ROLE OF ASSISTIVE TECHNOLOGY DEVICES IN FACILITATING READING SKILL IN CHILDREN WITH VISUAL IMPAIRMENT IN THE TWENTY FIRST CENTURY NIGERIAN CLASSROOM

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Abstract
This paper examined the role of assistive technology devices in facilitating reading skills among children with visual impairment in the twenty-first-century Nigerian classroom. The paper was premised on the view that children with visual impairment have the right to acquire functional reading skills and benefit from the educational, social, and personal advantages associated with literacy development. Reading remains a fundamental tool for academic achievement; however, children with visual impairment often encounter difficulties in accessing printed materials due to limitations imposed by visual loss. The paper discussed the various modes through which children with visual impairment access reading materials, including visual reading through magnification devices, tactile reading through Braille, auditory reading through audio technologies, and electronic reading through information and communication technologies. Particular attention was given to the role of assistive technology devices such as magnifiers, Braille machines, refreshable Braille displays, screen readers, audio books, text-to-speech software, and other digital technologies in enhancing reading skills. The paper further highlighted major challenges associated with the utilization of assistive technology devices, including inadequate awareness, high procurement and maintenance costs, limited availability of devices in schools, insufficient teacher competence, scarcity of accessible reading materials, and poor infrastructural facilities. To address these challenges, the paper recommended increased stakeholder awareness, curriculum review for teacher education programmes, provision of adequate assistive technology devices and accessible learning resources, and improved funding mechanisms through government and development partners. The paper concluded that effective provision and utilization of assistive technology devices are essential for promoting reading skills, literacy development, educational inclusion, and lifelong learning among children with visual impairment in contemporary Nigerian classrooms.

Keywords: Assistive technology devices, children with visual impairment, reading skills, literacy development, inclusive education

Introduction

Reading is a fundamental language skill that enables individuals to acquire knowledge, communicate effectively, and participate meaningfully in society. It involves the ability to recognize, interpret, and derive meaning from written symbols and texts. According to Andzayi (2024), reading goes beyond word recognition and pronunciation to include the ability to comprehend and interpret information conveyed through written language. Similarly, Babudoh (2024) described reading as an interactive process through which readers construct meaning from texts by relating new information to their prior knowledge and experiences. Reading therefore serves as a critical foundation for learning and academic success.

Language is an essential tool for communication and social interaction. It enables individuals to express thoughts, feelings, and ideas through spoken, written, or symbolic forms. According to *Britannica* (n.d.), language is a system of conventional spoken, written, or gestural symbols used by members of a social group to communicate and participate in culture. The interpretation and understanding of these symbols constitute the process of reading. Consequently, reading plays a vital role in educational development, as it provides access to information across all areas of learning. For children with visual impairment, the acquisition of reading skills presents unique challenges due to limited or absent visual access to printed materials. Visual impairment refers to a condition in which an individual experiences significant loss of vision that cannot be corrected fully through conventional means. Ozoji, Unachukwu, and Kolo (2020) explained that visual impairment may range from low vision to total blindness and may be viewed from both medical and educational perspectives. From an educational standpoint, visual impairment is characterized by the inability to access ordinary print materials effectively without specialized instructional adaptations and support services.

Children with visual impairment often encounter barriers in accessing reading materials, participating in classroom activities, and developing literacy skills comparable to those of their sighted peers. Lowenfeld (2020) observed that visual impairment affects many aspects of a child's development, including learning, communication, and social interaction. Because vision contributes significantly to the acquisition of information, learners with visual impairment frequently rely on alternative sensory channels such as touch and hearing to access educational content. Traditionally, Braille has been the primary medium through which children with visual impairment develop reading and writing skills. Braille is a tactile system of raised dots that allows individuals with visual impairment to read through touch. Sykes and Ozoji (2021) noted that Braille remains one of the most effective means of literacy development for persons who are blind. However, the production and distribution of Braille materials are often costly, and Braille texts may be bulky and less readily available than conventional print materials. These challenges underscore the need for additional instructional resources and technological innovations that can enhance reading opportunities for learners with visual impairment.

The twenty-first century has witnessed remarkable advancements in assistive technology, creating new opportunities for children with visual impairment to access information and develop literacy skills. Assistive technology refers to any device, equipment, or system that improves the functional capabilities of individuals with disabilities. The Technology-Related Assistance for Individuals with Disabilities Act (Tech Act, 1988) defined assistive technology as any item, product, or system used to increase, maintain, or improve the functional capabilities of individuals with disabilities. Similarly, the Individuals with Disabilities Education Act (2024) recognizes assistive technology as an important support mechanism for enhancing educational participation and learning outcomes among persons with disabilities.

Assistive technology devices for children with visual impairment include Braille machines, screen readers, electronic Braille displays, magnification devices, audio books, text-to-speech software, optical character recognition systems, and digital learning applications. According to Washington University (n.d.), assistive technology enables individuals with disabilities to perform tasks that might otherwise be difficult or impossible. These devices facilitate access to printed and digital information, thereby enhancing reading efficiency, comprehension, and independent learning.

Research has demonstrated the effectiveness of assistive technology devices in promoting reading skills among learners with visual impairment. Akang (2020) found that the use of low-vision aids significantly improved reading comprehension among learners with low vision in Kaduna State. Similarly, Ozoji, Akang, and Dala (2021) reported that low-vision devices enhanced learners' ability to access printed materials and improved reading performance. Furthermore, Olukemi (2022) revealed that audio-media resources positively influenced reading comprehension among students with visual impairment by providing alternative means of accessing textual information. The role of assistive technology devices in facilitating reading skills extends beyond improving access to educational materials. These technologies promote learner independence, increase participation in classroom activities, enhance motivation to learn, and support academic achievement. Willings (2019) emphasized that literacy and reading skills are foundational competencies that enable learners with visual impairment to access the curriculum and participate effectively in educational activities. Through assistive technology, children with visual impairment can engage with a wider range of learning resources and achieve educational outcomes comparable to those of their sighted peers.

In the contemporary Nigerian classroom, the integration of assistive technology devices has become increasingly important as schools strive to promote inclusive education and equal learning opportunities for all learners. Ozoji et al. (2020) emphasized that modern trends in special education encourage the adoption of innovative technologies that address the diverse learning needs of children with disabilities. Consequently, assistive technology devices have become indispensable tools for facilitating reading skills among children with visual impairment in the twenty-first century. Therefore, the effective provision and utilization of assistive technology devices can significantly enhance reading development, literacy acquisition, and educational participation among children with visual impairment. By improving access to information and promoting independent learning, these technologies contribute substantially to the realization of inclusive and equitable education in the twenty-first-century Nigerian classroom.

Reading Skills among Children with Visual Impairment

Children with visual impairment have the same right as their sighted peers to acquire literacy skills and benefit from the educational, social, and personal advantages associated with reading. Reading is a fundamental skill that promotes academic achievement, independent learning, communication, and lifelong development. However, the inability to access conventional print materials presents significant challenges to children with visual impairment. As a result, specialized instructional approaches and alternative reading methods are necessary to ensure that they develop effective reading skills. Government, educational institutions, and other stakeholders therefore have a responsibility to provide the resources, services, and support systems needed to facilitate literacy development among these learners.

Children with visual impairment access reading materials through different modes depending on the nature and severity of their visual loss. Learners with low vision often rely on visual reading through magnification devices that enlarge print and improve readability. Such devices include magnifying glasses, reading spectacles, electronic magnifiers, and screen enlargement software. Akang (2020) reported that the use of low-vision aids significantly improved reading comprehension among learners with low vision. Similarly, Ozoji, Akang, and Dala (2021) observed that low-vision devices enhanced

learners' access to printed materials and improved reading performance. For learners with severe visual impairment or blindness, tactile reading through Braille remains one of the most effective means of literacy development. Braille is a system of raised dots arranged in specific patterns that represent letters, numbers, and punctuation marks. Through touch, learners can read and write independently. Sykes and Ozoji (2021) noted that Braille continues to play a vital role in promoting literacy among persons with visual impairment. Although Braille remains indispensable, challenges such as the high cost of production, limited availability of Braille materials, and relatively slower reading speed compared with print have necessitated the use of additional technological supports.

Another important approach to reading among children with visual impairment is auditory reading. This involves accessing information through listening rather than visual or tactile means. Audio books, talking books, recorded instructional materials, radio programmes, and text-to-speech applications provide learners with opportunities to access educational content through hearing. Olukemi (2022) found that audio-media resources improved reading comprehension among students with visual impairment by providing alternative methods of accessing information. Auditory reading is particularly beneficial because it enables learners to access large volumes of information within a relatively short period and enhances comprehension through repeated listening.

The rapid advancement of information and communication technology has further transformed reading opportunities for children with visual impairment. Electronic reading through computers, smartphones, tablets, screen readers, and digital learning applications has expanded access to educational materials. These technologies enable learners to access digital texts through speech output, Braille displays, or magnified print. Consequently, barriers that once limited reading opportunities for children with visual impairment are gradually being reduced, thereby promoting greater participation in educational activities and improving literacy outcomes.

Role of Assistive Technology Devices in Facilitating Reading Skills

Assistive technology devices are essential tools that support children with visual impairment in accessing information and developing reading skills. The Technology-Related Assistance for Individuals with Disabilities Act (1988) defined assistive technology devices as products, equipment, or systems designed to improve the functional capabilities of persons with disabilities. Similarly, the Individuals with Disabilities Education Act (2024) recognized assistive technology as a critical support mechanism that enhances educational participation and achievement among learners with disabilities. In the context of reading, assistive technology devices help children with visual impairment overcome barriers associated with limited or absent vision and provide alternative means of accessing printed and digital information.

One of the major roles of assistive technology devices is improving access to reading materials. Devices such as magnifiers, electronic magnification systems, Braille machines, Braille embossers, and refreshable Braille displays enable learners with visual impairment to access information in formats that suit their individual needs. These devices help learners read textbooks, assignments, examination materials, and other instructional resources that would otherwise be inaccessible. By improving access to information, assistive technology devices enhance educational participation and academic success.

Assistive technology devices also improve reading speed and comprehension. Screen readers and text-to-speech software convert written text into spoken language, allowing

learners to access information quickly and efficiently. Similarly, audio books and digital talking books enable learners to listen to educational content while simultaneously developing comprehension skills. According to Olukemi (2022), the use of audio-based technologies enhances understanding and retention of information among learners with visual impairment. Through these technologies, children are able to process information more effectively and participate actively in classroom learning.

Another important role of assistive technology devices is the promotion of independent learning. Technologies such as smartphones, tablets, computers, and electronic Braille devices enable learners to access information without relying heavily on teachers, parents, or peers. This independence contributes to the development of self-confidence, self-reliance, and problem-solving skills. Furthermore, electronic technologies provide access to digital libraries, online learning platforms, and educational applications, thereby exposing learners to a wider range of reading materials and learning opportunities. Assistive technology devices also facilitate inclusive education by reducing the gap between learners with visual impairment and their sighted counterparts. Ozoji, Unachukwu, and Kolo (2020) emphasized that modern special education practices encourage the integration of innovative technologies to address the diverse learning needs of learners with disabilities. Through the effective use of assistive technology devices, children with visual impairment can participate more fully in classroom activities, complete academic tasks independently, and achieve educational outcomes comparable to those of their peers.

In the twenty-first-century Nigerian classroom, assistive technology devices have become indispensable tools for facilitating reading skills among children with visual impairment. They enhance access to information, improve reading comprehension, promote independent learning, and support inclusive educational practices. Therefore, the provision and effective utilization of assistive technology devices should remain a priority for government, educational institutions, teachers, and other stakeholders committed to improving literacy development and educational outcomes among children with visual impairment.

Table 1

Reading Media Matrix for Children with Visual Impairment and Related Assistive Technology Devices

Visual Reading (Low Vision)	Tactile Reading (Severe Visual Loss)	Auditory Reading (Low Vision/Blindness)	Electronic Reading (Low Vision/Severe Visual Loss)
Magnifying lens	Braille	Audio texts	Electronic Braille note taker
Projector	Braille translation software	Computer-based audio reading software	Electronic Braille writer
Reading glasses	JAWS (Job Access With Speech) screen reader	FM listening systems	Closed-Circuit Television (CCTV)
Optical magnifiers	Braille book maker	Cassette recorders	CCTV with distance camera
Large-print	Perkins Brailler	Special talking books	Electronic magnifiers

materials			
Colour filters	Braille printers/embossers	Audio descriptions	Smartphones and iPhones with built-in reading applications
Screen readers	Braille typewriters	Text-to-speech systems	Cell phones with reading applications for newspapers and documents
Video magnifiers	Refreshable Braille displays	Podcasts	Digital encyclopedias
Magnifying hardware	Reading and scanning software	Radio	Screen readers integrated with Braille devices
Magnifying software	Text-to-Braille translation software	Digital audio learning resources	Computer-based reading software
Screen magnifiers	Screen readers for the blind	Recorded instructional materials	JAWS (Job Access With Speech)
Colour identification devices	Braille production software	Educational audio programmes	Kurzweil Educational Reading Software
	Braille learning devices		Refreshable Braille displays

Source: Adapted from Sykes and Ozoji (2021), Ozoji, Unachukwu and Kolo (2020), and Washington University (n.d.). **Fig 1. Assistive Technology Devices.**

Challenges Associated with the Use of Assistive Technology Devices in Facilitating Reading Skills among Children with Visual Impairment

Notwithstanding the significant benefits of assistive technology devices in promoting reading skills among children with visual impairment, several challenges hinder their effective utilization in Nigerian classrooms. One of the major challenges is the inadequate availability of assistive technology devices in schools. Many schools that serve children with visual impairment lack essential devices such as Braille machines, refreshable Braille displays, screen readers, magnification devices, audio books, and text-to-speech software. As a result, learners often depend solely on conventional Braille materials, which may not adequately meet their diverse learning needs. The absence of these technologies limits learners' access to information and reduces opportunities for independent reading and learning.

Another significant challenge is the lack of awareness among stakeholders regarding the importance of assistive technology devices in the education of children with visual impairment. Many school administrators, parents, teachers, and policymakers are unaware of the educational benefits associated with these technologies. Akang (2020) observed that many learners with low vision are often compelled to rely exclusively on Braille despite possessing residual vision that could be enhanced through low-vision devices. This lack of awareness often results in the underutilization of available technologies and inadequate investment in assistive technology resources.

The high cost of procuring and maintaining assistive technology devices also constitutes a major barrier to their effective use. Most assistive technology devices are

imported and therefore expensive to acquire, particularly in developing countries such as Nigeria. The rising cost of technological equipment, coupled with limited educational funding, makes it difficult for schools and parents to provide the necessary devices for children with visual impairment. In addition, maintenance, repairs, software updates, and technical support services further increase the financial burden associated with these technologies. Inadequate teacher preparation and professional competence represent another challenge. Many teachers lack sufficient training in the selection, operation, and integration of assistive technology devices into classroom instruction. Consequently, even when devices are available, they may not be effectively utilized to support reading development. Effective use of assistive technology requires specialized knowledge and skills, which many teachers have not acquired through their pre-service or in-service training programmes. This situation limits the potential benefits that learners with visual impairment can derive from assistive technologies.

Poor reading culture and limited availability of accessible reading materials also hinder the development of reading skills among children with visual impairment. Many educational materials are produced only in conventional print formats, making them inaccessible to learners who depend on Braille, audio, or electronic formats. The scarcity of Braille books, audio books, and electronic learning resources reduces opportunities for extensive reading and literary engagement among children with visual impairment. Consequently, learners may struggle to develop advanced reading skills and literary appreciation. Parental factors also contribute to the challenges associated with reading development among children with visual impairment. Some parents possess limited literacy skills and may be unable to provide the necessary academic support and reading encouragement at home. In some cases, negative attitudes toward disability and limited awareness of educational opportunities for children with visual impairment discourage parents from investing in assistive technology devices and literacy development. This situation negatively affects learners' motivation and access to reading opportunities outside the school environment.

Furthermore, inadequate infrastructural facilities, including unstable electricity supply, poor internet connectivity, and limited technical support services, restrict the effective use of modern assistive technology devices. Many digital technologies depend on reliable electricity and internet access to function optimally. Where these facilities are lacking, the effectiveness of assistive technology devices in facilitating reading skills is significantly reduced.

Conclusion

Assistive technology devices play a vital role in facilitating reading skills among children with visual impairment in the twenty-first-century Nigerian classroom. These technologies enhance access to information, improve reading comprehension, promote independent learning, and support academic achievement. However, challenges such as inadequate availability of assistive technology devices, limited awareness, high costs, insufficient teacher preparation, scarcity of accessible reading materials, parental constraints, and infrastructural deficiencies continue to hinder their effective utilization.

Addressing these challenges requires concerted efforts from government, educational institutions, teachers, parents, and other stakeholders. Through increased awareness, improved teacher training, adequate provision of assistive technology devices, availability of accessible reading materials, and sustainable funding mechanisms, children with visual

impairment can be provided with meaningful opportunities to develop effective reading skills. Ultimately, the effective integration of assistive technology devices into educational practice will promote literacy development, educational inclusion, and lifelong learning among children with visual impairment in Nigeria.

Suggestions for Enhancing the Use of Assistive Technology Devices

To improve reading skills among children with visual impairment, there is a need for increased awareness among stakeholders regarding the importance of assistive technology devices. Government agencies, educational institutions, non-governmental organizations, and professional associations should organize awareness campaigns, workshops, and seminars to educate parents, teachers, school administrators, and policymakers on the benefits of assistive technology in literacy development. Increased awareness will encourage greater acceptance, investment, and utilization of these devices in schools and homes.

Teacher education programmes should be strengthened to include comprehensive training on assistive technology devices and their application in reading instruction. Institutions responsible for teacher preparation should review their curricula to ensure that pre-service and in-service teachers acquire the knowledge and skills required to effectively utilize assistive technology devices in supporting learners with visual impairment. Continuous professional development programmes should also be organized to update teachers on emerging technologies and best practices in inclusive education.

Schools should ensure that children with visual impairment have access to appropriate reading modes and assistive technology devices based on their individual needs. Learners with low vision should be provided with magnification devices, while those with severe visual impairment should have access to Braille technologies, audio resources, and electronic reading devices. In addition, educational publishers should produce learning materials in accessible formats such as Braille, audio, and electronic versions to increase reading opportunities for learners with visual impairment.

Adequate funding is essential for the successful provision and utilization of assistive technology devices. Government should allocate sufficient resources to special and inclusive education programmes to facilitate the procurement, maintenance, and replacement of assistive technology devices. Educational intervention agencies, development partners, corporate organizations, and philanthropic bodies should also support schools by providing assistive technology resources and technical assistance. Such collaborative efforts will help bridge the gap in access to assistive technologies and promote inclusive learning environments.

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