



ASSISTIVE TECHNOLOGIES IN SPECIAL AND INCLUSIVE EDUCATION

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ABSTRACT

Assistive technologies have moved from being niche tools used in special education rooms to becoming a core infrastructure for inclusive schooling. When well selected and properly supported, they expand access to communication, literacy, participation, and independent learning for students with diverse needs, while also improving flexibility for many learners without diagnosed disabilities. This article reviews how assistive technologies fit within special and inclusive education, clarifies key concepts and definitions, and explains why technology alone never “solves” inclusion without pedagogy, accessibility, and systems-level support. Practical implementation logic is discussed through decision-making frameworks, teacher competence requirements, classroom design approaches such as Universal Design for Learning, and evaluation principles that focus on participation rather than gadgets.

INTRODUCTION

Inclusive education is often described as a values-based commitment, but in practice it is also a design problem: how to ensure that learning goals, materials, and participation opportunities are reachable for students with very different sensory, motor, cognitive, and communication profiles. The right to an inclusive education system at all levels is explicitly stated in the Convention on the Rights of Persons with Disabilities, including the requirement to provide reasonable accommodation and individualized support when needed. In real classrooms, those obligations meet concrete barriers: print that cannot be read by a blind student, rapid oral instruction that a hard-of-hearing learner cannot decode, fine-motor writing tasks that exclude a student with cerebral palsy, or time-pressured assessments that penalize a learner who needs alternative input methods. Assistive technologies exist precisely at this junction, translating a legal and ethical commitment into usable access.

A second reason assistive technologies matter is scale. The global need is not marginal. A major international assessment reported that more than 2.5 billion people require one or more assistive products, and the number is expected to increase as



populations age and chronic conditions rise. Education systems are therefore dealing not with a rare exception, but with a recurring reality that touches students, families, and educators in every community. If schools treat assistive technology as an occasional add-on, they will continue to produce exclusion by default. If they treat it as part of learning design and service delivery, inclusion becomes more predictable, measurable, and sustainable.

MATERIALS AND METHODS

In educational policy and practice, assistive technology is best understood as both devices and services. A widely used formal definition describes an assistive technology device as any item, equipment, or product system used to increase, maintain, or improve the functional capabilities of a child with a disability. Assistive technology services include evaluation, selection, acquisition, customization, training, and maintenance that directly help the learner use the device effectively. This distinction is not bureaucratic hair-splitting. Schools often purchase devices but underinvest in service components such as training, setup, and repair. The result is predictable: devices sit unused, students become frustrated, and teachers conclude that assistive technology “doesn’t work,” when in fact the system failed to deliver the service that makes the tool usable [1].

In special and inclusive education, assistive technologies can be grouped by the barrier they reduce rather than by brand names. For access to information, common solutions include screen readers, text-to-speech, braille displays, magnification tools, high-contrast settings, captioning, and alternative formats such as structured digital text. For expression and communication, augmentative and alternative communication tools are central, ranging from low-tech communication boards to high-tech speech-generating devices that allow students with limited speech to participate academically and socially. For physical and motor access, switch devices, alternative keyboards, eye-gaze systems, and ergonomic supports enable students to interact with learning materials and demonstrate knowledge. For organization and cognition, reminders, task-sequencing apps, and simplified interfaces can reduce executive-function load, though they require careful ethical use to avoid surveillance or unnecessary restriction. Across categories, the unifying principle is functional participation: the technology is justified when it expands what the student can do in authentic learning tasks [2].

RESULTS AND DISCUSSION

A crucial shift in modern inclusion is the convergence between assistive and mainstream digital technologies. The boundary is increasingly blurred because general-purpose devices include accessibility features and can be paired with specialized supports. UNICEF’s teacher-focused guide explicitly notes this convergence and argues that educators must be aware of both mainstream and assistive options in order to remove barriers across in-person, blended, and distance learning environments. This matters because inclusion fails in predictable ways during digital transitions: when a school adopts a new learning platform without keyboard navigation, when videos lack captions, when PDFs are scanned images that screen readers cannot parse, or when online tests are not compatible with alternative input. Inclusive technology, therefore, is not only



about individual devices, but also about the accessibility of the entire digital ecosystem [3].

Universal Design for Learning is one of the most practical bridges between assistive technology and inclusive pedagogy. UDL emphasizes providing multiple ways of representing information, allowing learners different ways to act and express, and supporting engagement through flexible pathways. The UDL Guidelines highlight the need to present key information through different modalities and to ensure adjustability, such as text enlargement, amplified sound, captions, and transcripts, while also warning that digital does not automatically mean accessible. In a classroom shaped by UDL, many barriers are reduced for everyone before individualized technology is even considered. This does not replace specialized tools; it makes specialized tools more effective because the learning environment stops fighting the student.

Decision-making is where many schools go wrong. Selecting tools based on what is trendy, what was purchased last year, or what looks impressive during a demonstration usually ends with poor fit. A more reliable approach is to start with the student's strengths and needs, analyze the environments where participation is expected, define the tasks that matter, and only then choose tools. The Student, Environment, Tasks, Tools approach is widely used for precisely this purpose and is described as a collaborative decision-making model that keeps "tools" as the final step after understanding the learner and context. This logic also prevents a common failure mode: giving a student a device that works in a quiet therapy room but collapses in a noisy classroom, on a crowded bus, or during group work.

In practice, the most effective classrooms normalize tool use as "how we learn here," rather than labeling it as a disability marker. When captioning, readable fonts, adjustable displays, and multiple response options are routine, individual accommodations draw less attention and students are more willing to use them [4].

Finally, inclusive technology raises ethical and practical issues that deserve honest attention. Affordability is consistently reported as a major barrier to access, alongside availability, support, and maintenance. Schools also face procurement challenges, compatibility problems, and the risk of "pilot fatigue," where short-term projects die as soon as external funding ends. Data privacy matters as more tools collect usage data or rely on cloud services. Equity matters because students who need technology the most often have the least access at home, turning homework into a new exclusion mechanism unless schools plan for continuity. If inclusion is the goal, systems must fund services, not only devices, and must design digital learning environments to be accessible by default [5].

CONCLUSION

In practice, inclusion becomes more stable when schools combine two moves. First, they design learning through accessibility and UDL so that many barriers disappear for everyone. Second, they provide individualized assistive technology supports for students who still face barriers after universal design improvements. This blended approach avoids the false choice between "one-size-fits-all" and "individual exceptions." The final takeaway is simple and slightly annoying for anyone who hoped for an easy fix: the tool is



rarely the problem; the implementation usually is. Schools that invest in collaboration, training, accessible digital ecosystems, and ongoing support will see assistive technologies function as intended: not as gadgets, but as bridges into learning, communication, and belonging.

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