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Assistive technology to help students with disabilities

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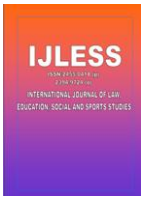

ABSTRACT

This section surveys a portion of the low-tech as well as the innovative gadgets accessible for a wide assortment of understudies with extraordinary advancing necessities. A background marked by assistive innovation gadgets is investigated and characterized. Assistive innovation has expanded being used in ongoing a long time because of openness of PCs and the computerized age. Advanced gadgets like hand held scanners, internet learning conditions, and computerized assets have changed the instructive encounters for understudies with exceptional necessities and inabilities. Accordingly, educator in-administration programs and progressing proficient improvement programs should be involved to comprehend and foster proper 21st-century learning amazing open doors and educational plans. Future patterns, like computer generated simulation (VR) conditions, permit open doors for protected, successful learning. To help with understanding and picking the suitable gadgets, various assets, like worldwide and public associations, and online assets are given.

Key Words: modern technology, Education, Assistive technology, Inclusive learning, Accessibility, Adaptive devices Educational tools.

Introduction

Assistive Technology (AT) has evolved significantly over the past three decades, from traditional devices like slides and overhead projectors to modern technologies like 3D simulations and VR. This chapter explores the use of low to high tech devices in assisting students with disabilities, focusing on AI, VR, and simulated environments. It also emphasizes the need for quality professional development for general education and special education teachers to maximize assistive technology use.

What is Assistive Technology?

Assistive technology refers to any product, instrument, equipment, or technology designed to improve the functioning of individuals with disabilities. The definition of assistive technology can vary globally, with the United States Department of Education defining it as any item, piece of equipment, or product

system used to increase, maintain, or improve functional capabilities of individuals with disabilities. There are several categories of assistive technology devices, including low technology (low tech) and high technology (high tech) devices. Low technology devices are inexpensive and simple to make, while high-tech devices involve sophisticated, programmable equipment. High-tech devices, such as computers with extended keyboards and modified screens, can be costly and require a comprehensive Individual

Education Plan (IEP)to identify student needsOver 75% of low-income countries worldwide lack prosthetic and orthotics training programs, and countries with the highest prevalence of disability-related health conditions have the lowest supply of skilled health professionals involved in assistive technology provision. The World Health Organization estimates that over one billion people worldwide need assistive technology products, with populations aging and non-communicable diseases expected to increase to over two billion by 2050.

The History of Assistive Technology Devices

Assistive technology has been instrumental in helping individuals live and learn for thousands of years. Early devices included hand tools, prosthetics, and mobile devices like wheelchairs. Around 1000 A.D., handheld lenses were used for the visually impaired, and eyeglasses were introduced in the 13th century. Gutenberg's printing press in the 15th century made print materials accessible. After World War II, Alexander Graham Bell invented Braille. Today, modern assistive technology devices are relatively new phenomena.

In the last few decades, the number of commercially available devices has increased exponentially due to the advent of new computers and digital technologies. In post-secondary education, technology such as the Internet, web-based learning, and collaborative software programs have positively impacted students with disabilities. Higher education organizations have become early adopters of technology, including digital presentations, Learning Management Systems (LMS), and the internet for learning. However, early assistive technology in the last few decades was mainly focused on people with visual impairments.

In the digital age, students with visual impairments can view, create, and submit assignments online digitally. However, the cost of digital technology and assistive technology has been high, and specific hardware and software systems may not always communicate with each other, making assessing and using digital devices for students with disabilities problematic.

Why Use Assistive Technology Devices?

When appropriate to the user and the user's environment, assistive technology is a powerful tool to increase independenceand improve participation (Funk, 2012)

Assistive technology can significantly increase independence and participation in learning for children with special needs, especially when used appropriately. It enables them to become independent and participate in learning activities with their peers. The choice of the appropriate assistive technology device is crucial for successful learning. Studies show that when used effectively, assistive technology devices can improve day-to-day operations, such as game-based learning and location-based services. Additionally, AT devices create a positive environment for independence and skill improvement, enabling young children with disabilities to overcome their weaknesses and reach their potential. A positive attitude towards assistive technology positively affects the motivation of both the child and their teacher.

Brown et al. (2011) indicate that assistive technology devices when used effectively with students with disabilities, have produced positive results in students performing day-to-day operations. Brown et al. suggest that game-based learning and location-based services (high tech) can be useful in helping users navigate the "real-world"

The goal in education for children with disabilities is to ensure success for all students in an inclusive general education classroom. This involves creating a positive learning environment for all students, including those with disabilities, and fostering a culture of diversity and learning for all students.

Educational leaders and administrators play a crucial role in creating an inclusive school culture by involving them in the decision-making process for students' Individualized Education Plans (IEPs). They need the necessary knowledge and skills to make informed decisions and be aware of available assistive technology devices and services. To positively impact assistive technology on learning, they should possess essential skills.

- Defining assistive technology
- Following assistive technology laws and legislation
- Participating in an IEP team
- Recognizing assistive technology devices and services
- Identifying assistive technology funding sources
- Providing professional development in assistive technology
- Following ethical guidelines

Educational leaders and administrators play a crucial role in creating an inclusive school culture by involving them in the decision-making process for students' Individualized Education Plans (IEPs). They need the necessary knowledge and skills to make informed decisions and be aware of available assistive technology devices and services. To positively impact assistive technology on learning, they should possess essential skills.

The Digital Generation and 21st Century Learning

Digital technology devices are increasingly prevalent in today's students' culture and general education classrooms, necessitating teachers to ensure successful and engaging learning for all students. While marginal training and curriculum are provided, there is a need for additional assistive technology knowledge and skills in teacher education programs and professional development activities. According to Judge and Simms (2009) and Lee and Vega (2005), because of the lack of training, teacher proficiency has lagged in assistive technology devices and appropriate use for students with disabilities.

Students today connect daily with digital devices, a shift from previous generations. Students are growing up with digital hand-held devices that previous generations did not have. Lin (2008) points out that children are now embracing technology as a part of their everyday life and to effectively educate this new generation of students, teachers need to move away from the didactic/behavioural model of teaching to an active learner approach that is hands-on and engaging. Lindsey-Glenn and Gentry (2008) concur and point out that students with autism spectrum disorder (ASD) could benefit from learning literature and language by using active engagement techniques. They suggest that because students with ASD have unique challenges with their limited ability to speak and communicate, in addition to social challenges, they need to engage with visual support systems, such as visual aids/technology and hands-on activities.

Glaeser, Pierson, Fritschmann (2003) and Rao and Gagie (2006) emphasize the importance of visual activities in active learning and engagement. They suggest that technology, such as e-books and computerized support systems, can be used for expression. Positive visual learning strategies include digital storytelling, multimedia software, and story creation websites. Rao and Gagie (2006) emphasize the critical role of visual supports in learning.

- VS are part of everyone's communication system
- VS can attract and hold a student's attention
- VS enable the students to focus on the message and reduce anxiety
- VS make abstract concepts more concrete for the student
- VS assist the student expresses his or her thoughts (p. 26).

Teacher Education and Professional Development

Van Laarhoven et al. (2008) argue that the lack of availability, affordability, and accessibility of assistive technology devices in the classroom is no longer an obstacle. Instead, the problem lies in teachers' lack of knowledge and skills in assessing students with disabilities. They suggest that teachers need to be provided professional development activities to learn how to use the appropriate assistive technology device to benefit their students effectively. Abner and Lahn (2002) and Huang, Suggen, and Beveridge (2009) also highlight the frustration teachers experience when lacking knowledge of assistive technology, leading to inefficient use. Alves, Monteiro, Rabello, Gasparetto, and de Carvalho (2009) found that while technology is beneficial for students with visual impairment, most teachers do not use it appropriately. Kelly (2009) suggests that teachers are often overwhelmed and untrained in working with students with disabilities and assistive technologies. Corn and Wall (2002) suggest that knowledge about assistive technology use affects a teacher's ability to use it effectively with visually impaired students.

Teachers' knowledge and beliefs about assistive technology are crucial in selecting the right device. They can reduce student frustration and enhance learning. Grandin (2013) and Hutinge et al. (2006) agree that a teacher's professional knowledge, value, and teaching philosophy significantly impact the effectiveness of selecting and using assistive technology devices.

Edyburn (2003) suggests that general classroom teachers are typically the primary educators of students with disabilities, and provides three categories of knowledge about assistive technology.

1.Awareness,

2. Working Knowledge, and

3. Transformation.

Level 1 of awareness of assistive technology devices and students with disabilities can be achieved through professional development workshops and low-level courses. This level encourages teachers to learn more about services and devices, identify students with disabilities, diagnose them, and choose appropriate devices.

Level 2 involves working knowledge, identifying issues, and making decisions on devices and services.

Level 3 involves teachers promoting systematic change for the adoption, evaluation, and inclusion of assistive technology globally, going beyond necessary skills and identifying appropriate devices.

General education teachers require assistance in using assistive technology due to limited knowledge. Training on assistive technology should be provided for all instructors, and professional development should be provided by educational leaders and administrators. Colleges should also incorporate assistive technology curricula into their in-service teacher programs.

Koch (2017) highlights that in-service and pre-service teacher education programs often lack adequate training for implementing assistive technology in classrooms. The pre-service level faces challenges due to limited resources and funding. Koch suggests that providing adequate knowledge of assistive

technology to teacher candidates and general education classroom teachers can differentiate instruction and accommodate all students.

Pre-service teaching programs often struggle with a lack of curriculum to support assistive technology knowledge and skills, making differentiated instruction challenging. This issue persists due to inadequate training, materials, and funding. Chmiliar's (2007) report on special education teachers highlights serious shortcomings in pre-service training for teachers.(p.14)

Teachers often struggle with balancing their workloads, grading papers, and preparing for IEP meetings, making it difficult for them to learn new applications and software. Lawless and Pellegrino (2007) published a literature review on the integration of technology into the learning process, focusing on what is known and what is not. The review encourages educators to ask appropriate questions and contribute to the learning community's understanding of assistive technology in general education classrooms.

Teachers should allocate time for discussing and exploring low and high-tech approaches to work with students with multiple needs, including behavioral, social, interpersonal, and communication skills. Prioritizing goals and objectives is crucial, especially in today's world. Jost and Mosley (2011) recommend developing Professional Learning Communities (PLC) between general education teachers and special education professionals, as high-level discussions and interactions between both groups create positive learning environments. Expediency is often necessary in today's world.

Trends and Resources

Teachers face increasing challenges in providing remediation and intervention for students' academic success, with some students requiring minimal support, while others require extensive intervention. The Individuals with Disabilities Education Act (IDEA) defines assistive technology as items or systems used to enhance a child's functional capabilities, such as dictionaries or thesaurus. There are two main groups of students who require accommodations: documented disabilities, physical, medical, or sensory difficulties, and cognitive or intellectual disabilities. Section 504 of the IDEA covers conditions like AIDS, allergies, arthritis, asthma, cancer, cerebral palsy, drug or alcohol addiction, epilepsy, leukemia, obesity, orthopedically impaired, traumatic brain injury, conduct disorder, special health care needs, temporary disabilities, Tourettes syndrome, Osgood Schlatters, and tuberculosis. Low-tech interventions, such as developmentally appropriate books, outlines, and definitions, are less expensive and more readily available than high-tech software and applications.

Assistive Technology and Content Areas Mathematics and Reading

Teachers are expected to create a nurturing environment for all students, ensuring they feel accepted and respected. Low-tech interventions may not be beneficial for 21st-century learners or those with low incidence conditions, such as children with autism, deaf and blind children, and those with traumatic brain injuries. High-tech assistance can be provided through ancillary materials and educational software like The Waterford Early Reading program, Headsprout Early Reading, PLATO Focus, Academy of Reading, LeapTrack, READ 180, Scholastic, Knowledge Box Central, and Pearson Digital Learning.

For students struggling with arithmetic and math, both low and high-tech elements can be used. Low-tech interventions involve using items like pennies, nickels, dimes, and quarters to teach basic units and convey meaning. In the multiplication realm, times tables can be used to help students write from 2 x 1=2 to 2 x 12=24.

High tech strategies for children include calculators and cell phones, which can assist in checking work and performing routine functions. Texas Instruments calculators can compute means and standard deviations.

MathPad is an advanced resource that aids students with cerebral palsy in performing arithmetic functions on computers or cell phones. It offers a talking math program for organization, sequencing, and lining numbers in columns. Portable calculators with talking multiplication tables are available at independentliving.com. GT Calc Scientific Calculator is a software program with four screen magnification levels for visual difficulties. The Talking Pocket Calculator is a small, thin calculator with precise numbers and setting functions. The Talking Texas Instruments Scientific Calculator offers silent or speaking operations, earphones, and volume controls. Big: Calc has six specific layouts and can be adjusted for better visibility and those with figure/ground difficulties.

Expressive Language and Writing

Expressive writing is crucial for students, and speech therapy can enhance their skills. Low-tech interventions, such as daily conversations and language development kits, can help assess students' response to teacher interventions. Low-tech strategies include clipboards, better writing tools, and large grippens. Scotch-taped paper helps maintain concentration. A word processor with spell and grammar check can improve writing efficiency, but proofreading is still necessary. A dictionary or thesaurus can also be helpful. Cell phones have dictionaries, and Siri can be used for questions, but it is not receiving a grade. Advanced writing resources like Co-Writer Universal and FlexSpell can help students with word prediction, grammar, vocabulary, subject-verb agreement, word usage, and proper nouns.

EZKeys is a mouse-based program that offers dual word prediction and an expanded keyboard. It helps students identify the most frequently used words with similar letters.

Gus!Word Predictions aids in typing speed, helping those with slow typing, cerebral palsy, or missing fingers. It also includes a dictionary and abbreviation expansion.

WordQWriting Aid Software offers spoken feedback and word prediction, while Write Outloud provides immediate feedback on word usage and misspellings. This program helps students with documented disabilities function more autonomously.

Draft:Builder assists students in formulating a draft by organizing, taking notes, and completing it. These tools provide a framework to organize and link basic ideas and information.

Future paths

The Internet has revolutionized teaching and learning, enabling multiple ways of knowing and doing in a digital world. Advancements in digital technology devices are becoming standard, available, and affordable for all students. These devices transform the way students access information, communicate, learn, and function in daily life. Digital pens allow individuals to upload handwritten notes and playback audio from lectures. Operating systems like Windows 10 and OS10 offer built-in assistive technology functions, such as Narrator, Magnifier, Closed Captioning, and adjustable keyboards. Additionally, cloud computing is a trend in education

Cloud computing is a digital platform that uses software, websites, and storage space on the internet, eliminating the need for expensive hardware. It allows students to share information and communicate globally, enabling anytime, anywhere learning. Examples include Massive Open Online Courses (MOOCs) and digital presentation software like Prezi and Google Docs. Cloud computing offers universal access to files and shared simulated environments, such as virtual reality applications. It also provides opportunities for students with disabilities to create, collaborate, and share documents online.

Virtual Reality (VR) environments have the potential to improve daily life skills and provide a safe 3D learning environment. They offer strengths such as malleability, controllability, replicability, modifiable sensory stimulation, and the ability to implement individualized intervention approaches.

VR can also be used for practical applications, such as learning to travel city streets or riding a bus. Teachers can create virtual environments for their students and interact with other educators globally. VR also offers affordability, providing repeated training scenarios for learning new concepts and skills in a safe environment. For instance, children who spent time in a virtual safe environment learning to use wheelchairs showed gains in their driving skills. VR can also be used as a diagnostic tool, allowing students with disabilities to observe their reactions to given situations and modify the environment accordingly. However, universal design of interfaces and design standards for VR environments are needed to ensure accessibility for all students.

Humanoid robots have the potential to engage children with disabilities by providing safe, predictable responses that can be modified over time based on individual responses. They can also be used as diagnostic tools and reprogramed to provide specific treatments based on individual children. Diehl and colleagues developed three broad categories for applying robots in a clinical setting: elicitation of behaviors, modeling, teaching, and/or practicing a skill, and providing feedback.

Standen et al. (2016) suggest that robots can perform consistent, repeated behaviors, such as throwing a ball, which elicits a response and makes children feel comfortable interacting with them in speech-language therapy sessions. Lee and Hyun (2015) found that children initiated conversations with a robot and were able to exchange 2-way communications effectively based on the robot's consistent feedback. Kim (2013) found that children with ASD spoke more while interacting with a social robot than with another adult or touchscreen computer game.

CONCLUSION

It is essential to consider a variety of assistive technology devices to reach all students, including general education classroom teachers, special education professionals, parents or guardians, and educational leaders. Challenges include time-consuming, labor-intensive processes, specialized guidance, training, cost, care, and maintenance of devices. A team of dedicated individuals must work together to develop positive and productive learning environments when choosing and utilizing assistive technology devices.

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Assistive Technology Applications

Hearing Applications

- **Dragon Dictation** – Voice recognition software for mobile devices (PC/Mac).
- **FM Sound Devices** – Wireless listening system for classroom support.

Text-to-Speech and Visual Tools

- **Talking Calculators** – Aid for visually and hearing impaired students.
- **Be My Eyes** – Connects visually impaired users with volunteers.
- **Read2Go** – eBook reader with adjustable text and speech for iOS.

Autism Support Tools

- **Scene Speak** – iPad app for creating communication books.
- **Proloquo2Go** – AAC app converting pictures to speech (iPhone/iPad).

ADHD Tools

- **MindNode** – Visual mind-mapping tool for iOS (https://mindnode.com/)
- **Inspiration/Kidspiration** – Visual learning tools (http://www.inspiration.com)

Math Tools

- **National Library of Virtual Manipulatives** – http://nlvm.usu.edu
- **MathTalk** – Speech recognition software for math (http://www.mathtalk.com)

Reading and Writing Tools

- **Reading Rockets** – Reading strategies and support (http://www.readingrockets.org)
- **Livescribe Smartpen** – Records and transcribes written/spoken input.
- **Ghotit** – Writing and reading assistant for dyslexia (https://www.ghotit.com)

Built-in Assistive Tech

- **Windows 10 –** Narrator, Magnifier, captioning, customizable input.
- **Mac OS X –** VoiceOver, zoom, customizable accessibility settings.

iPad Apps

40 Amazing iPad Apps for the Learning Disabled
http://www.matchacollege.com/blog/2011/40-amazing-ipad-apps-for-the-learning-disabled/

Assistive Technology Organizations

International

- **AAATE –** http://aaate.net/
- **ARATA (Australia) –** https://www.arata.org.au/
- **Ministry of Education, Singapore –** https://www.moe.gov.sg/education/special-education/assistive-technology
- **UN – Article 32 –** https://www.un.org/development/desa/disabilities
- **WHO GATE Initiative –** https://www.who.int/initiatives/gate

Research and Education

- **Adaptech Research Network –** http://www.adaptech.org/
- **Closing the Gap –** https://www.closingthegap.com/
- **CEC (Council for Exceptional Children) –** https://www.cec.sped.org/
- **WAI (Web Accessibility Initiative) –** https://www.w3.org/WAI/
- **Technology and Media Division (TAM) –** http://www.tamcec.org/
- **ECTA Center –** http://ectacenter.org/topics/atech/natlorgs.asp
- **ISAAC –** https://www.isaac-online.org
- **NARIC –** http://www.naric.com/
- **AHEAD –** https://www.ahead.org/