



# Leveraging Technology for Supporting Students with Learning Disabilities

Bitalo J. U.

Faculty of Education Kampala International University Uganda

## ABSTRACT

This paper explores the integration of technology in education to support students with learning disabilities, focusing on dyslexia, dyscalculia, and dysgraphia. The advancements in educational technology have provided new tools and strategies to enhance learning experiences and outcomes for these students. We will examine the characteristics of learning disabilities, the role of technology in addressing these challenges, and the benefits and obstacles of using technology in educational settings. Through qualitative and quantitative research, this study highlights effective practices and future directions for leveraging technology to empower students with learning disabilities.

**Keywords: Technology, Students, Learning and Disabilities**

## INTRODUCTION

Lifelong affiliation professionals aspiring to entrepreneurial vision are attuned to irreplaceable factors. Tech can help. Knowing that learning disabilities are related to neurobiological characteristics is important [1-5]. It does not matter if people with learning disabilities have acquired great strategies and are successful. Employers with such knowledge are a true asset - the best technology for a specific type of learning is an experimental partnership conducted among the technology-savvy learner population using the newest software available [6]. Follow the child. Encouraging learning about neural plasticity not only enables our learning-disabled students to comprehend that they are similarly learning changemakers in their own story, but it also challenges the decrease of bias throughout business [7]. We build better technology for them while delivering an underrated net worth. Throughout this chapter, we will be examining the characteristics of students with reading disabilities and/or ADHD, exploring the features of technology that can be leveraged to support these students, and considering qualitative and quantitative research that has looked at student response to these technologies [8]. Of course, many students struggle with learning disabilities. We have chosen to focus on these two types of learners for a number of reasons [9]. First, these two dimensions give us diversity with respect to the underlying issues. Second, they suggest an ill-fitting of what comes next, a kind of growth-promoting technology, and a kind of thoughtful evaluation. Third, there are some interesting and promising paths that have been taken and broadly curated in the educational community [10-12].

### Types of Learning Disabilities

1) Dysgraphia: Dysgraphia is a specific learning disability in written expression characterized by issues with handwriting, spelling, and idea generation [13]. The disability can manifest as difficulty with handwriting, organizing and expressing thoughts on paper understanding the alphabet, written expression, or written language structure. Individuals with diagnosed dysgraphia may struggle to communicate through writing, which can greatly impact a student's ability to succeed both in school and beyond [14].

2) Dyscalculia: Dyscalculia is a specific learning disability in math. Marked differences in their ability to understand number relationships, as well as mathematical formulas, cannot be linked to their inability to read or concentrate or inattention to math training. Major signs include difficulty understanding arithmetic facts or learning how to manipulate numbers [15].

3) Dyslexia: Dyslexia is characterized by difficulty with reading and phonemic awareness, which impacts reading comprehension and accuracy (which is not due to low IQ, socio-economic status, lack of educational opportunities, etc.). Spelling and learning to read and decode words are affected as well. These individuals may also experience challenges understanding what they read [16].

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This section provides an overview of the three most common types of learning disabilities - dyslexia, dyscalculia, and dysgraphia. Although we focus on these three types, it is important to note that learning disabilities are very individualized and can present in different ways for each person [17]. For example, a student with dyslexia may have trouble decoding "numerous" letters assigned on a page; thus, reviving a decoding specific computer software program, the student is ready to decode quickly the current version online speed [12]. This opportunity to support the necessary material to improve decoding accuracy can change when the capabilities of the students to overcome reading skills such as reading paragraphs, understanding reading comprehension's acquisition meanings, and determining the main idea and interpretation of meaning [18]. Outside of specialized instructional settings and programs, advances in technology can provide a learning tool to help prepare students with learning disabilities to lecture in general education curriculums. Technology has been used in one form or another in education for hundreds of years [19]. In recent years, educational technology has exploded on the scene, with the Internet and computers that are essential components in many homes, particularly those who have children who experience learning disabilities [20]. However, much of this technology is designed for the general population and does not necessarily meet specialized needs, as put forth by the individualized education plan (IEP). Computer, software, or web-based tools specifically designed to help students with learning disabilities need to be identified and used to make enough use of this valuable resource. In this paper, the role of assistive technology is to be reviewed [21]. The importance of appropriate augmented communication technologies and educational software is particularly emphasized [22].

### **Benefits of Using Technology for Students with Learning Disabilities**

Some students may need different degrees of assistance at different times, while others need continuous help. Technology can provide scaffolds for these students [23]. For example, students with learning disabilities make use of technology to make mathematical expressions less demanding [24]. Current mathematical technologies offer various ways to support or challenge the student, depending on the student's needs [25]. Technology can also help students monitor the mathematical work to make instant adjustments. For example, software like "Aplus" and "Tarp" provides direct, conceptual guidance and feedback, which can increase the learning speeds. This type of program can be excellent for those who have low self-regulatory abilities [26]. Highly structured systems seem to increase the benefit that students with LD have from mathematical computer applications [27-30]. With sufficient support, most students with LD can learn basic knowledge using technology. Although there are extensive specialized materials to enhance general education, we found limited programs for students with LDs in the United Arab Emirates [31]. The majority of those focused on basic math, reading, and writing training. Students with learning disabilities can use appropriate software to reinforce the skills associated with deficit areas. Since Cooperative Learning is effective in providing successful learning for many children, including those with learning disabilities, computer-mediated communication can facilitate Cooperative Learning [32]. Digital communication tools offer a platform for students to express their ideas and questions in a method that can be less overwhelming than in person. Lastly, technology has the capability to be developed based on learning principles from the scientific literature [33].

### **Personalized Learning Opportunities**

The U.S. Department of Education's Office for Civil Rights has expressed major concerns about online and blended learning models' impacts on students with disabilities' learning experiences and opportunities [34]. Today, technology-rich instructional models serve a smaller proportion of students with disabilities than other students, they are used in separate classrooms, and the courses used in these classrooms provide fewer opportunities to build social capital, completion rates, and college and career readiness skills [35]. Additionally, students with emotional or behavioral disabilities face questions about how successful they can be in technology-based instruction. Many educators cited insufficient administrative support, lack of training, and regulatory concerns as barriers to using online and blended learning opportunities with students with disabilities [36]. Given the reasonable hesitation to institute technology-based instruction given these challenges, how might we proceed to ensure that students with learning disabilities are appropriately benefiting from personalized learning? Some schools are beginning to explore more personalized learning opportunities for their students. Such opportunities may result from district or school policy decisions, Community Eligibility Provision (CEP) status, and other reasons [23]. Personalized learning—whether self-paced instruction, adaptive technology, or small-group rotation models—has the potential to propel the field of special education forward [20]. However, schools should implement personalized learning with care and appropriate safeguards for students with disabilities [27]. In technology-rich personalized learning settings, some students may be inadvertently discriminated against and placed in inferior educational settings. Key protections must be in place so that personalized learning extends to students with disabilities and opens doors to new, effective learning

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opportunities. For students with learning disabilities in particular, personalized learning may be a foot in the door toward joining their general education peers for 100 percent of the school day—freeing precious resources for more intensive academic and behavioral interventions [36-39].

#### **Increased Engagement and Motivation**

Using computers for learning has several benefits. First, the computer is inexhaustible. This means that it does not become bored or tired, and it does not get annoyed with the student [40]. It also does not take any negativity from the student, which is important for children who have difficulty controlling their emotions [41]. The computer is also a friend that is always there, no matter the conditions, to show a student how to solve problems. Finally, the computer can produce a motivating sound or graphical effect, a type of feedback that cannot be easily duplicated by humans [42]. All these benefits can be particularly important for students with learning disabilities who often have difficulty trusting the adult who is assisting them with the lesson [43]. Computer technology makes it easy to differentiate instruction on set tasks, to tailor the lesson plan based on the progress of the student on prescribed tasks, to repeat instruction or remediation for particular skills, and reduce extraneous stimuli in the environment for the student of the digital learning environment. These opportunities of computer technology will be the focus of this paper.

#### **Enhanced Accessibility and Accommodations**

The following are examples of apps for Android and iPad students that enhance or bypass learning disabilities. Do a search for the Apple and Android apps by the name if the app name doesn't appear in the following list.

##### **The Use of a PDA for Speech Output Adaptive Hardware**

Optical Character Recognition: A special scanner lets a student "read" and "highlight" a handout or textbook on the computer.

##### **Adaptations to Keyboards and Mice**

Word Prediction and Word Completion: Learns the student's vocabulary so he or she can "write" in a flow, not stop and think of the next word.

Abbreviation input: The student types a combo and the computer suggests a word. (The student efficiently chooses the word.)

##### **Speech-to-Text and Text-to-Speech: Students can sit and listen to text read.**

##### **Talking Calculators and Spreadsheets**

Homework/assignment notetaker: A student dictating homework and notes or a teacher dictating an assignment can send a file to anyone by e-mail.

Talking Graphic Organizers: For writing stories or working through cognitive processes.

Talking Word Processor: Writes a term paper with voice commands.

Speech Recognition: Software that transcribes verbally spoken words into text on the computer screen. The user needs to dictate and use a microphone and sometimes headphones [44]. (Turn off the microphone and the program can read text such as e-books out loud.) The next tier of technologies are power tools for teaching and learning that help students work around specific learning limitations or simply work better [45]. In school, these features are called accommodations or modifications. Whether built right into the hardware and commercial software, or added online, these features can be used in a mainstream or special setting and can take the form of:

#### **Challenges and Considerations in Implementing Technology for Students with Learning Disabilities**

This chapter highlights some of the most prevalent concerns with how technology might be implemented to help students with learning disabilities and provides a series of overarching considerations which are intended to help teachers and researchers understand how to optimally support these students with software programs [46]. In the following section, an overview of the relevant literature is presented. This is followed by a discussion of some of the key challenges which need to be considered as new teaching practice is developed, and then a set of design principles for teachers when considering what software to use with students with learning disabilities [47-51]. As technology continues to change and become more readily available in schools, it is crucial to examine how these new tools can be used to support students' learning [52]. This is especially important for students with learning disabilities who have a known deficit in one or more areas of learning, and who often need augmented instruction to access novel curricular content [53]. It is essential for innovative teaching practices to be evidence-based and informed by a well-developed sense of how technology can exacerbate or counteract the disadvantages students with learning disabilities face [54]. While teachers have the best knowledge of their students and their needs, challenges with instructional technology and, in some cases, uncertainty

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about how to incorporate technology in programming can limit its use [55]. This chapter reviews four key challenges that can inhibit the effective use of technology in classrooms.

#### **Access and Equity**

Assistive technology, which is defined as "any item, piece of equipment, product or system, whether acquired commercially, off-the-shelf, modified or customized, that is used to increase, maintain, or improve functional capabilities of individuals with disabilities" by the Technology-related Assistance for Individuals with Disabilities Act of 1988, provided students with a wide range of devices and services [56-59]. Technology can support more sophisticated applications for students with learning disabilities. Specifically, technology for students with learning disabilities can assist in the areas of academic skills, adaptive/general functioning, assistive learning systems, adaptation for software, and technology for students with visual impairments [60]. Technology used for students with learning disabilities range from specialized technologies to software and hardware that is available in the general education setting [48]. These individualized technologies do not have to be solely used in the special education setting. The students can take these devices to the general ed classroom and enhance their learning experience. According to the Consortium for School Networking (CoSN), technology can work to ensure access and equity, increase and support positive learning environments and opportunities, and connect classrooms to the wider world. Access to technology is evident in the digital divide [61]. The digital divide refers to the inequality in access and effective use of information, communication and related technologies among less affluent groups [62]. The widespread availability of the internet, which provides access to mass amounts of information for students, leads to the creation of a new divide as students' abilities to effectively access and use this technology comes into play. In many cases, the divide is not in the students' ability to use technology but rather a measure of access to technology [62].

#### **Professional Development for Educators**

The benefits of online professional development include the availability of learning activities with high levels of engagement and interactivity, opportunities for personalization and self-pacing, and accessible opportunities to interact with students and peers for coaching and mentorship [63]. In addition, it helps increase the likelihood that technology-enhanced learning innovations become more regularly and successfully utilized in the classroom, and it helps to ensure the successful implementation of technology-based learning activities [64]. Since the development of new technologies is often associated with learning and knowledge creation, educators can use technology to enhance their own professional development [65]. The use of technology to support the learning needs of students with learning disabilities provides educators with a variety of challenges, from inconsistent access to learning materials designed for students with diverse [66]. An essential component of successful educational provision is the professional capacity of the educators involved in providing instruction and support to students with learning disabilities [67]. High-quality, ongoing professional development for educators is believed to maximize the positive impact of technology-based learning in special education by improving educator insight and expertise [68]. Technology-based professional development offers a unique alternative to traditional teacher training because it offers flexible, personalized learning activities that are not limited by timing and location [69].

#### **Privacy and Data Security Concerns**

Privacy concerns are amplified by the format of the information, its storage location, how it is attained (e.g., whether users consent to the use of their data), and how it is used and disseminated [70]. Limiting the use of data transparency can impede the development of algorithms to enhance teaching and learning. Providing a clear explanation of Privacy-Enhancing Techniques (PETs) can reassure users that sensitive data or behaviors are protected while allowing those data and behaviors to be used for innovation [71]. Although advances in technologies are increasing the privacy risks, they also offer techniques that mitigate them, thus widening the gap between the current practices [72]. As technology continues to evolve to use big data for better educational outcomes, it is not enough for commercial interests to mitigate privacy risk and maximize financial gains [38]. Reconsidering data usage, especially as it becomes available at a more granular scale, is a critical point. Privacy and data security are principal concerns related to students' personal information [41]. Personal information obtained from students is increasingly digital and accessible to a broader range of individuals because of the decentralized storage of data in the cloud, online learning management systems, and personal devices [43]. For students with learning disabilities, personal information may include data from testing, from teacher, student, and family conversations, and from student learning activities. Personal data may reveal medical information, mental health history including learning disability identification and provision of accommodations, and family dynamics. Snapshots of time-stamped text written by students in the classroom, in the library, or from a device at home could provide insight on student engagement, writing skills, mastery, and

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conceptual understanding of various topics [45]. Providing guidance on how to appropriately use data and not make decisions based on privacy measures is challenging as data usage and privacy will continue to evolve over time [73].

### **Effective Strategies and Tools for Integrating Technology in Special Education Universal Design for Learning (UDL)**

UDL is best understood by three core principles. The first, Representation, involves the perception of the learning objective, content, or skill for instruction [74]. To gain access, learners must have access to sense and meaning that is present through print, video, animation, speech, read aloud, and digital content. The second principle, Action and Expression, comprises the essential functions for engagement: physical action, gestures, speech, and expression, navigation to goals, and other targeted skills that are critical to demonstrate their knowledge and skills [75]. Users with disabilities may access and receive information without limitation [39]. The third principle, Engagement, provides targeted strategies for learning that include: opportunities to make choices, build understanding, and collaborate with others while facing barriers. Such learning barrier reduction and motivation to learn are addressed by UDL. UDL proposes three primary units to be intentionally considered when creating learning environments: means of representation, means for action and expression, and means of engagement [40]. While the traditional one-size-fits-all approach to teaching allows some degree of customization, only UDL allows instructors to match instruction to the diversity of student variability. Specifically, UDL emphasizes proactive, flexible approaches attempting to accommodate different ways of enabling the students' interaction with the learning environment. UDL practice prioritizes the identification of barriers to learning caused by the design of the instructional environment rather than focusing exclusively on the deficits of individual learners [75-77].

### **Assistive Technology Devices and Software**

Overall, the technology products emphasized here can and should be developed to support students with a wide range of skills who are addressing diverse curriculum-related goals. Word recognition and decoding programs, transcription-recognition systems that facilitate writing, graphic organizers, concept mapping software, and multimedia story frameworks and templates [49]. These curricular tools can be used to support - and simplify - the performance of challenging literacy activities. They help ready students for current educational tests and for computer-based assessments that are increasingly implemented. Technology products developed for diverse learner groups can also be beneficial for addressing the needs of students who are not members of these groups [56]. Assistive technology encompasses any item, piece of equipment, or product system, whether acquired commercially, off the shelf, modified or customized, that is used to increase, maintain, or improve the functional capabilities of individuals with disabilities. The legal definition of assistive technology devices in the USA includes any item, piece of equipment, or product system, whether acquired commercially, off the shelf, modified or customized, that is used to increase, maintain, or improve the functional capabilities of a child with a disability [59]. The selection and use of assistive technology devices is critical in the context of educational practices for meeting the unique needs of students with learning disabilities [60]. There are students with severe disabilities who require complex and expensive technologies to perform learning activities in school settings, while others may need simple yet effective technology devices that can provide great benefit [78].

### **Educational Apps and Online Platforms**

Many educational apps and online platforms specifically support students and as such, are focused on building different academic skills, providing ongoing formative data, and typically practice focused with internal rewards or extrinsic motivation system. Apps often do so in a way that makes the content conceptually accessible to students [58]. Each of these types of apps and online platforms fills a meaningful niche that is often challenging to achieve for students with learning disabilities in more traditional instructional environments. A second category of technology that supports students with learning disabilities is educational apps and online platforms. Students with learning disabilities often struggle with traditional methods of instruction, due to challenges with attention, working memory, and processing speed [61]. Research supports making learning more interactive and multimodal as a way to engage students and create opportunities for learning in which students with working memory and processing speed deficits are not as disadvantaged [68]. Apps provide interactive, multimodal content that can be personalized based on individual student needs. Additionally, both apps and online platforms have a built-in ability to collect and provide real-time data on student progress or areas struggling, enabling teachers to quickly respond with targeted and tailored support [79].

### **Success Stories from Schools and Districts**

Many disabled students may not accept themselves even after they receive the appropriate learning device [80]. Acceptance begins when students realize that they can accomplish things (skills, functions) that



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they did not believe they were capable of doing before their assistive device [81]. A student's self-efficacy can impact the way specific situations are managed. The students brighten up and show enthusiasm for accomplishing their tasks when they realize that the learning device is a tool that can support the students with learning disabilities (SLDs) [83]. The purpose of using assistive technology is to improve the general education curriculum and support students to be more responsible for being successful. With a wide range of helpful technologies available to empower people with disabilities, the schools, teachers, and supportive personnel need to make sure appropriate technology tools are introduced in a positive and helpful way [84-86]. The main goal of assistive technology in education is to allow the student to function more within the educational environment [44]. As students gain confidence in learning, new assistive technology will promote the individual's self-efficacy [87].

### CONCLUSION

The integration of technology in education offers promising solutions for supporting students with learning disabilities. By utilizing personalized learning tools, assistive devices, and adaptive software, educators can create more inclusive and effective learning environments. These technological advancements not only help students overcome their learning challenges but also empower them to be active participants in their educational journeys. It is crucial for educators, administrators, and policymakers to continue exploring and implementing innovative technological solutions to ensure that all students, regardless of their learning disabilities, have the opportunity to succeed and thrive.

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