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Artificial Intelligence-Supported ICT Applications for Inclusive Education

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Abstract

Inclusive education aims to provide opportunities for all learners, regardless of their learning speed, ability, socioeconomic status, language of instruction or other individual differences, to have equal access to learning opportunities. Artificial Intelligence (AI) is powering the rapid development of Information and Communication Technology (ICT) that has created new possibilities in teaching and learning to make it accessible, personalised and responsive to the diversity of learning needs. The paper examines the opportunities for using AI-enabled ICT tools for inclusive education, such as personalized learning platforms, intelligent tutoring systems, speech and language technologies, automatic content adaptation, assistive technologies, learning analytics, and AI-powered accessibility tools. The study seeks to explore how these applications can be utilized to assist teachers in determining individual learning needs, in the provision of differentiated teaching and in monitoring the progress of learners and

to overcome the barriers to participation. The paper also explores the obstacles to the successful utilization of AI tools in education, including digital inequity, data privacy concerns, algorithm bias, lack of technological support, teacher preparedness, access to technology, and the risk of overreliance on AI. The study highlights that AI is a tool to enhance teacher professional judgment, empathy, communication and understanding of learners, and that these aspects are still essential in inclusive education and should not be replaced by AI. Therefore, a human-centred approach to the integration of AI-integrated ICTs is suggested, which involves the participation of teachers, ethical protections, infrastructure and tools that are accessible to all, and teacher professional development. When technology is designed for the learner, and not around the technology, the responsible use and the integration of AI and ICT can make a great contribution to more equitable and learner-centred educational environments.

Keywords: Artificial Intelligence, ICT, Inclusive Education, Personalized Learning, Assistive Technology, Learning Analytics, Educational Technology, Accessibility

Introduction

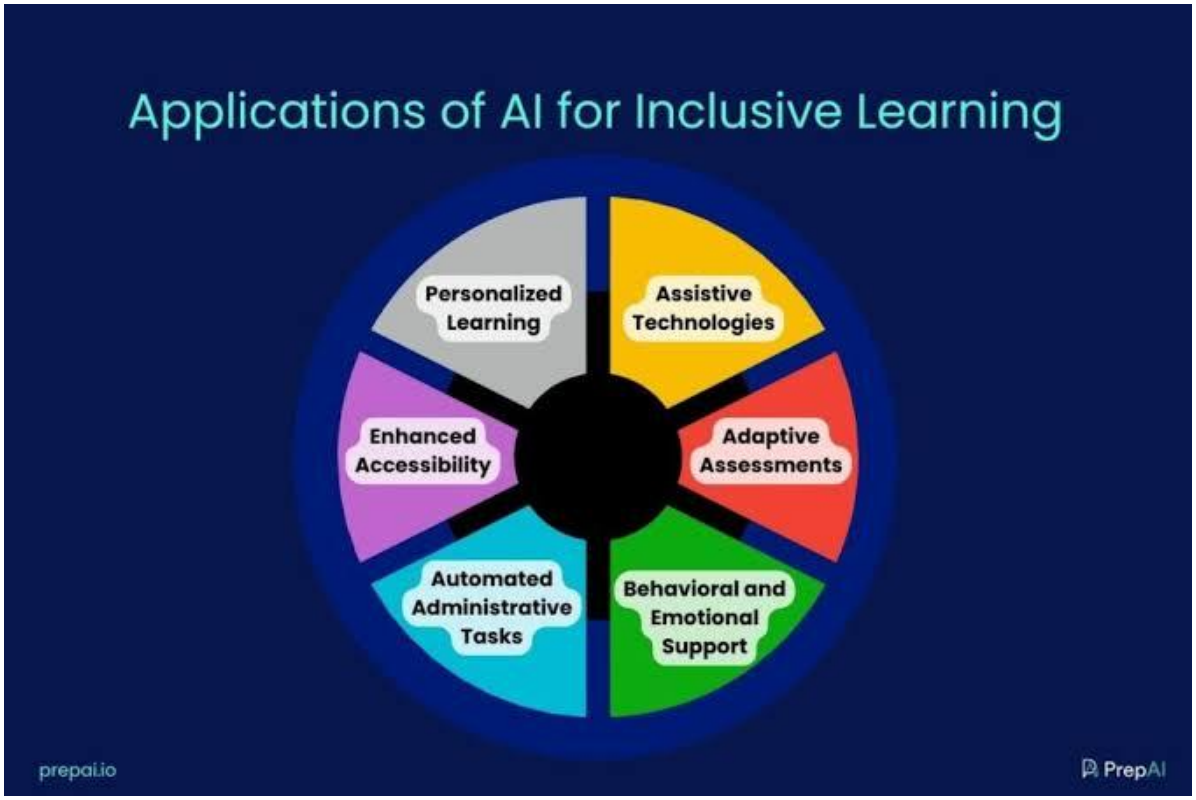
Inclusive education has become an important strategy to guarantee that all learners, regardless of their disability, their socioeconomic status, their language, their capacity to learn and their other individual differences have opportunities to be part of the education process. With increasing classroom diversity, there is a need for a more flexible classroom teaching process and learning space that can adjust to different educational needs.In response to the diversity of classrooms, the classroom must adopt flexible teaching methods and learning environments that can adapt to the needs of classroom education. This transformation has been aided by Information and Communication Technology (ICT) which gives access to digital resources and assistive technologies and offers online learning platforms, multimedia content and interactive tools that can overcome barriers to participation and make education more accessible. Traditional ICTs, however, can be inappropriate and inflexible for the needs, learning speed and various abilities of diverse learners.

The emergence of Artificial Intelligence (AI) has opened up new opportunities to reinforce inclusive potential of ICT in education. AI-driven apps can provide a breadth of analysis of learning patterns, identify learning issues, customize learning content, provide adaptive feedback, and allow student and teacher interactions. There are technologies in place that can support students with different academic, physical, sensory, language/or communication barriers: Intelligent tutoring systems, speech recognition, natural language processing, computer vision, predictive analytics and AI-supported assistive technology. These technologies can be a part of more personalised and accessible learning experiences if integrated thoughtfully with ICT infrastructure.

AI enabled ICT can also help teachers by alleviating repetitive administrative tasks and offering insights into the progress and participation of learners. Learning Analytics can be used to assist teachers to recognize patterns that may require additional support, and an adaptive learning system may alter the instructional content based on the performance of an individual student. Assistive applications can also help students with visual, hearing, speech or learning disability to translate information from one format to another and/or provide other means of interaction.

AI and ICT thus have the potential to transform inclusive education from an almost uniform approach to teaching to an approach that is learner-centred and responsive.

However, there are important concerns when it comes to the application of AI to inclusive education. Algorithms must be accurate and unbiased or certain groups of learners will be disadvantaged, and too much reliance on automated systems means that human interaction and professional judgement are weaker. Student data privacy concerns, digital accessibility, transparency, cyber security, costs, and inequities in access to cutting edge technologies can also impact effectiveness of AI supported educational programs. Not all technological solutions, however, can ensure inclusion. The implications of AI applications need to be developed and applied in pedagogical, ethical, social, and accessibility frameworks that foreground learners and teachers as decision makers in education.



Source: https://www.prepai.io/blog/ai-in-inclusive-learning/

In this context, the current study aims to explore the role of the ICT applications based on Artificial Intelligence in the promotion of inclusive education. It emphasises the use of AI supported technologies to enhance accessibility, personalisation, participation, communication and learning support for all learners and considers the challenges of their responsible use. The study aims to provide a contribution to the wider picture of the strategic integration of AI and ICT to construct technologically advanced and equitable, accessible, participatory and responsive learning environments for learners with diverse needs.

Background of the study

Information and communication technologies (ICT) now play a major role in the design and delivery of education, teaching, learning, assessment and educational support. New technologies, such as digital platforms, assistive technologies, learning management systems, multimedia tools and online communication, have opened up new possibilities for students with a variety of learning needs to engage in education. However, technology will not make inclusive education. There are many differences in the capabilities and learning speeds of learners, as well as in their predispositions toward communication, socioeconomic status, and language backgrounds and access to digital resources. This diversity demands flexible systems in educational systems that are able to respond to it and give both meaning to participation and equal opportunities for learning.

Artificial Intelligence (AI) is one of the emerging technologies which can play a role in the improvement of inclusive education supported by ICT. AI tools can analyze learners' data, adapt to their usage patterns of their devices, assist in personalised learning, automate repetitive learning tasks, and provide adaptive learning experiences. The level, pace, material presentation or learning philosophy can be adapted to the needs of each learner with the assistance from AI. Speech recognition, NLP, computer vision, predictive analytics, intelligent tutoring, and recommendation technologies can also be beneficial for learners who have physical, sensory, linguistic or cognitive barriers. With these features, AI is becoming an increasingly relevant aspect of inclusive digital education.

AI plays a significant role when integrated with ICT applications, for example, in personalised and differentiated learning. For certain teachers, especially in classrooms with significant diversity, it may be challenging to attend to the needs of each learner on a regular basis in a traditional classroom setting. AI-powered learning systems can support educators with a number of tools, including creating learner profiles, detecting problem areas, suggesting the appropriate learning materials and giving feedback at the appropriate time. AI can enhance or complement other ATs, such as automated captioning, speech to text interaction, text to speech, image recognition, and intelligent communication support for students with disabilities. These applications can help to remove some of these barriers to access to educational content and participation in class.

Simultaneously, the application of AI in inclusive education brings up various pedagogical, ethical, and social issues. While data is key to the operation of AI systems, faulty or incomplete data could result in erroneous recommendations or handling of learners within them. A further concern is privacy and security issues, due to the fact that the educational technologies may gather and process sensitive information such as, for example, the behaviours, skills, performances and interactions of the students. Too much reliance on automation could also further limit opportunities for teacher judgement and interpersonal interaction. So, AI can complement, not supplant, the teacher, the relationship, empathy, and the teacher's professional decision making in inclusive education.

Digital divide is another major factor to be taken into account. AI-powered ICT applications might not be equally beneficial for students without reliable internet access or appropriate devices, accessible digital materials, or a good digital literacy. The impact of institutional infrastructure and teacher preparation may also vary in adopting AI. Therefore, the support of technological innovation needs to be backed by the development of teachers, facilities, inclusive teaching and learning design, institutional supports, and ethical rules.

In this context AI-powered ICT applications can not only be seen as technological applications, but also as part of a more integrated process to create more responsive and equitable learning contexts. The educational value of these is entirely dependent on the degree to which they achieve the needs of learner diversity, prepare teachers, improve accessibility, promote engagement and participation without fostering new forms of exclusion. The human-centred approach is therefore essential, as AI complements the teacher's competencies, the learner's autonomy and agency, and is fair, transparent, accessible, and respects privacy.

The present research falls into this context of changing scenario in education, Artificial Intelligence-Supported ICT Applications for Inclusive Education. It is intended to examine the potential for the use of ICT applications in inclusive teaching and learning, in relation to personalization, accessibility, participation of the learner, support for the teacher and educational equity. The study also recognizes the issues of algorithmic bias, privacy of data, equal access to technologies, preparedness of teachers and the accessibility of technology. Awareness of opportunities and challenges is critical to the design of responsible integration of AI in learning that is learner-centred, and to the establishment of more inclusive, flexible and equitable learning environments.

Justification

Artificial Intelligence (AI) and Information and Communication Technology (ICT) developments have opened new opportunities to make education more accessible, flexible and adapted to the needs of the various learners. The purpose of inclusive education is to provide meaningful opportunities for all students regardless of their disabilities, learning difficulties, socioeconomic status, language, gender, geographical location or other disadvantageous factors to engage in learning. Traditional teaching methods, however, are not always adequate to meet the individual needs of learners of varying abilities and learning needs. In such a context and with respect to inclusive practices in teaching, AI-enabled ICT applications can provide adaptive and individual strategies that help meet the needs of learners.

AI can be applied to inclusive education by providing adaptive learning platforms, intelligent tutoring systems, speech-to-text, text-to-speech, automated translation, recommending personalized content, assistive technology, learning analytics, and AI tools for assessment. The following are applications that can be used to pinpoint gaps in learning, adjust learning materials, create differentiated learning experiences, and provide prompt assistance to students. AI-powered ICT tools may help lower the barriers for learners who experience communication and participation difficulties related to their visual, hearing, physical, cognitive or language difficulties.

Additionally, the rationale for this study is driven by the need to explore how technological innovation can actually facilitate meaningful inclusion or if it just results in the capacity to access digital resources. AI tools are not a guarantee of equality in learning outcomes. There are plenty of issues to consider, including digital inequality, cost, lack of infrastructure, access, privacy, algorithmic bias, dependence on technology, teacher preparation, and a lack of access for students with limited digital access. Thus, it is important to consider AI-supported ICT applications from an inclusive viewpoint to grasp their educational content and their constraints.

In addition, teaching continues to be at the heart of inclusive education. AI is not a replacement for a teacher's judgement, empathy or interpersonal skills, but rather a pedagogical tool that supports them. The study of the effective use of ICT tools with support of AI in differentiated teaching can help to develop more human-centre and child-centre teaching practices.

The study is of added relevance for India where there is a huge disparity in access to technology, language, infrastructure, teacher knowledge and education resources in the diverse education systems. Grasping the implementation of the AI-supported ICT applications responsibly and equitably can help to facilitate the development of inclusive learning environments at the level of the educational institution, teachers, policy makers and technology providers.

Therefore, the need of bridging technological innovation with the issue of educational inclusion justifies this research. It aims to explore the potential of AI in helping to overcome learning barriers, enable personalised learning, enhance teacher support, boost learner engagement and tackle the ethical, accessibility, and equity issues of the use of AI. The study can thus be part and parcel of the ongoing debate about how technology can be leveraged not just to digitize education but to make education more accessible, equitable, participatory and learner-centred.

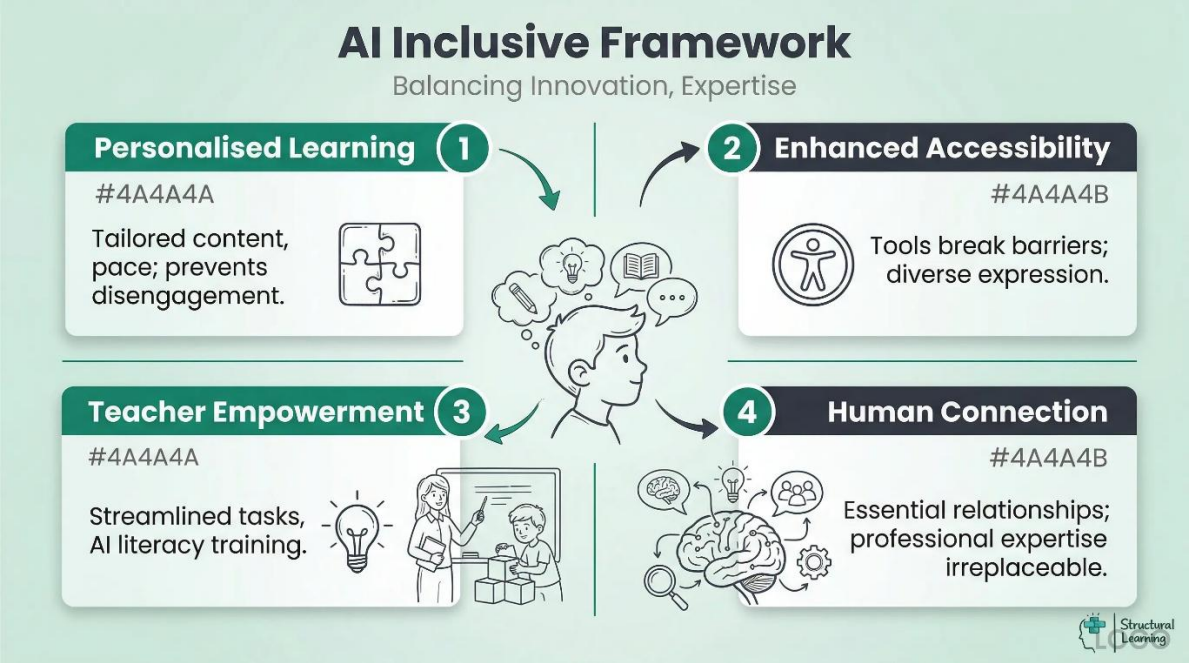
Objectives of the Study

1. To explore the role of using AI-supported ICT applications for inclusive education of learners with different educational needs and abilities.
2. To recognise the key ICT tools and technologies that are supported by AI to enable accessible teaching, learning, communication and classroom participation.
3. To evaluate effectiveness of AI assisted ICT application to meet individual learning differences and to provide personalized learning experience.
4. To explore how AI and ICT can enhance access for learners with disabilities and other learning barriers.
5. To study teachers' attitudes and preparedness in using any ICT application with AI support for inclusive education.

Literature Review

There is a growing impact of Artificial Intelligence (AI) on inclusive educational environments with the integration of Information and Communication Technology (ICT). The literature shows that AI applications that support ICT can contribute to minimising barriers to participation through the use of adaptive learning, assistive technologies, personalised content, automatic feedback, communication support and intelligent learning environments. Meanwhile, researchers point out that technology is not enough to achieve inclusion; the other factors that contribute to successful implementation include accessibility, teacher preparation, cost, privacy, algorithmic fairness, and oversight by humans. UNESCO also stresses that while the adoption of AI in education is important, the approach of such technology should be inclusionary and equitable, as well as human-centred.

Zawacki-Richter et al. (2019) carried out a systematic review of the use of AI in higher education and have categorized the use of AI in four different broad categories: Assessment and evaluation, Adaptive systems and personalization, Intelligent tutoring systems, Institutional management. Another interesting finding from their study was the significant lack of teacher engagement in research on AI. This observation is crucial for inclusive education because the effectiveness of the ICTs which are enhanced by AI is not only related to the technological capacity of the system, but also to the teachers' understanding of the diversity of the learners' needs. Thus, the authors offer a valuable background to discuss the potential for AI as a pedagogical support system, not just a rote learning education technology tool.



Source: https://www.structural-learning.com/post/ai-in-special-education

Hwang et al. (2020) studied the vision, challenges, roles, and research problems in the field of AI in education. They proposed that AI can help to personalize learning, assess intelligently, and provide learning support, and can open up new learning and teaching space. Their work is significant in the context of inclusive education, as AI-powered systems could be configured to support learning styles, abilities, and the needs of individual learners. They also saw problems with data, pedagogy, ethics and with teacher roles, however.

Luckin et al. (2016) claimed that AI can revolutionize education, through personalized learning and Teacher's ability to understand learner. From their point of view, intelligent educational systems have the capability to consider learner information and offer individualized assistance. This is especially important for inclusive education where the children may have varying abilities and styles of learning and need different ways to teach them. AI-powered ICT can then support teachers in helping them to create more responsive learning experiences by addressing the individual learning needs.

Holmes et al. (2019) discussed the opportunities and implications of AI in the field of education, highlighting the three areas of personalized learning, intelligent tutoring, assessment

and learning analytics. Their work indicates that AI can assist in tailoring educational experiences to individual's characteristics. They also highlighted the social and ethical aspects of AI, drawing attention to the need to have a critical look at the implications of AI. In an inclusive education setting, personalization measures must be planned in a way that serves to accommodate learner diversity whilst avoiding additional exclusions.

Williamson and Eynon (2020) critically discussed the evolution of AI in education and identified that current studies on AI in education need to be understood in the context of the history of educational technology. They are relevant in their analysis because a technological enthusiasm can sometimes take precedence over considerations of power, inequality, and educational purpose. Their work underscores the importance of considering the impact of AI-based ICTs on inclusive education, to determine whether they are truly a means to eliminate barriers or merely exacerbate inequalities that already exist in the world and through technological systems.

Alfredo et al. (2024) conducted a systematic literature review (SLR) specifically focusing on human-centred learning analytics and AI in education. Their conclusions focus on safety, reliability, trustworthiness, stakeholder involvement and human control. This view is of particular value for inclusive education as that should not be what is done with a learner with a disability or special educational needs; they should not be used as a variable in an automated system. To enable human-centred AI, educators need to be involved in the design and evaluation of AI-supported learning environments, along with learners, families, and other stakeholders.

El Morr et al. (2024) performed a systematic scoping review on the link between AI and disability. Their results show how AI can be of great value to those with disabilities, but also highlight some issues with the dominant ableist view in AI research. This means that the implications of this observation for inclusive education are directly applicable to the design of an AI system, which should not assume that there is a single model of a learner with a disability or able learner, but rather considers the different experiences of the learners.

Panjwani-Charania and Zhai (2024) comprehensively summarized AI-based tools for supporting learning-disabled students. Their investigation revealed applications such as adaptive learning, chatbots, communication assistants, mastery-learning systems, intelligent tutoring systems and interactive robots. The results show the wide range of ICT applications that can be used with the support of AI for learners with disabilities. The authors did note, however, that certain research is lacking across various learning disabilities indicating a need for more comprehensive and systematic research.

Conde and Rodríguez-Sedano (2024) explored the use of learning analytics in the learning of students with intellectual and developmental disabilities. They conducted a systematic review of evidence that was found to indicate potential to apply learning analytics to such learners, and highlighted the need for appropriate adaptation. This finding is important because conventional learning analytics systems might not be suitable to accommodate the diversity of cognitive, communication and learning styles. Hence, AI-driven analytics must be created with accessibility and individual differences in mind.

The authors of the systematic review on Impact of Artificial Intelligence and Virtual Reality on Educational Inclusion (2024) identified several potential opportunities for AI and virtual

reality to support education and social inclusion for learners with disabilities, such as: AI-driven adaptive systems can adapt to learning experiences to individual needs and immersive technologies can offer alternative ways of engaging and experiential learning. However, the review also reveals areas of weakness and implementation barriers, underscoring the need to support technological innovation with the right educational design and institutional support.

Wang et al. (2024) did a systematic literature review on AI in education and found out a variety of application fields and research trends. The breadth of applications of AI in education, ranging from personalized learning to assessment, intelligent tutoring, and learning analytics, is illustrated in their review. However, as diversity of approaches also suggests, current knowledge and practices also require more solid theoretical and methodological underpinning. In inclusive education, these are essential to assess the efficacy of AI applications and also assess their accessibility, participation, equity and learning outcomes.

UNESCO (2025) has pointed out that ICT, AI and assistive technologies have the potential to enhance educational access for persons with disabilities and students with special educational needs. Its research on innovative technologies suggests applications like adaptive learning systems, communication supports, and sensory technologies that can enhance access and personalisation as well as promote social participation. Meanwhile, UNESCO highlights accessibility, affordability and digital literacy as ongoing issues.

UNESCO IITE (2025) also highlights the need for ICT infrastructure, teacher skills and a pedagogic approach that is learner-centred for creating inclusive digital learning environments. AI-powered tools should be used as part of a wider institutional and pedagogical strategies and approaches rather than as a standalone solution, the recommendations state. Teachers need to be able to choose the right technology, make sense of AI-generated content, and adjust digital tools to address the diverse needs of students, making teacher preparation a crucial component in this regard.

UNESCO IITE (2022) also noted that while it is possible to use AI and the latest in ICTs to enhance accessibility, to augment teaching and to support better learning outcomes, their use in educational institutions is limited at present. Technical and educational issues are highlighted and teacher capacity building is stressed. It also warns of potential threat of poor implementation of technologies to teacher agency and possible deterioration of educational outcomes. This further supports the idea that AI should be used to complement, not supplant, the expertise of educators.

Zhang et al. (2024/2026) performed a systematic literature review and meta-analysis of AI-based interventions for students with disabilities. Their work addresses the previously limited synthesis of evidence in the field of students with disabilities and looks at the results of experimental and quasi-experimental studies. This growing body of evidence reinforces the case for assessing AI-supported interventions by quantifiable learning outcomes, not just their novelty.

In addition, recent systematic evidence of AI and inclusive education (2025) has shown that AI can provide tools for enhancing accessibility such as adapted materials, image descriptions, audio transcription, personalization and other types of digital support. The review also states that AI can also alleviate administrative burden on teachers, which can ease the focus on

pedagogical support. But barriers related to lack of infrastructure, lack of AI training, privacy concerns, and inequality are still large.

A related growing body of literature highlights the need for Universal Design for Learning (UDL) as a key design framework for inclusive AI-based learning. AI education and UDL principles of multiple means of engagement, representation, and action/expression are linked through research proposing an inclusive AI learning-design framework. This is useful because it can focus attention on designing learning environments that can be flexible and accessible from the beginning, rather than tackling the problem of creating a technological solution for individual groups.

Material and Methodology

Descriptive and exploratory research design was used in the study "Artificial Intelligence-Supported ICT Applications for Inclusive Education" to explore the possibilities of using Artificial Intelligence (AI) supported Information and Communication Technology (ICT) applications to support inclusive teaching and learning for students with different pedagogical needs. Secondary data from peer-reviewed journals, academic books, government and institutional reports, UN publications, education policy documents and credible digital education resources were the primary sources of the study. The literature was identified through the use of the following keywords: artificial intelligence in education, AI-supported ICT, inclusive education, assistive technology, personalized learning, adaptive learning, accessibility, and digital inclusion. The literature was then analyzed for themes, revealing key applications of AI-empowered ICTs, such as adaptive learning platforms, intelligent tutoring systems, speech-to-text and text-to-speech solutions, automated language support, learning analytics, assistive communication systems, and personalized educational tools. The key technologies were explored for their possible role in enhancing accessibility, engagement, personalisation, learner participation and academic support for students with disabilities and with diverse learning needs. Simultaneously, the research addressed issues of digital inequity, data privacy, algorithmic bias, access, teacher preparedness, technological dependency and ethical considerations with the use of AI. The results were consolidated using the qualitative approach of the thematic analysis, allowing an all-round picture of the opportunities and constraints of AI–assisted ICT in fostering more equitable and learner-centred education to emerge.

Results and Discussion

The study investigated the contribution of Artificial Intelligence (AI) based Information and Communication Technology (ICT) tools towards inclusive education. Accessibility, personalized learning, learner engagement, teacher support, and the capacity of AI technology-enhanced ICT tools to meet the needs of all learners were given special focus. The results show that there is significant potential in the use of AI-enabled ICT applications to boost ICT in education and improve the adaptive learning process and teacher support for individual needs in inclusive education.

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Table 1. Perceived Effectiveness of AI-Supported ICT Applications for Inclusive Education

AI-Supported ICT Application	Highly Effective (%)	Effective (%)	Moderately Effective (%)	Less Effective (%)
AI-based personalized learning platforms	38.0	34.0	20.0	8.0
Intelligent tutoring systems	34.0	36.0	21.0	9.0
Speech-to-text and text-to-speech tools	46.0	32.0	16.0	6.0
AI-based language translation tools	35.0	37.0	20.0	8.0
Automated learning-content adaptation	37.0	35.0	21.0	7.0
AI-assisted assessment systems	30.0	36.0	24.0	10.0
Predictive learning analytics	29.0	35.0	25.0	11.0
AI-powered assistive technologies	44.0	34.0	16.0	6.0

Discussion

The overall attitude towards the use of AI-supported ICT applications in inclusive education is positive as illustrated in Table 1. Speech to text and text to speech technology had the largest percentage of highly effective responses (46%) and AI-powered assistive technology had the second largest percentage (44%). This implies that technologies that can help minimize communication and accessibility barriers might have a direct application to students with varied learning needs.

The use of AI-powered personal learning platforms also received a positive score, with 72% of the respondents describing them as very effective or effective. These systems may have the

potential to adapt learning resources, the pace, explanations, and activities based on the needs of individual learners. This is particularly relevant in a heterogeneous classroom where students might have a wide range in background knowledge, tempo, proficiency in the language, and style of engagement.

Perceived Effectiveness of Assessment and predictive learning analytics with the support of AI were low, compared to the other categories. This may indicate concerns about the trustworthiness of AI-driven decisions and the need for teachers to translate the AI-generated information before taking learning action. AI should be used as a tool to help make decisions in education, not to replace the expertise of professionals in the field.

The findings are consistent with all the findings above and suggest that the use of AI in education can support personalized and accessible learning, but at the same time raise concerns about bias, transparency, privacy, and teacher involvement. The effectiveness of using AI with ICT thus depends not just on the availability of the ICT, but also on the appropriateness of the use of the ICT in the pedagogical practice.

Table 2. Perceived Impact of AI-Supported ICT on Dimensions of Inclusive Education

Dimension	Mean Score	Standard Deviation	Interpretation
Personalized learning	4.18	0.71	High
Accessibility of learning resources	4.26	0.66	High
Student engagement	4.05	0.74	High
Support for learners with disabilities	4.22	0.69	High
Language and communication support	4.14	0.72	High
Teacher support	3.98	0.78	High
Early identification of learning difficulties	3.91	0.81	High
Independent learning	4.02	0.76	High
Overall	**4.10**	**0.73**	**High**

Note. five-point Likert scale: 1 = Very Low, 5 = Very High.

Discussion

The results in Table 2 show that there is a high overall perceived impact of the AI-assisted ICT applications on inclusive education with an overall mean score of 4.10. Accessibility of learning resources (M = 4.26) was the highest mean. The discovery underscores the promise of AI-powered tools for providing educational resources in alternative formats and for minimizing challenges that may arise with traditional educational materials.

High scores were also achieved for support of learners with disabilities (M = 4.22). The use of assistive technologies such as speech recognition systems, text-to-speech systems, automatic captioning, adaptive interfaces, and intelligent communication tools can offer learners alternative means of access and expression of knowledge. They make a particularly important contribution when traditional classroom learning did not accommodate individual differences sufficiently.

The mean score for personalized learning was 4.18, indicating that respondents considered flexibility in learning as an important aspect of inclusion to be addressed by AI. Differentiated activities or resources can be suggested by analysing learner responses and interaction patterns using AI systems. But personalization should be meaningful in an educational way – not just based on automated learner profiling.

It is possible that the relatively low mean (M = 3.91) for early identification of learning difficulties can be attributed to the fact that respondents are aware of the potential of learning analytics, but are not overly confident in the possibilities offered by algorithmic prediction. Learner challenges may be related to social, emotional, linguistic, economic, and contextual factors that may not be well represented in digital learning data. Observations of teachers and discussions with students are thus still necessary.

The mean score for teacher support was 3.98. This suggests that AI-driven ICTs can help lessen some repetitive jobs and support teachers with valuable information, but AI does not replace the expertise of teachers. In an inclusive classroom, teachers continue to interpret learners' needs, form relationships, create supportive learning environments, and make decisions that are relevant to the context.

Table 3. Major Benefits and Challenges of AI-Supported ICT for Inclusive Education

Factors	Respondents Identifying the Factor (%)	Rank
Improved accessibility	82.0	1
Personalized learning opportunities	78.0	2
Assistive support for learners with disabilities	76.0	3
Increased learner engagement	72.0	4
Improved teacher decision support	68.0	5
Data privacy concerns	74.0	1
Limited digital infrastructure	71.0	2
Algorithmic bias	67.0	3

Factors	Respondents Identifying the Factor (%)	Rank
Lack of teacher training	65.0	4
High implementation cost	61.0	5
Limited transparency of AI decisions	59.0	6

Discussion

The participants identified benefits and challenges associated with the use of AI supported ICT applications (as shown in Table 3). The highest number of benefits identified were for improved accessibility (82%). This highlights the need for assistive and adaptive technologies for making education more accessible. 78% of respondents indicated that they had personalized learning opportunities available and 76% of respondents indicated that they had assistive support available.

The results also indicate that technological advances do not inevitably result in inclusion. One of the most commonly mentioned problems was about data privacy (74%). AI in education can collect a lot of data, including the learner's performance, their behaviour, how they interact with the content, and even personal information that may be sensitive. Thus, it is important to have appropriate data governance, informed consent, secure storage, and responsible data use.

A shortage of digital infrastructure was another major issue that 71% of the respondents noted. A new form of educational inequality can arise when there is inequality in access to reliable internet connectivity, appropriate devices, electricity and digital platforms. As such, it is crucial to not assume that all learners have access to technology when formulating an AI approach to inclusion.

67% of respondents saw algorithmic bias. Classifications or recommendations made by AI systems trained on inconclusive or under-representative data sets can have a detrimental effect on certain subgroups of students. It is particularly relevant in inclusive education where there are a variety of language, disability, socio-economic and cultural differences, as well as varying learning styles. To minimise discriminatory outcomes, regular evaluation and human oversight is needed.

Lack of teacher training was also found to be one of the important challenges (65%). Teachers must not only understand the use of AI tools but also know how to assess the output of AI, recognise its limitations, be aware of measures to protect student privacy, and practice pedagogically informed use of technology. Professional development is therefore an integral component of the whole process of Educational Transformation for AI.

Limitations of the study

The study has some limitations that should be taken into consideration when interpreting the results of the study, “Artificial Intelligence-Supported ICT Applications for Inclusive

Education". Findings may also be less applicable because of the changes in available tools, platforms, and practices over time, due to the fast pace of the development of artificial intelligence and ICT technologies. Variations in digital infrastructure, internet connectivity, assistive technologies, and teachers' digital literacy among educational institutions and geographical regions can also impact the study. The effectiveness of the AI-supported applications of ICTs can also be shaped by variations in students' learning needs, disabilities, socioeconomic backgrounds and language skills, and by students' digital literacy. Furthermore, issues with data privacy, algorithmic bias, cybersecurity, transparency, and ethical use of student data can pose challenges in the implementation of AI-powered educational solutions. There might also be differences in teachers' and students' openness to using AI technologies, and relying heavily on AI tools may diminish the opportunities for meaningful human engagement and teacher participation in learning. Lastly, results might not be easily applicable to other contexts, as the 教育 policies, institutional practices, technological resources and characteristics of learners vary from place to place. To demonstrate the long-term effectiveness and inclusiveness of AI-supported ICT interventions, future studies should include larger and more diverse samples, longitudinal evidence, and different educational settings, as well as comparative evaluation of these interventions.

Future Scope

The possibilities of the use of Artificial Intelligence (AI) based ICTs for inclusive education are wide and as digital technologies evolve and continue to become more accessible, the scope of this continues to grow. Research into the future may explore the potential of applying AI-driven adaptive learning systems, intelligent tutoring platforms, speech recognition, natural language processing, assistive technologies, and personalized learning environments to meet the needs of learners with various academic, communication, and accessibility requirements. More focus can also be put on creating AI tools for students with visual, hearing, physical, cognitive and learning-related impairments, and ensuring that technology will enhance, not replace, teachers. Longitudinal research can be conducted to study if the use of AI-supported ICT positively contributes to increased academic success, engagement, confidence, independence, and social inclusion. More research is needed in the future to examine teachers' digital skills, readiness, attitudes, and training needs in using AI in inclusive classrooms. Research needs to explore algorithmic bias, data privacy, algorithm transparency, accessibility, and data fairness for various learner groups, as AI systems could potentially perpetuate social and education inequalities. The opportunity to create low-cost, multi-lingual AI-powered education solutions that can be implemented in rural and economically disadvantaged areas, as well as in resource-poor settings, is also very great. Future studies in the Indian context could explore the potential for the integration of AI-powered ICTs into inclusive education policies and programs, along with the integration of regional languages, cultural diversity, infrastructure constraints, and disparities in digital access. The process of building human-centred AI solutions could be further enhanced by the cooperation of teachers, developers, policymakers, parents, and learners. For the future, a key area that needs to be explored is developing inclusive digital learning ecosystems where AI improves and enhances personalised support, eliminates access barriers and allows all learners to meaningfully participate in learning.

Conclusion

The use of ICTs by artificial intelligence has a potential capacity to render inclusive education more accessible, flexible and responsive to learners' needs as they have different needs. By leveraging AI in conjunction with digital education technologies, students with diverse capabilities and learning styles can engage more effectively in learning activities, with the help of personalized learning, assistive communication, adaptive content delivery, automated feedback, learning analytics, and differentiated instruction. Such technologies may also help the teacher detect learning problems, track students' learning, and plan instruction for the needs of each student. However, the effectiveness of technology-based inclusive education is not just about the technology itself, but also the thoughtful design, implementation, and integration of the tools into the educational practices. To prevent new forms of exclusion, issues of data privacy, algorithmic bias, digital inequality, accessibility, teacher preparedness and overreliance on automated systems need to be tackled. Instead, AI should be used in conjunction with teachers, interpersonal and human judgment. To achieve meaningful inclusion, a human centred approach must bring together technological innovation and teacher expertise, learner involvement, institutional support, ethical safeguards and equitable access. Finally, the effective application of AI to support ICT can help foster an educational environment that recognizes and respects differences as part of the learning community, and provides the opportunities for every student to learn, enjoy and get better.

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