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Artificial Intelligence in Inclusive Education: Applications and Challenges for Learners with Disabilities

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Abstract: Artificial Intelligence (AI) is becoming an important technology in education. It can support learners by improving access to educational content, providing personalized learning support, assisting communication, and helping teachers. For learners with disabilities, AI-based assistive technologies can reduce some barriers to learning and participation. This paper provides a descriptive review of the use of AI in inclusive education, with particular attention to learners with disabilities. It discusses common applications such as speech recognition, text-to-speech, computer vision, adaptive learning, intelligent tutoring, and communication support. The paper also considers the main benefits and challenges of these technologies. The literature indicates that AI can improve accessibility, learning support, communication, participation, and learner independence. However, issues related to privacy, cost, accuracy, bias, infrastructure, teacher training, and human interaction remain important. The paper concludes that AI should support learners and teachers rather than replace human involvement. Responsible and learner-centred use of AI can contribute to more accessible and inclusive education.

Keywords: Artificial Intelligence, Inclusive Education, Assistive Technology, Learners with Disabilities, Accessibility, Personalized Learning.

I. INTRODUCTION

Education is an important part of individual and social development. Every learner should have an opportunity to access quality education. However, learners with disabilities may face difficulties in accessing educational content, communicating with teachers, participating in classroom activities, and completing learning tasks. Inclusive education aims to reduce these barriers and provide meaningful learning opportunities for all learners. Technology has played an important role in this process. Traditional assistive technologies, including screen readers, text-to-speech software, captioning tools, and alternative communication systems, have helped learners access educational materials. The development of AI has expanded these possibilities by allowing digital systems to recognise speech, process language, analyse information, and respond to individual needs [1], [2].

Recent research shows growing interest in AI for learners with disabilities. Studies have examined AI-supported learning, assistive technologies, communication systems, intelligent tutoring, adaptive learning, and other applications [1]–[5]. These studies suggest that AI can improve access, personalization, communication, engagement, and independence. At the same time, privacy, accuracy, bias, cost, infrastructure, and teacher readiness remain important concerns [1], [4], [5].

This paper provides a descriptive review of AI in inclusive education. It focuses on major applications, potential benefits, challenges, research gaps, and future directions. The aim is to present the topic in a clear and practical way rather than through complex statistical analysis.

II. OBJECTIVES OF THE STUDY

The main objective of this paper is to understand how Artificial Intelligence can support inclusive education for learners with disabilities. It also examines the major AI applications used for educational support, the benefits reported in the literature, the challenges associated with implementation, and future possibilities for AI-based assistive technologies.

III. REVIEW APPROACH

This paper follows a descriptive literature review approach. Relevant academic articles and review studies related to Artificial Intelligence, inclusive education, assistive technology, special education, and learners with disabilities were examined. Particular attention was given to research that discusses educational applications of AI rather than AI used only for medical diagnosis.

The literature was considered under four broad areas: applications of AI, support provided to learners with disabilities, benefits of AI-based technologies, and challenges of implementation. The review is intended to provide a clear synthesis of the literature without statistical meta-analysis or complex modelling.

IV. ARTIFICIAL INTELLIGENCE AND INCLUSIVE EDUCATION

Artificial Intelligence refers to computer systems that can perform tasks that normally require human intelligence. These tasks may include recognising patterns, understanding language, processing information, making predictions, and providing recommendations. In education, AI is increasingly being used to support teaching and learning. For learners with disabilities, AI can provide additional support because educational needs can vary significantly between individuals. One learner may need support with reading, another may require communication assistance, while another may need an alternative way to interact with digital content. AI can provide different forms of assistance according to these needs [2], [3]. Inclusive education requires more than placing learners with disabilities in the same classroom. It also requires reducing barriers that prevent meaningful participation. AI-based assistive technologies can contribute to this goal when they are designed around learner needs and used together with appropriate teaching support [4], [5].

V. APPLICATIONS OF AI FOR LEARNERS WITH DISABILITIES

A. Speech Recognition

Speech recognition converts spoken language into text. It can help learners who have difficulty writing or accessing spoken classroom information. It can also support communication between learners and teachers and provide an alternative to conventional keyboard or writing input [1], [2].

B. Text-to-Speech

Text-to-speech technology converts written information into spoken language. It can help learners who have difficulty reading printed or digital content and can improve access to educational materials. It is particularly useful for learners with visual or reading-related difficulties [2], [3].

C. Computer Vision

Computer vision enables computers to interpret images and other visual information. In inclusive education, it can support visual assistance, object recognition, and gesture-based interaction. Such applications can help reduce barriers when learning activities depend strongly on visual information [4], [5].

D. Adaptive Learning

Adaptive learning systems can adjust learning content according to learner performance. A learner who needs more practice may receive additional activities, while a learner who progresses quickly may receive more advanced content. This can make learning more flexible and responsive to individual needs [3], [5].

E. Intelligent Tutoring

Intelligent tutoring systems provide learning assistance through explanations, questions, feedback, and practice. They can be useful for learners who need repeated explanations or individual support. Research on AI in special education has identified intelligent tutoring among the approaches being explored for learners with disabilities [3], [5].

F. Communication Support

AI can support communication through speech, text, symbols, and other forms of interaction. These systems may help learners who experience communication difficulties participate more effectively in classroom activities and interact with teachers and peers [1], [2].

VI. BENEFITS OF AI IN INCLUSIVE EDUCATION

One of the main benefits of AI is improved accessibility. AI can convert information from one form to another, allowing learners to access content in a format that better matches their needs. This can reduce barriers created by traditional learning materials.

AI can also provide personalized learning support. A traditional classroom may not always allow teachers to provide individual attention to every learner. AI-based systems can provide additional practice, explanations, feedback, or alternative learning materials. Personalization is an important theme in recent research on AI and special education [3]–[5].

Another benefit is improved communication. Speech recognition, language technologies, captions, and other AI-based tools can help learners communicate and interact with educational content. These technologies may increase participation when communication is a major barrier.

AI may also support greater independence. When learners can access content, communicate, or complete certain tasks with less assistance, they may gain greater control over their learning. Research on AI-based assistive technologies has reported potential benefits for learner support and independence [4], [5].

Teachers can also benefit from AI. AI may assist with preparing accessible materials, providing learning recommendations, and supporting routine educational activities. However, AI should assist teachers rather than replace them. Teachers remain important for understanding learners, selecting suitable strategies, and providing human support.

VII. CHALLENGES OF AI IN INCLUSIVE EDUCATION

Despite its potential benefits, AI also creates challenges. Privacy is one of the most important concerns because AI systems may collect information about learners and their learning behaviour. Educational institutions therefore need appropriate measures to protect this information.

Cost and infrastructure can limit adoption. Some AI technologies require suitable devices, reliable internet access, software, and technical support. These requirements may be difficult for schools with limited resources. Recent reviews have identified accessibility, cost, technical barriers, and limited teacher readiness as important challenges [4], [5].

Accuracy is another concern. AI systems can make mistakes. Speech recognition may misunderstand a learner's speech, while a computer-vision system may incorrectly interpret visual information. Such errors can affect learning if the technology is used without human checking.

Bias is also important. AI systems are developed using data. If those data do not adequately represent learners with different disabilities, languages, cultures, and backgrounds, the system may not work equally well for everyone. Responsible development therefore requires attention to fairness and representation [4], [5].

Teacher training is another practical issue. Providing an AI tool does not automatically result in effective use. Teachers need to understand what the tool can do, what its limitations are, and when it should or should not be used.

Finally, AI cannot replace human interaction. Education includes encouragement, motivation, emotional support, social interaction, and professional judgement. These human elements remain central to inclusive education [1], [5].

VIII. DISCUSSION

The reviewed literature shows that AI has considerable potential to support inclusive education, particularly when it is used to address a specific learning barrier. The value of AI is therefore not simply in using advanced technology, but in using appropriate technology for an identified learner need.

For example, a learner with a visual disability may benefit from text-to-speech and visual assistance. A learner with a hearing disability may benefit from captions or speech-to-text systems. A learner with reading difficulties may benefit from reading support and personalized learning. These examples show that inclusive AI needs to be flexible rather than based on a single solution for every learner [2]–[5].

The literature also suggests that AI should be viewed as part of a wider educational support system. Recent reviews report promising applications while also stressing the need for stronger evidence, teacher readiness, privacy, and equitable access [1], [4], [5]. Technology should therefore be introduced alongside appropriate teaching practices and institutional support.

A human-centred approach is important. Learners with disabilities should have a voice in the development and evaluation of AI tools. Teachers should remain involved in decisions about how technologies are used. The aim should be to increase access and participation rather than simply automate educational activities.

IX. RESEARCH GAPS

Although research on AI and inclusive education is increasing, several areas require further attention. More research is needed in real classrooms because the effectiveness of a technology in a controlled study may differ from its use in everyday educational settings.

Research is also needed across a wider range of disabilities. Recent reviews show that some areas, including autism and learning disabilities, receive more attention than other disability groups [3]–[5]. More balanced research would help ensure that AI development does not leave particular learners behind.

There is also a need for more research in developing countries and resource-limited settings. Technologies developed for well-resourced environments may not always be affordable or practical elsewhere. Local languages, connectivity, device availability, and teacher support should be considered.

Teacher and learner perspectives also require greater attention. Technologies should be evaluated not only for technical performance but also for usefulness, ease of use, acceptance, and actual educational value.

Finally, more long-term research is needed. Short-term improvements do not necessarily show whether AI creates lasting educational benefits. Future studies should examine sustained learning, participation, independence, and learner well-being.

X. FUTURE DIRECTIONS

Future AI development for inclusive education should focus on technologies that are simple, accessible, affordable, and reliable. The best solution is not always the most technically advanced solution. A tool that solves a specific problem effectively may be more useful than a complex system that is difficult to operate.

Learners with disabilities should be involved in the design and testing of AI systems. Their experiences can help developers understand whether a technology actually reduces the barrier it was designed to address. Teachers should also be involved so that AI tools fit practical classroom needs.

Privacy, fairness, accessibility, and safety should be considered from the beginning of development. AI systems should also be tested with learners from different backgrounds and educational settings. For countries such as India, local languages and differences in digital access should receive particular attention.

Future research should move beyond demonstrations of technology and examine educational outcomes in real settings. This would provide stronger evidence about when AI is useful, for whom it is useful, and under what conditions it should be implemented.

XI. CONCLUSION

Artificial Intelligence has the potential to support more inclusive education for learners with disabilities. Speech recognition, text-to-speech, computer vision, adaptive learning, intelligent tutoring, and communication technologies can help reduce barriers to learning.

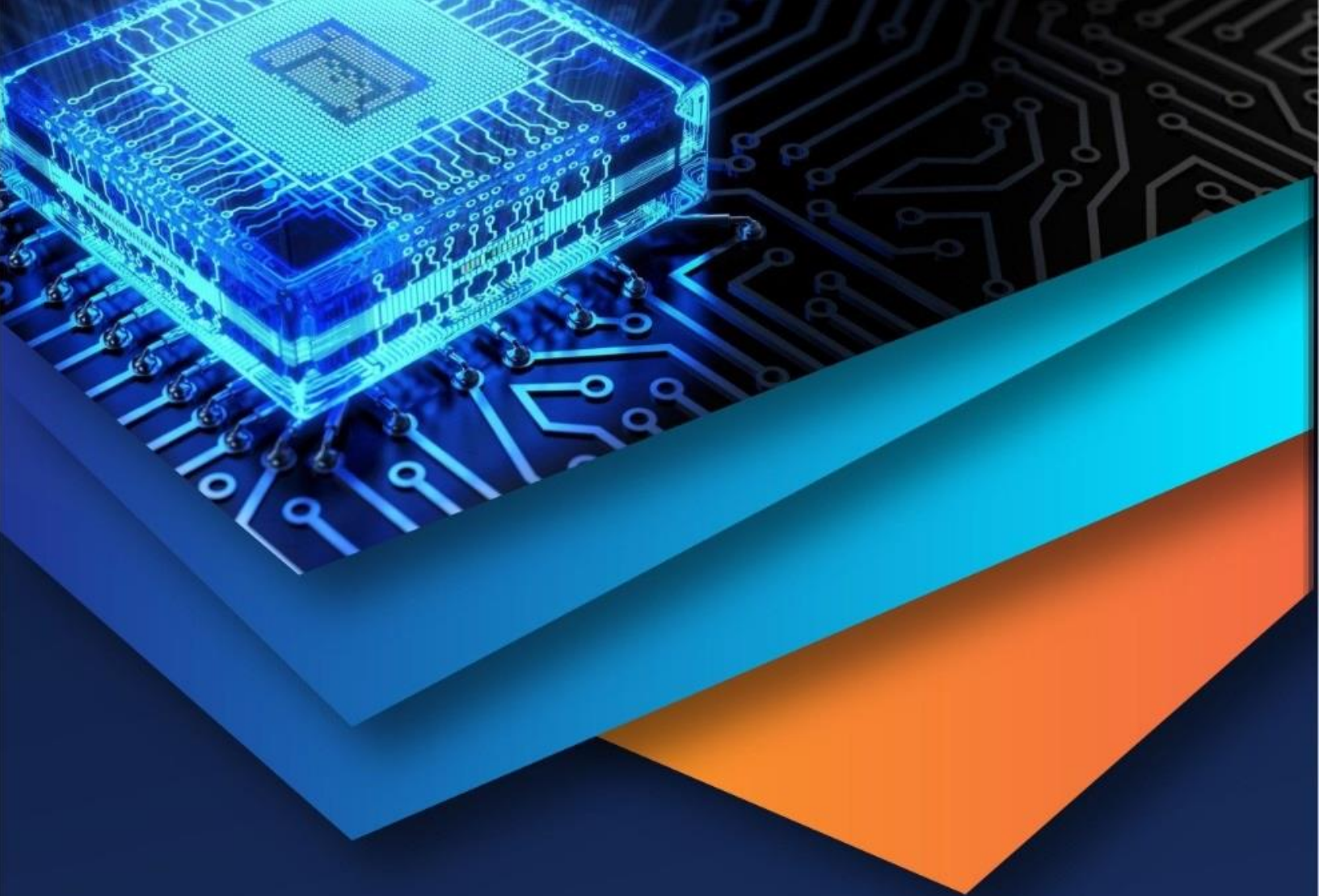
The major potential benefits include improved accessibility, personalized learning, better communication, greater participation, and increased independence. At the same time, privacy, cost, infrastructure, accuracy, bias, teacher training, and human interaction remain important concerns.

AI should therefore be introduced carefully and responsibly. It should support teachers and learners rather than replace human involvement. The success of AI in inclusive education should ultimately be judged by whether it makes learning more accessible, meaningful, and useful for learners with disabilities.

With appropriate design, learner participation, teacher involvement, and responsible implementation, AI can become a valuable tool for creating more inclusive educational environments.

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