



RESEARCH ARTICLE

DIGITAL TECHNOLOGY FOR INCLUSIVE EDUCATION: ENHANCING ACCESSIBILITY, PARTICIPATION, AND LEARNING OUTCOMES

Ramakanta Pradhan¹ and Dr. Shivakumar, S.²

¹Research Scholar, Central University of Kerala, Kasargod, India; ²Assistant Professor in Education, Central University of Kerala, Kasargod, India

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*Corresponding author:
Ramakanta Pradhan

ABSTRACT

Digital technologies are becoming increasingly significant enablers of inclusive education by providing new ways to improve accessibility, promote student engagement, and enhance the learning experiences of students with diverse needs. This paper engages in a thematic discussion of digital technologies in inclusive education, with a particular focus on children with disabilities and special needs. Thematic discussions of how assistive technologies, artificial intelligence, augmented reality/virtual reality (AR/VR), and adaptive learning platforms are creating new equitable and responsive learning environments are drawn from recent empirical research as well as policy frameworks and practitioner perspectives. The paper also gives an overview of the ongoing challenges of technology and its integration in education, such as the digital divide and lack of adequate teacher training, as well as equity and accessibility concerns. The paper concludes with implications for policy, teacher education, and future research in inclusive digital education.

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INTRODUCTION

From ancient civilisations to the modern AI era, educators, governments, and professionals have promised to provide equitable, quality education for all. In recent decades, the inclusive education movement has gained significant momentum, drawing on principles of equality, social justice, and the recognition that every child - regardless of ability, background, or circumstance - has the right to participate fully in education (Navas-Bonilla *et al.*, 2025). Inclusive education is now widely understood as a rights-based approach that seeks to ensure equitable access, meaningful participation, and positive outcomes for all students, irrespective of disability, gender, socioeconomic status, language, geography, or cultural identity (Chattopadhyay, 2025). In India, the commitment to inclusive education has been reflected through a range of legislative and policy instruments over the past few years. The Rights of Persons with Disabilities Act (RPwD, 2016), the Right to Education Act (RTE, 2009), and the National Education Policy (NEP) 2020 collectively underscore the state's responsibility to ensure that learners with special needs and other disadvantaged groups are not left behind. In particular, NEP 2020 offers a renewed opportunity to shift the educational system towards equity and inclusion by removing structural and social barriers and introducing reforms across all stages of education, from early childhood to higher education (Nidhi Rai, Vinod Kumar Kanvaria, 2025).

The Education systems around the world were highly disrupted by the COVID-19 pandemic. The Pandemic, furthermore, lay bare the entrenched inequities that existed within educational systems. Children with Special Needs (CWSN), who already faced significant risk of being excluded from education, faced significant challenges to their being educated through the rapid transition to online learning and home schooling. The Pandemic did, in addition, significantly accelerate the use of digital learning tools and many educators are now turning their attention to the use of these digital educational tools to further promote Inclusive Education practices in relation to all students. Busri & Jamil (2025) note that technology in the current era, which includes the emergence of Artificial Intelligence, has transformed the way educators can implement education. Technology is now the primary means by which education can be delivered to students and can be used to deliver education in flexible ways to all students, including those that are unable to access traditional school settings. The NEP 2020 explicitly recognises digital technology as a transformative force in achieving inclusive and equitable education. By leveraging information and communication technology (ICT), assistive technologies, open educational resources, and multilingual digital content, the policy envisions a learning environment that is responsive to the diverse needs of all learners, including children with disabilities, students

from rural and marginalised communities, and first-generation learners (Alegria Arca *et al.*, 2026). Adaptive learning platforms and AI-driven tools are increasingly being used to deliver personalised content, support self-paced learning, and accommodate different learning styles, developments that are particularly significant for inclusive education (Busri & Jamil, 2025). Several empirical and qualitative studies have highlighted the effectiveness of digital technology for diverse learners, as well as its implications for teachers, parents, and policymakers. Rizk and Hillier (2022) confirm that digital technologies play a significant role in boosting student engagement by providing enhanced support and greater access to classroom content and learning processes. This paper explores the role of digital technologies in three interconnected domains: providing accessibility, encouraging active student participation, and improving the learning outcomes of students in inclusive educational programmes.

Digital Technologies and Accessibility: Accessibility is one of the most important ways that digital technology is helping include all students in education. For many students with disabilities, regular ways of teaching and normal classrooms create obstacles to their education. Digital tools—including assistive technologies and AI-based applications—have greatly increased the options available to diverse learners by allowing them to fully and positively participate in educational settings (Rizk & Hillier 2022). Students who struggle with writing and reading can use digital tools to learn using different methods. Applications such as NOVA Chat and Read 180 help students to personalise their education, learn as slowly or as quickly as they want, and watch their own progress. Even students who have trouble using their arms can learn by using touch screens and special ways to use a computer that provide interactive and accessible ways to learn (Kutest Kids n.d.). Students who cannot hear can use voice-to-text applications and software that translates into sign languages so they can understand classroom activities as they happen. There are also programs such as text-to-speech software and screen-readers to help make learning accessible by providing alternative formats of information—including captions and audio descriptions—so that students who are deaf or hard of hearing, or visually impaired, can use educational resources (Srushti 2025).

Assistive technology generally provides students with disabilities access to educational resources and makes it possible for them to participate in regular schooling with other students. As Dar *et al.* (2024) reported, Navas-Bonilla *et al.* (2025) found that multimedia materials, accessibility features, and interactivity were among the most commonly cited attributes of inclusive educational technology within the available studies of inclusive technology. By combining visual, aural, and interactive elements together, schools can meet a range of learning styles and sensory requirements; thus, a pupil with differing requirements can access and participate in the learning process. New possibilities for inclusive education exist because of augmented reality (AR) and virtual reality (VR), which provide opportunities for students to engage with simulated learning environments that accommodate their individual requirements. Furthermore, as noted by Navas-Bonilla *et al.* (2025), the use of digital fabrication technologies, including 3D printing, is being creatively used in inclusive educational settings. For instance, producing tactile Braille instruments for chemistry classes was created with the aim of allowing students with visual impairments to engage in hands-on activities with their sighted peers.

The use of technology in this manner shows that with proper thought, technology can be utilized to create equal access while also creating truly shared and inclusive learning experiences.

Digital Technology and Student Participation: Digital technology helps to promote the active participation of all students in mainstream classrooms by enhancing the physical and cognitive accessibility of students. The inclusion of students with diverse learning needs involves more than just having them share the same classroom with their peers; it means that these students must also participate fully in the learning process and have the same opportunities to interact, collaborate, and contribute as their classmates (Navas-Bonilla *et al.* 2025). Digital technologies allow for multiple ways to engage learners with different profiles (Bešić *et al.* 2025). Studies show that using computer games, multimedia tools, and educational materials can effectively improve the reading abilities of students with disabilities (Rizk & Hillier 2022). Some of the most common resources used to support the participation of students in inclusive educational settings include mobile devices, tablets, and educational apps. These technologies provide students with access to learning materials that are appropriate for them based on their individual needs, at a time that is convenient for them, and in an environment that is appropriate for their needs. Because of how interactive educational apps and games are, they can create an enjoyable and motivating way for students to interact with and understand the material they are studying through direct interaction with it, resulting in improved comprehension and increased motivation to continue participating in the educational process.

Students with difficulties in communication find great assistance from technologies that facilitate communication. Augmentative and Alternative Communication (AAC), video conferencing tools and collaborative digital tools allow students who are unable to verbally communicate to interact more fully in classroom conversations (Navas-Bonilla *et al.*, 2025). Anselimus (2023) also discusses how assistive technology benefits students with visual disabilities by increasing opportunities for participation in extracurricular activities and demonstrates that assistive technology has added to the ways students can access information and develop mobility, build social relationships, and acquire educational skills. Students with disabilities use personalised learning tools such as e-books, online courses, and digital libraries to access the same information and material as their peers, thus contributing to their inclusion in a real and effective manner. Teachers also play an important part in helping students participate with technology to the same degree as their non-disabled peers. Bong & Chen (2021) observe that by preparing teachers in digital accessibility and inclusive practice, they will have the knowledge necessary to create a learning environment that is conducive to supporting student success. However, they also suggest that many teachers in developing countries are independently experimenting with and adopting digital technologies, including AI applications, without appropriate institutional support. This includes adequate supplies of hardware, software, connectivity, and/or professional development support. This situation places an undue burden on individual teachers and highlights the systemic conditions that ultimately determine whether digital technology can effectively support student participation.

Digital Technologies and Learning Outcomes: The relationship between digital technologies and student learning outcomes in inclusive settings is complex but becoming increasingly evidenced. For students with specific disabilities, technology offers specific kinds of support that can greatly enhance engagement with and attainment in the lessons they undertake. For instance, students with visual impairments use screen readers, digital magnifiers, and various forms of reading machines or text-to-speech systems, all of which provide direct access to written information. Students with physical or motor difficulties benefit from adapted devices. Through the use of alternative keyboards or joystick controllers, such students are able to navigate various digital learning platforms independently (Navas-Bonilla *et al.*, 2025).

The literature points to specific outcomes in inclusive settings that encompass a range of technology-related improvements in learning. Some organized research of Navas-Bonilla *et al.* (2025) reported that the integration of ICT in South Africa has thus improved the quality of education through the widening of access to distance educational programs, an increase in learning productivity, and customizations of teaching and learning to meet the varied individual needs of learners within the community. Another documented instance saw a collaborative AI-assisted mind mapping platform that was rolled out to students with Asperger's Syndrome, ADHD, and dyslexia and saw positive benefit in the area of creativity through equitable contribution in group assignments, student engagement, and esteem. According to Johnson (2022), improvements in comprehension, classroom engagement, and general academic achievements are linked with the use of various types of software and assistive devices designed specifically for students with disabilities. Examples of tech-enhanced learning include adaptive platforms and AI-driven systems that individually adapt and personalize all learning materials based on a student's progress and by delivering timely feedback to each student—features particularly useful in inclusive classrooms where students enter at different levels and develop at different paces. Moreover, Bong & Chen (2021) assert that there exists a tremendous opportunity to use AI responsibly and unselfishly to redesign the education system such that it produces better outcomes for diverse learners.

Challenges in Technology Integration in Inclusive Education

Training and Professional Support: The lack of training and professional support for teachers has been identified as a key barrier to effectively integrating technology in an inclusive education setting. Without sufficient training, teachers may not have the skills or confidence necessary to choose, modify and implement digital tools to truly benefit students with special requirements. Navas-Bonilla and colleagues (2025) stated that one of the major barriers to effective technology use in the classroom is the lack of training teachers receive on using the latest technologies as functional tools. The issue is more than just technical skills; it is also about pedagogical techniques, knowledge of accessibility, and differentiated instruction for all students, i.e., students who have similar characteristics to other students. This problem is made worse by the significant lack of support mechanisms in many developing countries, making it very difficult to successfully implement technology into teaching and learning processes. According to Chen *et al* (2024), in countries like the Philippines, teachers are

attempting to use artificial intelligence in their classrooms for themselves. They are doing this with limited to no access to required technology, reliable Internet access, and professional development/training opportunities. The result is that the implementation of technology to educate students occurs independently of the decision-making structures within the system and is not at all sustainable. According to Lighthouse Learning (2025), if there is insufficient and ongoing professional development, the impact of digital technology will most likely perpetuate new forms of exclusion instead of dismantling the existing barriers to inclusion. Therefore, teacher preparation programmes- and in-service professional development frameworks- must place significantly more importance on inclusive pedagogy and digital access in order for technology to be a truly effective tool for inclusion.

Cost, Availability, and the Digital Divide: To successfully incorporate digital technology into inclusive education, equitable access to the supporting infrastructure- which consists of: devices; software; quality internet connectivity; and a wide variety of technological resources- is crucial. In practice, access to these infrastructures currently varies widely, both nationally, as well as internationally. The digital divide- which represents the gap between those who have a reliable access to digital technologies and those who do not- is one of the most significant systemic barriers to the use of digitalisation in inclusive education. India has a unique challenge in regard to the lack of access to technology, particularly in rural and remote areas, where there is often little to no connectivity and devices available for students. If a student comes from a low income family or is part of a marginalised community (e.g., students with disabilities), that student faces even greater barriers when compared to other students due to the aforementioned lack of accessibility to technology. According to UNESCO (2023), digital technology can increase access to education (e.g., students using computers could learn at home or the use of assistive technology), but it also has the potential to widen the gap for learners who are unable to access it. For most families and schools in resource-poor areas, the cost associated with assistive technology and special education software can be a major barrier. Unless there are intentional policy solutions put in place to address the structural inequities of education in India, such as the implementation of digital infrastructure (e.g., building high-speed data networks), subsidised access to assistive technology for students with disabilities, or targeted resource allocation for schools that provide low-resource education, the positive impact that digital technology can have on promoting inclusive education will be limited for the students who need it most.

CONCLUSION

Digital Technology has great potential to change inclusive education by making education easier to access, providing opportunities for all students to actively participate in their learning, and improving the educational outcomes (results) of students with varying needs (including children with disabilities). Evidence shows that there are many tools available to assist students with disabilities/special needs, including assistive technology, adaptive learning platforms, AI-based applications, AR/VR environments, and communication devices; all these tools have made meaningful improvements to the educational experience of students with disabilities/special needs throughout the world.

The potential of leveraging digital tools for inclusive education cannot be achieved through the mere availability of technology; they must also be effectively integrated into inclusive education by preparing and supporting teachers, establishing institutional frameworks that support inclusive education, taking action to reduce the digital divide, and making a sustained commitment to placing the needs of the least respected/marginalized learners (from an educational planning perspective) as a priority. In India, the vision (as set out in NEP 2020) of technology-enabled inclusive education provides important guidance for developing policies to support inclusive education; however, turning this vision into reality within classrooms will require large investments in teacher professional development, school infrastructure improvements, and the development of cost-effective assistive technologies, particularly for CWSN who live in rural and under-resourced areas. Further studies should keep investigating lasting success for new technology in different inclusive contexts especially for historically underrepresented learners in literature. Additionally, student perspective from various disabilities should be integrated into the design, execution, and evaluation of inclusive digital education. Digital technologies need to be utilitarian within equity-based, rights-based, and educationally-based frameworks if digital technology can provide an inclusive and high-quality educational experience for everyone.

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