



Empowering learners through technology: Assistive and inclusive in education

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Abstract

Technology is reshaping modern classrooms by creating equal learning spaces for all students. This paper explores how assistive and inclusive technologies empower learners with diverse needs. Tools like text-to-speech software, screen readers, and adaptive devices remove traditional barriers to education. By blending these tools with the Universal Design for Learning (UDL) framework, teachers can cater to various learning styles and capabilities. The study highlights how technology fosters independence, improves academic outcomes, and boosts classroom collaboration. However, challenges like high costs and a lack of teacher training still limit its widespread use. Ultimately, the paper concludes that strategic investments in digital tools are essential to achieving truly equitable and inclusive education for every learner.

Keywords: Assistive technology, inclusive education, universal design for learning, digital accessibility, learner empowerment

Introduction

According to the National Institute of Health, India (National Institute of Health [NIH], 2023), 4.95% of citizens have some disability across all age groups, and 2.2% of this group have a severe form of disability. Technology accessibility for people with disabilities is a critical topic that highlights the need for inclusive design and assistive technology development. As society increasingly relies on digital platforms, ensuring that individuals with disabilities can access and utilize these technologies is paramount for promoting equity and independence.

In education, students with disabilities face barriers that limit their learning and achievement in classroom activities. These students must have access to the same opportunities to participate in society as their peers. In this context, digital technologies are a tool to access the curriculum. Evidence shows that digital technologies (computers, laptops, and mobile devices) have changed many students' lives (Bond, 2014) [3]. Despite these changes in education, little attention has been paid to how students with disabilities incorporate technology into their daily lives (Passey, 2013; European Schoolnet, 2014) [8, 14]. This is not surprising, given that research on children with disabilities remains limited (McLaughlin *et al.*, 2016), while generic research often excludes this student population (Connors & Stalker, 2007) [5]. This may make it harder to ensure equal opportunities to access and benefit from digital technologies.

According to the World Health Organisation (WHO), "Assistive Technology" (hereinafter AT) is a generic term that designates all systems and services related to the use of assistive products and the performance of services (WHO, 2001). Generally, and according to the AT Act of 1998, in the U.S., it is defined as "any item, piece of equipment or system, whether acquired commercially, modified, or customized, that is commonly used to increase, maintain, or improve the functional capabilities of people with disabilities" (Buning *et al.*, 2004, p. 98). For Lewis (1993) [4,

12], AT has two main purposes: to increase a person's capabilities so that their abilities balance out the effects of any disability. On the other hand, it provides an alternative way to approach a task so that disabilities are compensated for.

AT is proposed as an alternative for the interaction between students with disabilities and new digital devices (Emiliani *et al.*, 2011) [7], which:

Refers to the technologies (devices or services) used to compensate for functional limitations, to facilitate independent living, to enable older people and people with activity limitations to realise their full potential. Some technologies, even if not purposely designed for people with activity limitations, can be configured in such a way as to aid or assistive functions when needed. The term AT covers any kind of equipment or service capable of meeting this definition. Examples include wheelchairs, prosthesis, communicators and telecommunication services. In e-Inclusion, AT includes, for example, equipment and services for access to information (e.g., for seeing, hearing, reading, writing), interpersonal communication and control of the environment. (102)

To understand assistive technology in inclusive education, it is necessary to review inclusive education as well.

Inclusive education is rooted in a systems approach in which the various systems within the child's environment constantly interact to support the child (Swart & Pettipher, 2015) [19]. The concept of inclusive education has brought a much-needed commitment to equality in the education of the 'disabled' by giving them a level playing field to demonstrate their different abilities and prove they can learn and perform alongside their non-disabled peers. Addressing the individual learning needs of all children, youth and adults, with a specific focus on those vulnerable to marginalization and exclusion; inclusive education as an approach implies all learners, with or without disabilities, to be able to learn together through access to common pre-

school provisions, schools and community educational setting with an appropriate network of support services, which can be possible only in a flexible education system that assimilates the needs of diverse learners and adapts itself to meet these needs, ensuring that all stakeholders in the system are comfortable with diversity and see it as a challenge rather than a problem.

Assistive technology is the basis for creating inclusive education systems in which students with disabilities receive the same training and learning as their peers without limitations in daily activities. Assistive technology aids in reducing, if not eliminating, the handicap and circumventing the deficit to help the individual participate in learning and related tasks, reducing barriers and promoting accessibility with considerable ease and efficiency, which otherwise might not have been possible. It broadly spells out a continuum of tools, strategies, and services that match a person's needs, abilities and tasks, and includes evaluation of the needs of an individual with a disability, a functional evaluation of the individual in the individual's customary environment, and the selection, designing, fitting, customization, adaption, application, maintenance, repair, and replacement of assistive technology services, and their coordination with the existing education and rehabilitation plans and programs for inclusive development.

Assistive technology is necessary in inclusive education because learners have different needs in inclusive classrooms. The main obstacles the students with disabilities face include inaccessible textbooks, communication, mobility challenges, or information processing problems. Assistive technology is required to provide equal education to all learners. This can be done by meeting personalised learning needs, reducing learning barriers, and encouraging learners' participation. Another important factor assistive technology address is the self-esteem of learners with disabilities. With added support, they feel capable of completing their education efficiently. Without assistive technologies, it would be really tough for children with special needs to keep up with the classroom instruction. This might lead to frustration, low self-esteem, or dropping out.

To provide educational opportunities to all citizens without discrimination, the country launched an education campaign. To provide quality education for all learners with special needs (including children suffering from one or the other type of disability), the country faced great difficulty. But alternatives like VI schools, HI schools, ID schools, etc., were found. However, this alternative of providing separate provision/schools cannot be a viable solution for the vast population of India, with so many disability figures of prospective learners with disabilities. Moreover, children may differ significantly in relation to their incapacities and disabilities. In such a situation, it is very difficult to establish separate schools for every type of disability.

One way to ensure accessibility is to evaluate websites against the WCAG 2.2 guidelines. Some of the ways the accessibility standards could be maintained are (Haque, 2024) ^[9]:

1. Providing text alternatives for non-text content.
2. Ensuring that all functionality is available from a keyboard.
3. Giving users enough time to read and use content.
4. Minimising potential triggers for seizures and physical reactions.

5. Making it easier for users to see and hear content by separating foreground from background.

Another method is making the technology adaptable to assistive technologies in different ways, such as

1. Screen readers for users with visual impairments
2. Speech recognition software for users with mobility impairments
3. Refreshable braille displays
4. Alternative input devices like head pointers and eye gaze systems. (Krishna, 2024)

A review focused on scientific articles published between 2009 and 2020 ^[2] and aimed to evaluate the impact of assistive technology use in the education of students with disabilities. According to the articles, assistive technology is used at all stages of education, with the highest application in secondary education (41.94%), followed by primary education (38.71%). Among the types of Assistive Technology used for this group of students, we find a wide variety of tools. Among them, the use of Web 2.0 stands out (28.57%), such as the use of social networks, websites, browsers...; mobile learning (25%), among which we find the Tablet, the iPad or the mobile phone; or the use of hardware or software (21.43%). Considering the articles reviewed, these tools are being used mainly with visually impaired students (25%), followed by deaf students (21.43%) and physically impaired students (14.29%). Students with autism (10.71%), intellectual disability (7.14%) or behavioural disorder (3.57%) are less likely to be used.

According to the data, Assistive technology provides students with benefits such as inclusion (20.95%) and accessibility (20.95%) in school. Other benefits include improving the teaching-learning process (13.51%), developing autonomy and independence (18.92%), acquiring social skills (11.49%), participation (9.46%), and motivation (4.73%). All articles reviewed highlight Assistive Technology as a required tool for students with disabilities in school. However, schools still face challenges in applying these tools with their students. The main difficulties include the need for teacher training and education (42.86%), as well as access issues (32.14%). Teachers have a primary role in promoting the use of assistive technologies; therefore, in order to achieve inclusion of students with disabilities, teachers need to acquire the necessary skills and competences (De Sousa, 2014 ^[6]; Roque, Perreira, Neto & Macario, 2018; Ahmed, 2020; Viana & Fontoura Teixeira, 2019 ^[1, 17, 20]; Arori, Al Attivah, Dababneh & Hamaidi, 2020) ^[2].

In 1996, the Parliament of India passed an act called the Persons with Disabilities (PWD) Act. This legislation marked a new era of change for the education of children with disabilities in India (Sharma & Das, 2015) ^[19]. A vital aspect of this legislation was the need to integrate learners with disabilities into mainstream schools (Das, 2001). Following the enactment of the PWD Act, several other government-initiated policies have been undertaken. This is indicative of the Indian government's commitment regarding the implementation of policy on inclusive education (Sharma & Das, 2015) ^[19]. However, despite these efforts, it has not been possible to integrate the appropriate tools to satisfy the main needs of these students. This review identifies important directions for future research and

possible ways schools should consider integrating Assistive technology into the learning of students with disabilities.

Research in India indicates several issues within inclusive education and education in general. India is a vast country with a heterogeneous population defined by ethnicity, religion, culture, language, economic status, access to resources and political resolve (Sharma & Das, 2015) ^[19]. Consequently, a unified approach to the development and implementation of policies and programmes will not be efficacious.

The future of assistive technology in inclusive education is promising because digital technology is at a peak. Artificial intelligence, adaptive learning systems, mobile applications, and cloud-based tools have opened assistive technology to a wider, more affordable market. Individualised learning systems, artificial intelligence speech, and intelligent accessibility devices are also likely to make inclusion more effective. With supportive policies, teacher training, and investment, assistive technology can transform inclusive education and promote equal learning opportunities for everyone.

Assistive technology can greatly benefit learners facing learning limitations due to disabilities. By improving student engagement and boosting confidence, assistive technology helps support inclusive education. Despite challenges like inadequate teacher training and high costs, assistive technology still positively impacts education systems. Whether high-cost or low-cost, educators should use assistive technologies to improve their teaching methods for special-needs students.

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