The Impact of Assistive Technologies on Academic and Social Outcomes of Deaf-Blind Students in Nigeria.

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Keywords	Abstract
	The study investigated the Impact of Assistive Technologies on Academic and Social Outcomes of Deaf-Blind Students in Nigeria. The study employed a mixed-methods research design, guided by five research purposes and five research questions. A stratified random sampling technique was used to select a representative sample of schools, educators, and students across Nigeria. The schools were categorized by geographical regions, and specific schools were chosen based on their accessibility to assistive technologies and enrollment of deaf-blind students. A total of five schools were selected, with 15 teachers and 10 students from each school, resulting in a sample size of approximately 75 teachers and 50 students. Data collection instruments included a questionnaire for teachers, an interview guide for semi-structured interviews with teachers, administrators, and students, and a focus group discussion guide for facilitating group discussions. To ensure validity, the research instruments were reviewed by experts in special education and assistive technologies. Their feedback was used to refine the instruments before conducting a pilot study with a small sample of teachers and students. This pilot phase assessed the clarity and relevance of the questions. Reliability was ensured through a test-retest procedure, where the instruments were administered to the same group of participants at two different times, and the results were compared to evaluate consistency. Quantitative data collected from the questionnaires were analyzed using descriptive statistics, including frequency counts, percentages, and means, to summarize the availability and use of assistive technologies, as well as

their perceived effectiveness and challenges. Qualitative data from the interviews and focus group discussions were transcribed verbatim and analyzed using thematic analysis. Themes were identified based on participants' responses, focusing on the impact of assistive technologies on academic and social outcomes, as well as the challenges encountered in their implementation.

The results revealed that while basic assistive technologies like Braille machines and screen readers were widely available and utilized, advanced tools such as speech-to-text software and video captioning devices were less accessible and infrequently used. Despite these limitations, participants conveyed positive perceptions of the effectiveness of assistive technologies, particularly regarding academic outcomes. The study also highlighted several challenges, including inadequate teacher training, insufficient funding, and a lack of technical support, which hindered the optimal utilization of these tools. Additionally, the findings underscored the positive impact of assistive technologies on academic performance and social integration, emphasizing their role in fostering greater independence and inclusion for deaf-blind students.

Based on these findings, the study recommended efforts to improve the availability of advanced assistive tools, such as speech-to-text software and video captioning devices, in special schools. It also suggested that schools should seek partnerships with government bodies, NGOs, and private sectors to secure funding and resources. Moreover, it advocated for the expansion of teacher training programs to include comprehensive training on the effective use of assistive technologies, along with continuous professional development to ensure teachers were confident in integrating these tools into their instructional practices.

Introduction

Educational needs of deaf-blind students are often underserved due to the complex challenges posed by dual sensory impairments, which hinder their ability to communicate, access information, and engage in traditional learning environments. Deaf-blindness, which combines varying degrees of hearing and vision loss, creates unique educational requirements that call for specialized teaching methods, adaptive technologies, and tailored resources. Yet, in many Nigerian special schools, these essential supports are not readily available. Without appropriate interventions, deaf-blind students face significant risks of isolation, limited academic progress, and reduced opportunities to acquire vital skills for independence. Assistive technology has emerged as a transformative tool that holds potential to address these challenges and bridge educational gaps for deaf-blind students worldwide. Through devices and resources such as Braille displays, tactile communication aids, and screen readers, assistive technology can provide deaf-blind students with access to educational materials, enable effective communication with teachers and peers, and foster the

development of crucial cognitive and motor skills. In regions where such technology is integrated into special education programmes, students with dual sensory impairments have shown remarkable improvements in academic performance, social engagement, and self-confidence. Despite these promising outcomes, the adoption and implementation of assistive technology in Nigerian special schools remain limited due to several challenges, including high costs, lack of trained educators, and insufficient institutional support. Introducing assistive technology for deaf-blind students in Nigerian special schools could significantly enhance their educational experiences and learning.

Asghar et al. (2017) describe learning as a process through which individuals acquire new knowledge, skills, and behaviors, leading to changes in their abilities or capacity to perform tasks. Learning encompasses the development of skills, knowledge, and attitudes that equip individuals to navigate and contribute effectively to society. In the context of this study, learning pertains specifically to the acquisition of knowledge, skills, and attitudes by deaf-blind students in Nigerian special schools. Mobile learning, defined by Ismaili and Ibrahimi (2017) as the use of mobile devices like smartphones, tablets, and laptops to access educational resources anytime and anywhere, is recognized as an alternative to traditional assistive technology tools for students with special needs. In this study, mobile learning is explored as a means to enhance the educational experience for deaf-blind students in Nigerian special schools, offering accessible and flexible opportunities for acquiring knowledge through assistive technology.

Assistive Technology (AT) encompasses a range of products, equipment, systems, and devices that support and enhance an individual's functional capabilities and independence (Federici & Scherer, 2017). AT includes both low-tech and high-tech solutions such as hearing aids, communication devices, wheelchairs, and specialized software applications—all designed to improve the quality of life for individuals with disabilities and promote their social inclusion (Karlsson et al., 2018). In educational contexts, AT has proven to be an invaluable tool for enhancing the learning experiences of students with disabilities, facilitating greater academic achievement and social integration (Ahmed, 2018). Studies have demonstrated the effectiveness of AT in improving both academic performance and social inclusion for students with disabilities (Desmond et al., 2018).

The GREAT Summit on Assistive Technology highlighted the urgent need for policy frameworks that make high-quality assistive technology affordable and accessible to all (Maclachlan et al., 2018). The availability of diverse AT products allows individuals with disabilities to perform daily tasks more independently, fostering empowerment and autonomy (Smith et al., 2018). Research has consistently shown the benefits of AT in improving the lives of individuals with disabilities. For example, Dicianno et al. (2019) found that mobility-related AT significantly increased the independence, mobility, and social participation

of individuals with disabilities. Similarly, Antunes et al. (2019) observed that communication-based AT improved the quality of life and social interactions among older adults. Integrating AT into the education of deaf-blind students can create equal opportunities, support their independence, and enhance their social inclusion in special education.

Deaf-blindness is a condition characterized by a combination of visual and hearing impairments, resulting in unique communication needs for affected individuals. People with deaf-blindness often require specialized assistive technologies and communication tools to support their communication abilities (Matter et al., 2017). This condition presents considerable educational challenges, particularly for deaf-blind students in Nigerian special schools. In the context of this study, deaf-blindness refers to individuals with both hearing and visual impairments. Special schools, defined as educational institutions dedicated to serving students with disabilities, provide tailored education and support services to meet the diverse needs of these students, including those with deaf-blindness (Taherian & Davies, 2018). In Nigeria, such schools play a crucial role in educating children with disabilities, offering specific programs for students with deaf-blindness.

Introducing assistive technology in Nigerian special schools has the potential to greatly improve the learning experiences of deaf-blind students. These tools not only enhance communication but also support social inclusion and academic success. By addressing the unique challenges faced by these students, assistive technologies create opportunities for a more inclusive and equitable educational environment. The benefits of assistive technology are significant. Tools such as tactile displays and electro tactile devices enable effective communication without the need for interpreters (Hatakeyama et al., 2014). Assistive learning technologies (ALTs) provide access to electronic learning environments, enhancing students' academic performance and time management (Khek et al., 2007). Furthermore, these devices play a critical role in fostering social inclusion by improving cognitive engagement and facilitating peer interactions (Cunha et al., 2008). However, implementing these technologies comes with challenges. Limited resources, including inadequate funding and infrastructure, hinder the adoption of advanced assistive tools in many Nigerian special schools (Pradeep, 2023). Additionally, educators and caregivers often require specialized training to effectively use these devices, presenting a barrier to their successful integration (Beard et al., 2006). Addressing these challenges is crucial for maximizing the benefits of assistive technologies for deaf-blind students.

The studies by Darcy et al. (2017) and Alves et al. (2017) emphasize the significance of AT in promoting communication and social inclusion, which are critical for deaf-blind individuals. Specific AT devices such as tactile and audio-based communication tools, including the Perkins Brailler and Braille

note takers, provide essential support in overcoming communication barriers. Other mobility devices, such as white canes and electronic travel aids, help these students navigate their environment safely, while sensory devices like vibratory vests enhance spatial awareness.

Furthermore, AT devices support academic achievement by enabling deaf-blind students to access educational content. Borgestig et al. (2015) underscore that the effectiveness of devices like eye gaze-based AT depends on the user's ability and familiarity with them, while Foley & Masingila (2015) and Alnahdi (2014) discuss the benefits of mobile AT in resource-limited settings. The incorporation of screen readers, refreshable Braille displays, and environmental control devices has been shown to foster independence, as well as increase engagement in learning activities.

The process of introducing AT begins with assessing individual needs, as recommended by Zapf et al. (2015). This assessment should consider various factors, such as cognitive abilities, age, and learning style, to determine the most appropriate technology for each student. Involving stakeholders—students, parents, and teachers—in the selection and implementation of AT devices is essential for their success, as found by Williamson et al. (2015). Additionally, teachers require specialized training to effectively integrate these tools into instructional practices, as noted by Alkahtani (2013) and Flanagan, Bouck, and Richardson (2013).

Recent advancements in AT, including text-to-speech software, tactile displays, and haptic technology, offer promising applications. Tactile displays, for example, enable students to interact with complex diagrams in science and geography, as shown by Snoek (2014), while haptic technology provides an immersive learning experience by simulating the touch of virtual objects (Zhang et al., 2014). Moreover, mobile and wearable technologies, such as smartwatches and tablets, facilitate greater independence and communication among deaf-blind students (Johnston et al., 2014).

Ohtsuka et al. (2010) demonstrated the effectiveness of a communication system using body-Braille and infrared technology, facilitating communication between deaf-blind and non-disabled individuals. Similarly, Rastogi et al. (2015) found that a smartphone application significantly improved communication among deaf, blind, and mute individuals. Challenges for deaf-blind people using public transport, including communication barriers and inadequate signage, were highlighted by Sellbach and Loo (2018), with recommendations for virtual "leading blocks" to aid navigation (Amemiya et al., 2004). Wearable finger-Braille interfaces were also effective in enhancing navigation for deaf-blind students in inclusive spaces (Hirose & Amemiya, 2003).

Assistive technology (AT) impacts not only students but also teachers, with Bruce (2002) noting improvements in teachers' practices when using a communication intervention model with congenitally

deaf-blind students. This emphasizes the need for training and support to effectively integrate AT into teaching (Bruce, 2002; Hamad, 2017; Nkhoma et al., 2017). Social interactions are crucial for the well-being of deaf-blind individuals who often face isolation, as shown by Hasselt et al. (1989). Tactile aids, supported by Arnold and Heiron's (2002) findings on tactile memory, enhance the learning experience of deaf-blind students, supporting Reid's (2010) assertion that AT fosters independence for deaf-blind users. Early screening for deaf-blindness enables timely AT interventions, ensuring support from infancy through education (Holte et al., 2006).

Collaborative and engaging learning environments further enhance learning outcomes. Qureshi et al. (2021) highlighted the role of AT in enabling deaf-blind students to participate in collaborative learning, and Ames and Archer (1988) emphasized the importance of achievement goals in motivating students. A conducive learning environment is critical, impacting students' engagement and motivation (Closs et al., 2021), as is the use of tailored blended learning approaches to address individual learning needs (Shamsuddin & Kaur, 2020).

Technology-based learning, including chatbot-based micro-learning, has been shown to improve learning motivation and outcomes, making it effective for deaf-blind students needing instant feedback (Yin et al., 2020). Augmented Reality (AR) can similarly engage students by visualizing complex concepts (Chen, 2020). Gamification, tailored to students' personality traits, increases engagement for students who are naturally extroverted or open (Smiderle et al., 2020). Mobile chatbot technology has been particularly successful in promoting self-efficacy, especially in nursing training (Chang et al., 2021), suggesting its potential for deaf-blind students.

Ongoing collaboration with AT experts is crucial for maintaining effective AT use (Khalil et al., 2020; Barrot et al., 2021), as is selecting appropriate tools that cater to students' abilities and regularly updating them to ensure functionality (Alzahrani, 2017; Abbasi et al., 2020). Teachers should work closely with students to customize AT use, emphasizing flexibility to allow experimentation (Khalil et al., 2020; Baticulon et al., 2020). Continuous data collection and feedback from students and parents are also essential to assess AT effectiveness, with necessary adjustments prioritized (Hamad, 2017; Abbasi et al., 2020).

Olumorin, Babalola, and Amoo (2022) identified various assistive technologies tailored to the needs of students with different disabilities. For students with hearing impairments, visual alert systems and accessible telephones were highlighted as available tools. Assistive technologies for students with visual impairments include large print books, reading stands, low-vision lamps, and screen reader software. Students with physical disabilities have access to crutches, walkers, and wheelchairs, while those with

learning disabilities benefit from videotaped social skills programs and electronic worksheets. Additionally, students with language disabilities utilize remote microphones, TV streamers, and amplified telephones. Ahmed (2018) observed that special schools in Nigeria primarily cater to students with hearing, visual, and physical impairments, among other needs. The study noted that many Nigerian schools are increasingly acknowledging the presence of special needs students and are beginning to provide the necessary attention and support. This demonstrates that assistive technologies are becoming more widely available to meet the diverse needs of special needs students.

The Social Model of Disability emphasizes that barriers in society and the environment, not impairments, hinder the participation and inclusion of individuals with disabilities (Harniss et al., 2015). Removing these barriers, such as through assistive technology in special schools, can enable deaf-blind students to access information, communicate, and actively participate in learning, promoting their social integration.

The Theory of Reasoned Action posits that behavior is influenced by one's intention to perform it (Sonne et al., 2016). For deaf-blind students, the intention to use assistive technology in learning will largely determine its adoption. Building a positive attitude toward this technology is essential and can be achieved by involving students in its selection and customization to meet their preferences and providing comprehensive training and support for students, teachers, and caregivers (Adebisi et al., 2015).

The Technology Acceptance Model (TAM) explains that user acceptance of technology is influenced by perceived usefulness, ease of use, and attitude toward the technology (Shore et al., 2018). Deaf-blind students have unique learning needs and preferences, so selecting and customizing assistive technology should prioritize these factors. Making technology useful and user-friendly increases the likelihood of acceptance (Fassbinder, 2016).

In summary, this study's theoretical framework combines the Social Model of Disability, the Theory of Reasoned Action, and TAM. The Social Model emphasizes removing barriers to inclusion, the Theory of Reasoned Action highlights the role of intention in technology adoption, and TAM focuses on ease of use and perceived usefulness in user acceptance. Together, these frameworks support the effective introduction of assistive technology to improve learning outcomes for deaf-blind students in Nigerian special schools.

Statement of the Problem

Inclusive education seeks to ensure that all students, including those with disabilities, have equal opportunities to access and benefit from the curriculum. However, students with dual sensory impairments, particularly those who are deaf-blind, face profound barriers to communication, learning, and social interaction. These challenges significantly limit their participation in educational activities.

Globally, developed nations have made considerable progress in integrating assistive technologies (AT) to support students with disabilities. These technologies enhance access to educational content, facilitate communication, and promote social engagement. In contrast, Nigeria encounters significant obstacles in providing assistive technologies for deaf-blind students. Despite a growing awareness of the needs of students with disabilities, systemic issues such as resource limitations, inadequate teacher training, and restricted access to AT tools impede the inclusion of deaf-blind students in the educational system. Consequently, deaf-blind students in Nigeria often face academic struggles and social exclusion, with minimal research addressing their specific needs. Existing studies emphasize the potential of assistive technologies to improve the educational outcomes of students with disabilities. However, there remains a critical gap in understanding the availability, use, and impact of these technologies on deaf-blind students in Nigerian special schools.

This study aims to bridge these gaps by exploring the use of assistive technologies for deaf-blind students in Nigerian special schools. It focuses on identifying the types of assistive technologies available, understanding the challenges in their implementation, and evaluating their impact on both academic and social outcomes. Furthermore, the study seeks to provide actionable recommendations for addressing barriers and improving the educational experiences of deaf-blind students.

Table 1: Availability of Assistive Technologies in Schools

Type of Assistive Technology	Frequency (n=50)	Percentage (%)
Braille Machines	45	90%
Screen Readers	40	80%
Audio Books	38	76%
Magnifiers	30	60%
Adaptive Keyboards	25	50%
Speech-to-Text Software	20	40%
Video Captioning Devices	10	20%

Interpretation: The most commonly available assistive technologies in the schools were Braille machines (90%) and screen readers (80%), followed by audio books (76%). Technologies such as speech-to-text software (40%) and video captioning devices (20%) were less commonly available. This suggests that while there is significant investment in basic assistive technologies, more advanced or specialized tools are limited in availability.

Table 2: Frequency of Assistive Technology Use in Classrooms

Type of Assistive Technology	Daily Use (%)	Weekly Use (%)	Monthly Use (%)	Rarely Used (%)
Braille Machines	80	15	5	0
Screen Readers	75	20	5	0
Audio Books	60	30	10	0
Magnifiers	50	40	10	0
Adaptive Keyboards	40	45	15	0
Speech-to-Text Software	30	50	20	0
Video Captioning Devices	20	50	20	10

Interpretation: The results show that Braille machines and screen readers were used most frequently, with 80% and 75% of participants reporting daily use. Other technologies such as audio books, magnifiers, and adaptive keyboards had varied frequencies of use, with speech-to-text software and video captioning devices being used less frequently. This may reflect the level of integration of these technologies into daily teaching practices.

Table 3: Perceived Effectiveness of Assistive Technologies

Type of Assistive Technology	Highly Effective (%)	Effective (%)	Moderately Effective (%)	Not Effective (%)
Braille Machines	85	10	5	0
Screen Readers	80	15	5	0
Audio Books	70	20	10	0
Magnifiers	65	25	10	0
Adaptive Keyboards	60	30	10	0
Speech-to-Text Software	55	35	10	0
Video Captioning Devices	50	30	20	0

Interpretation: The perceived effectiveness of assistive technologies was generally positive. Braille machines and screen readers were considered highly effective by 85% and 80% of respondents, respectively. Other tools such as audio books and magnifiers were also rated as effective by the majority of respondents. However, speech-to-text software and video captioning devices had a somewhat lower perceived effectiveness, with 55% and 50% of respondents rating them as highly effective.

Table 4: Challenges in Implementing Assistive Technologies

Challenge	Frequency (n=50)	Percentage (%)
Lack of training for teachers	45	90%
Insufficient funding	40	80%
Lack of technical support	35	70%
Limited availability of resources	30	60%
Difficulty in maintaining devices	25	50%
Resistance to technology adoption	20	40%

Interpretation: The main challenges in implementing assistive technologies were lack of teacher training (90%) and insufficient funding (80%). This suggests that while the technologies are available, effective usage is hindered by a lack of resources and training. Other challenges included limited technical support and maintenance issues.

Qualitative Data

The qualitative data collected through interviews and focus group discussions were transcribed verbatim and analyzed using thematic analysis. The key themes identified from the responses are presented below.

Theme 1: Impact on Academic Outcomes Participants consistently reported that assistive technologies had a positive impact on the academic performance of deaf-blind students. Educators noted that Braille machines and screen readers helped students access reading materials more efficiently, leading to improved comprehension and academic achievement. Students expressed that these tools allowed them to engage more actively in lessons, particularly in subjects like mathematics and language arts.

Theme 2: Impact on Social Integration Assistive technologies were also seen to improve social integration for deaf-blind students. Teachers highlighted that tools like audio books and magnifiers enabled students to participate more fully in class discussions and group activities. Students shared that the technologies made it easier for them to interact with peers, thereby enhancing their social experiences in school. The use of speech-to-text software, for example, allowed students to communicate more effectively with their classmates.

Theme 3: Training and Support Challenges A major theme that emerged was the lack of sufficient training for both teachers and students on how to effectively use assistive technologies. Several educators expressed frustration with the insufficient professional development opportunities to learn about new tools.

Additionally, students struggled with the lack of hands-on support, particularly in maintaining and troubleshooting devices.

Theme 4: Financial and Resource Constraints Another significant theme was the challenge of limited financial resources. Both educators and administrators pointed out that while assistive technologies were available, their upkeep and expansion were constrained by insufficient funding. This led to difficulties in ensuring that all students had access to the necessary tools. Participants also noted that the maintenance of these devices often fell short, causing interruptions in their use.

Theme 5: Resistance to Technology Adoption Finally, some participants mentioned resistance to the adoption of new technologies. A few teachers expressed concerns about the effectiveness of these technologies, particularly with newer tools like speech-to-text software. Some expressed doubts about whether these tools could effectively replace traditional teaching methods, leading to reluctance in fully embracing these technologies.

These results suggest that while assistive technologies are positively perceived and have demonstrated significant impact on both academic and social outcomes for deaf-blind students, there are considerable challenges in terms of training, funding, and technical support. Addressing these challenges is essential to enhancing the overall effectiveness and sustainability of assistive technology use in Nigerian special schools.

Discussion of Findings

The findings of this study provide insights into the availability, use, perceived effectiveness, and challenges related to assistive technologies for deaf-blind students in Nigerian special schools. These findings are discussed in relation to existing literature, highlighting both supporting and contrasting perspectives from previous research.

Availability of Assistive Technologies

The study found that Braille machines (90%) and screen readers (80%) were the most commonly available assistive technologies in the schools, with lower availability of more specialized tools such as speech-to-text software (40%) and video captioning devices (20%). This finding aligns with previous research by Senjam. **et al. (2021),** who noted that while basic assistive technologies are more commonly available in special education settings, more advanced technologies are often limited due to financial constraints and lack of resources. Alimi et al. (2022) identified that the assistive technology devices accessible for special education in Ilorin Metropolis include adjustable tables and computers, which are available in substantial quantities. Other available devices include wrist rests, writing frames, Braille and Braille embossers, models and mock-ups, electronic organizers, hearing aids, talking dictionaries, speech input/output tools, books on

tape/CD, as well as adapted chairs and tables. Senjam et al. (2022) discovered that speech-to-text software and video captioning devices are not widely available, which restricts opportunities for students who depend on these technologies to enhance their learning experience.

Frequency of Use of Assistive Technologies

The data revealed that assistive technologies such as Braille machines and screen readers were used daily by a majority of respondents, while others like speech-to-text software and video captioning devices were used less frequently. This is consistent with (Santos et al (2024) & Arbelaiz et al., (2024) who found that Braille and screen readers are commonly incorporated into everyday teaching practices, enabling visually impaired students to access learning materials. However, Speech-to-text software remains underused, primarily due to insufficient training for educators, which hinders its potential to address diverse learning needs (Abdullahi, & Imam, 2023; "Using Assistive and Instructional Technologies," 2022). This study's findings support that theory, as many participants highlighted the need for more consistent support and training to enhance technology integration.

Perceived Effectiveness of Assistive Technologies

The perceived effectiveness of assistive technologies was largely positive, with Braille machines and screen readers being rated as highly effective by most participants. This aligns with Arbelaiz et al., (2024), who reported that assistive technologies significantly improve the academic performance of students with visual and hearing impairments. The finding is also in line with Zakiah et al., (2024) & Arbelaiz et al.,(2024), who emphasized that these technologies enable deaf-blind students to independently access learning materials, thus improving their academic outcomes. However, challenges remain, particularly with speech-to-text software and video captioning, which often receive lower effectiveness ratings due to inadequate training and infrastructure in educational settings(Ozor et al., 2024) (Manirajee et al., 2024).

Challenges in Implementing Assistive Technologies

The study identified several challenges, including a lack of teacher training (90%), insufficient funding (80%), and inadequate technical support (70%). These findings are consistent with Rehman, N. U., Aftab, M. J., and Ali, H. H. (2024) highlighted several barriers, including the absence of specialized technological tools (78% agreement), inadequate teacher training (92% agreement), budget constraints restricting access to technology (93% agreement), and resistance to change among educators (92% agreement).

Impact on Academic Outcomes

The positive impact of assistive technologies on academic outcomes was a major theme from both teachers and students. Participants reported that tools like Braille machines and screen readers allowed students to engage more actively with their learning materials, leading to improved comprehension and academic

achievement. These findings are supported by Arbelaiz et al. (2024) revealed that assistive technologies enhance students' ability to access educational content, promoting increased engagement in classroom activities. Similarly, Arifin et al. (2024) observed that students utilizing these tools exhibit better comprehension and academic performance than their peers without such support. Zakiah et al. (2024) further emphasized that technologies like screen readers and Braille displays are crucial for accessibility, enabling students to complete tasks independently.

Impact on Social Integration

Assistive technologies also had a positive impact on the social integration of deaf-blind students. Many participants noted that the use of tools like audio books and magnifiers facilitated peer interactions and class participation. This finding aligns with Diniz (2024) who highlighted that incorporating assistive technologies significantly improves the social inclusion of deaf-blind students by enhancing peer interactions and classroom participation. Tools such as audiobooks and magnifiers not only boost academic performance but also promote social engagement, with various studies underscoring their importance in fostering inclusive educational environments. Pradeep (2023) noted that technologies like speech recognition and text-to-speech software facilitate effective communication, alleviating feelings of isolation among students with disabilities. Assistive devices empower students to navigate educational settings with greater independence, building self-confidence and social competence (Ghafoor et al., 2023). Additionally, these technologies support collaborative learning experiences, enabling students to interact more actively with their peers (Karagianni & Drigas, 2023).

Financial and Resource Constraints

The challenges related to insufficient funding and limited resources, as highlighted in this study, were consistent with Tangcharoensathien et al. (2018) highlighted financial constraints as a significant challenge in acquiring assistive technologies, including hearing aids, spectacles, and other low-vision devices. This study's participants echoed these sentiments, emphasizing that the lack of funding restricted their ability to expand the use of these tools. However, Mosia & Lephoto (2022) suggested that schools could explore alternative funding sources, such as partnerships with non-governmental organizations or corporate sponsorships, to overcome this barrier.

Summary

This study explored the availability, use, perceived effectiveness, and challenges of assistive technologies for deaf-blind students in Nigerian special schools. The results indicated that while basic assistive technologies like Braille machines and screen readers were widely available and used, more advanced tools such as speech-to-text software and video captioning devices were less accessible and infrequently used.

Despite this, participants expressed positive perceptions of the effectiveness of these technologies, particularly for academic outcomes. Challenges included inadequate teacher training, insufficient funding, and a lack of technical support, which hindered the optimal use of assistive technologies. The study also highlighted the positive impact of these technologies on academic performance and social integration, suggesting that they enable greater independence and inclusion for deaf-blind students.

Conclusion

The findings of this study indicate that while assistive technologies are beneficial for deaf-blind students in Nigerian special schools, several barriers limit their full potential. These barriers include limited availability of advanced technologies, lack of adequate training for educators, and financial constraints. Despite these challenges, the study confirms that assistive technologies play a crucial role in enhancing academic outcomes and promoting social inclusion for deaf-blind students. The study contributes to the understanding of how assistive technologies can be integrated into Nigerian special education contexts, offering a basis for improving their implementation.

Recommendations

Based on the findings, the following recommendations should be considered:

There should be an effort to enhance the availability of advanced assistive tools such as speech-to-text software and video captioning devices in special schools. Schools should seek partnerships with government bodies, NGOs, and private sectors to secure funding and resources.

Teacher training programs should be expanded to include comprehensive training on the effective use of assistive technologies. Continuous professional development should be provided to ensure that teachers are confident in integrating these tools into their instructional practices.

Schools should establish a robust system for technical support, including regular maintenance and troubleshooting of assistive devices. This will ensure that the technologies remain functional and effective. Policymakers should prioritize assistive technologies in the educational sector, allocating more funds to support the procurement and maintenance of such tools. Creating policies that support the integration of assistive technologies in all schools, not just special schools, should be encouraged to promote inclusivity.

Efforts should be made to raise awareness about the importance of assistive technologies among school administrators, teachers, parents, and the wider community. Advocacy programs should highlight the positive impact of these technologies on the academic and social development of students with disabilities.

Contribution to Knowledge

This study contributes to the growing body of literature on the role of assistive technologies in special education, specifically within the Nigerian context. It provides insights into the current state of assistive technology integration in special schools, identifies significant challenges, and offers actionable recommendations to enhance their effectiveness. By highlighting the barriers and potential solutions, this research informs policy development and educational practice in special education. Furthermore, it emphasizes the importance of a holistic approach that includes adequate training, technical support, and funding to optimize the benefits of assistive technologies for students with disabilities.

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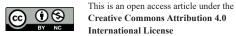
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