, becoming a vital resource for elevating students' educational experiences beyond what was previously possible. Special needs kids can benefit from a differentiated and enhanced education through the use of AI-based programs, which allow for unique instruction depending on each student's ability. Students' learning rates vary, but AI may aid by suggesting potential solutions early on. Expert systems, intelligent tutor systems, and dialogue-based systems are the three main types of artificial intelligence systems utilized in education. The field of education has seen a rise in the use of smart teaching systems, adaptive learning platforms, and autonomous evaluation systems. Because of the benefits they offer, learning analytics and educational data mining are quickly gaining popularity in the field of education. The following are examples of AI systems applied in the classroom:

## Expert Systems

Knowledge engineering is built upon expert systems, a subset of software developed within artificial intelligence (AI) that use its own set of concepts, tools, and methodologies to design software with a high level of competence and performance. Knowledge and experience in a certain domain form the basis of expert systems, which are computer-based systems. These computers can mimic the expertise of human specialists and use that information to guide their decision-making. These systems are knowledge-oriented, meaning they can solve issues on their own without human intervention, and they are created by translating human-based knowledge and experience into computer code. A user interface, an inference engine, and a knowledge base make up these systems. Information pertaining

to the domain of expertise, including rules, propositions, and general knowledge, is kept in the knowledge base. By analyzing data stored in the knowledge base, the inference engine is able to derive conclusions and make judgments. Users are able to engage with the system in an engaging way thanks to the user interface.

Consulting, engineering, health, and finance are just a few of the several industries that make use of expert systems. A medical expert system, for instance, may be employed to ascertain a disease's cause from a patient's history and symptoms, while an engineering expert system could be employed to ascertain the procedures required to address an individual problem. A primary goal in developing expert systems is to imbue computers with the expertise of human subject-matter experts. By improving the accessibility of information and streamlining decision-making processes, expert systems enable computers to supplement human knowledge.

Additionally, remote learning makes use of expert systems, which are trustworthy computer-based decision-making systems that combine intuition, past experience, and facts to solve difficult decision-making issues. Through the use of problem-solving and the provision of fully individualized feedback to distance education students, expert systems provide frameworks that increase the body of knowledge and enhance decision-making processes. Professor Feigenbaum and his colleagues at Stanford University created MYCIN, an expert system with extensive experience in the field, to aid in the medical diagnosis and treatment of bacterial infections. The DEC-20 interface is used when doctors choose to utilize this system, and it asks them a series of questions about themselves and their analysis findings, among other things. Also, the response "currently unknown" is introduced to the system in case there is unknown data. The system employs a three-stage approach, including perception, interpretation, and expert action, to propose diagnoses and treatments in the absence of complete data.

Students with special needs can have their unique learning requirements identified and met with the help of expert systems. Individualized learning plans may be developed for kids with special needs by taking into account their unique traits, including their learning styles, aptitudes, and limitations. By identifying the specific needs of each student, an in-depth study may be used to tailor learning resources to foster an enriching atmosphere. These methods allow teachers to keep tabs on their pupils' growth and tailor their instruction to the unique requirements of those students who are having difficulty keeping up with the rest of the class. Teachers may use expert systems to help them develop individualized lesson plans that cater to each student's unique set of circumstances, interests, and strengths. In the case of a student struggling with mathematical issues, for instance, expert systems can provide alternate answers or step-by-step instructions to help the learner solve the problem.

## Adaptive Tutoring Systems

These technologies provide pupils a tailored learning experience, ensuring that they comprehend the courses. Learning platforms and software that respond to students' particular requirements in receiving and interpreting knowledge are defined as "intelligent teaching systems," "adaptive," "personalized,"

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or "differentiated" by Baker et al (2019). By analyzing each student's unique set of skills and areas of weakness, this program can create individualized lesson plans. Personalized lesson plans are possible with the help of adaptive learning software. Consequently, students are guaranteed to acquire material in a manner that best suits their individual learning styles, which in turn enhances their engagement and the quality of their learning. System names like SCHOLAR, WHY, BUGGY, SOPHIE, and LISP Tutor are the finest instances of artificial intelligence research into adaptive teaching systems. These systems may categorize course materials based on students' requirements, offer immediate feedback, encourage group work, and pinpoint where students excel and where they need improvement.

An AI platform that offers adaptive learning to those with special needs is one example. After taking stock of their mathematical abilities, students can go to more difficult challenges. However, it may also give children who struggle with language access to resources that can help them develop their most fundamental language abilities. Students' progress may also be tracked continually using this platform. An AI platform can analyze student performance and identify areas that require further attention. Teachers can better meet the needs of their pupils if they have access to this information. Students can receive personalized and interactive feedback using AI systems. For instance, by examining a student's improper answer to a problem, it might offer hints as to what went wrong and how to fix it. Consequently, students may comprehend their errors and acquire the necessary skills to arrive at the right answer.

## Dialogue-Based Tutorial Systems

AI-powered systems that engage in conversation with learners are known as dialogue-based educational platforms. Students benefit from interactive systems because they allow for natural language communication, which enhances the learning process. In order to respond to student inquiries, assess their level of understanding, plan lessons, and offer extra help when needed, they employ machine learning and natural language processing. Interactive systems provide the ability to personalize learning experiences according to each student's requirements and proficiency levels. By improving the efficiency and interactivity of the learning process, these technologies can also boost students' intrinsic motivation to study. Dialogue-based instructional systems, of which AutoTutor and WatsonTutor are examples, are a subfield of artificial intelligence research.

Learning is enhanced by the use of dialogue-based tutoring systems, which engage students in natural language interactions. In a tutoring system, students are asked questions, their responses are evaluated, and further information or feedback is provided as needed. Students with special needs can benefit from this kind of system since it can tailor its material to each individual's interests and learning style. The dialogue-based tutorial system may engage in conversation with the learner to enhance their understanding of mathematical concepts whenever the student desires to learn about them.

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## V.     AI-POWERED TOOLS FOR LEARNING DISABILITIES

Artificial intelligence (AI) can increase accessibility and learning outcomes for a variety of distinct learning challenges by providing specialized tools and resources. Some ways that AI is helping kids with impairments are as follows:

### AI for Vision Impairment

Artificial intelligence provides a great boon to visually impaired students by way of tools that make it easier for them to access course materials:

- Text-to-Speech Software: Applications powered by artificial intelligence may transcribe text into spoken language, making written content accessible to visually challenged youngsters through their hearing.
- Screen Readers: To help people with visual impairments access digital material, advanced screen readers powered by AI can provide real-time descriptions of what's on a screen, including photos, graphs, and complicated layouts.
- Braille Translation: AI has the capability to convert text into Braille automatically, which opens up a world of instructional materials for tactile readers.
- AI-Enhanced Magnification: Intelligent magnification powered by AI can adapt to the user's requirements, making digital content more readable without introducing any distortion.

### AI for Hearing Impairment

Artificial intelligence (AI) offers new ways to help students who are hard of hearing overcome classroom communication barriers:

- Real-Time Transcription: Transcribing services powered by AI make it possible for students to follow along with lectures and class discussions by instantaneously turning audible speech into text.
- Automated Captioning: Tools driven by AI can automatically create video captions, allowing children with hearing loss to fully participate in multimedia experiences.
- Sign Language Recognition: To help students and instructors communicate, artificial intelligence is being worked on to recognize sign language and convert it into text or voice.
- Speech-to-Text Applications: Children with hearing loss will have an easier time understanding and joining in on discussions because to AI's ability to transcribe spoken language into text.

### AI for Mobility Impairment

Children with mobility disabilities are seeing a sea change in their interaction with instructional content due to AI technologies:

- Voice-Activated Software: Learners with restricted mobility may now autonomously access digital information thanks to AI, which allows them to manage computers and other devices via voice commands.

- Adaptive Input Devices: Adaptive gadgets powered by artificial intelligence (AI) provide students new ways to engage with computers, such eye-tracking software or specialized keyboards.

- Virtual Manipulatives: Children who have trouble moving around may still participate in hands-on learning activities thanks to AI-powered digital replicas of traditional educational manipulatives.

- AI-Assisted Robotics: Learners may gain more independence in their everyday lives and in the classroom with the help of AI-powered robots that can do tasks that need physical engagement.

**AI for Cognitive Impairment**

Artificial intelligence apps provide tailored assistance to kids with cognitive disabilities, boosting their learning and achievement potential:

- Personalised Cognitive Exercises: To improve memory, focus, and problem-solving abilities, AI may design individualised cognitive workouts that are modified according to the student's development.

- Task Management Tools: Learners may promote independence and self-regulation with the support of AI-powered tools that organize work, provide reminders, and break down difficult activities into simple stages.

- Memory Aids: Digital memory aides made possible by AI can help children with cognitive impairments remember things, follow directions, and do their homework.

- Behavioural Monitoring: Learners' real-time behavior may be tracked by AI systems, which can then recognize patterns that could indicate cognitive overload or stress and provide solutions accordingly.

## VI.    CONCLUSION

The use of AI has the potential to greatly improve educational opportunities for students with disabilities by solving persistent problems with accessibility, customization, and inclusion. Adaptive learning systems, intelligent multimedia tools, and AI-driven assistive technologies allow for the development of versatile learning spaces that adequately address the varied requirements of students with sensory, cognitive, and physical impairments. Learner engagement, understanding, and academic achievement are all enhanced by AI since it enables individualized training, real-time feedback, and accessible material delivery.

Ethical, technological, and institutional considerations must be carefully considered for the effective application of AI in disability-inclusive education. Systematically addressing issues like data privacy, algorithmic fairness, gaps in digital infrastructure, and educator readiness is necessary to guarantee ethical and equitable deployment of AI. With careful and ethical implementation, artificial intelligence has the potential to greatly benefit inclusive education. By carefully incorporating it into educational systems, we can help students with disabilities overcome obstacles to learning, increase educational equity, and take part in all aspects of formal and informal education.

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