



RESEARCH ARTICLE

Teachers' perceptions on the availability and utilization of assistive technology for pupils with learning disabilities in Eti-Osa, Lagos State

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Abstract: Assistive technology (AT) plays a crucial role in inclusive education by enhancing learning opportunities for pupils with learning disabilities and promoting their full participation in academic activities. This study investigated teachers' perceptions of the availability and utilization of assistive technology in primary schools in Eti-Osa Local Government Area, Lagos State, Nigeria. Using an ex post facto descriptive research design, 191 teachers from public and private schools were selected through purposive sampling. Data were collected using a validated questionnaire, the Assistive Technology in the Classroom (ATC), with a reliability coefficient of 0.87. The findings revealed that although several types of assistive technologies were available, they were insufficient to meet the learning needs of pupils with disabilities. Computers and iPads were the most commonly available and utilized tools, while specialized devices such as speech synthesizers, graphic organizers, and speech-to-text converters were notably absent. More than half of the teachers agreed that assistive technology enhances pupils' learning outcomes by compensating for cognitive deficits, thereby fostering classroom independence and task completion. However, barriers such as inadequate funding, lack of teacher training, and limited stakeholder commitment hinder the optimal use of these technologies. Addressing these challenges requires concerted efforts from government bodies, non-governmental organizations, and educational institutions. This study contributes to the growing body of literature on assistive technology in inclusive education and emphasizes the need for improved resource allocation and teacher training to bridge the educational gap for pupils with learning disabilities.

Key words: learning disabilities, Assistive technology, availabilities and utilisation

INTRODUCTION

One of the emerging concerns of governments globally is ensuring equitable access to quality education. Inclusive and equitable education is increasingly recognized not only as a fundamental human right but also as an essential foundation for social participation, human development, and sustainable economic progress (United Nations, 2015; UNESCO, 2020). This will help prepare learners for participation in a society in which knowledge and skills are increasingly important resources for social and economic development. Thus, since the turn of this century, widening access to education by reaching underserved populations, including learners with disabilities, has become a major concern for international development agencies, national governments, and educational systems worldwide (UNESCO, 2020; World Health Organization [WHO] & United Nations Children's Fund [UNICEF], 2015). Prior to the beginning of the 21st century, education for learners with disabilities faced a variety of social, cultural,

economic, institutional, and technological challenges that contributed to poor educational outcomes and exclusion from educational opportunities (Mull & Sitlington, 2003; UNESCO, 2020; WHO & UNICEF, 2015).

The United Nations, through international frameworks such as the Convention on the Rights of Persons with Disabilities (CRPD) and the Sustainable Development Goals (SDGs), has emphasized universal and equitable access to education for all children, including those with disabilities (United Nations, 2006, 2015). Article 24 of the CRPD specifically requires States Parties to ensure an inclusive education system in which persons with disabilities are not excluded from general education on the basis of disability and receive appropriate support to facilitate effective learning and participation (United Nations, 2006). Similarly, SDG 4 calls for inclusive and equitable quality education and equal access to all levels of education for vulnerable populations, including persons with disabilities (United Nations, 2015).

In order to align with the universal vision of equitable education, Nigeria's National Policy on Education incorporates provisions intended to enhance access, educational quality, and support for learners with special educational needs (Federal Republic of Nigeria, 2013). At the same time, research on assistive technology has increasingly demonstrated its potential to improve access, participation, and academic functioning among students with disabilities (Okolo & Bouck, 2007; WHO & UNICEF, 2015). While inclusive education aims to enable diverse

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learners to participate meaningfully within common educational environments, assistive technology can reduce functional and accessibility barriers that otherwise restrict access to information, communication, curriculum content, and classroom participation (UNESCO, 2020; WHO & UNICEF, 2015). Appropriate assistive technology can therefore promote independence, participation, and educational inclusion among children with disabilities (WHO & UNICEF, 2015, 2022). In recognition of the prominent role of technology in developing the knowledge and skills required for effective functioning in contemporary society, the provision and appropriate use of assistive technology have become increasingly important components of inclusive education, including within the Nigerian educational system (Federal Republic of Nigeria, 2013; Yusuf et al., 2012).

Nigerian classrooms are increasingly characterized by heterogeneous groups of learners with varying abilities and educational needs (Yusuf et al., 2012). With the global adoption of inclusive education, classroom diversity has become more visible, requiring teachers to respond to a wider range of learning profiles and instructional needs (UNESCO, 2020). Learners with learning disabilities may experience persistent difficulties in reading, written expression, mathematics, working memory, attention, planning, organization, and other executive functions despite receiving conventional classroom instruction (Khan & Lal, 2023). Such difficulties can interfere with students' ability to process information, follow multistep instructions, retrieve previously learned information, and complete academic tasks efficiently. Moreover, evidence indicates that school-aged students with learning disabilities may experience higher levels of anxiety than their peers without learning disabilities, further complicating their engagement with classroom learning (Nelson & Harwood, 2011). These challenges make students with learning disabilities a significant concern for teachers seeking appropriate instructional strategies and accommodations.

Assistive technology for pupils with learning disabilities includes products, devices, software, and related services that help compensate for functional limitations and enable learners to perform activities that might otherwise be difficult (Alper & Raharirina, 2006; WHO & UNICEF, 2015). For example, a pupil who struggles with printed text but has relatively strong listening skills may benefit from audiobooks or text-to-speech technology. Assistive technologies for pupils with learning disabilities may include audiobooks, electronic mathematics worksheets, database software, graphic organizers and outlining tools, data managers, optical character recognition, portable word processors, speech synthesizers, speech recognition systems, talking calculators, spelling and grammar checkers, electronic dictionaries, variable-speed audio recording, and word-prediction programs. Assistive technology is not limited to high-tech electronic devices; low-tech and non-electronic products may also improve functioning, accessibility, and participation depending on individual needs (WHO & UNICEF, 2015, 2022). Research synthesis further indicates that technologies such as word-processing systems, multimedia and hypertext applications, text-to-speech tools, speech-to-text systems, and other individualized technological supports can improve particular academic outcomes among learners with learning disabilities, although effectiveness varies across technologies and learner characteristics (Perelmutter et al., 2017).

The major learning challenges experienced by individuals with learning disabilities commonly involve

information processing, working memory, attention, executive functioning, and the acquisition and retrieval of academic knowledge. Research has consistently linked learning disabilities with difficulties in working memory, organization, planning, monitoring, reading, writing, and mathematical operations (Khan & Lal, 2023). In day-to-day academic activities, these difficulties may affect time management, abstract reasoning, sequencing, task completion, and the ability to follow multistep instructions. Consequently, some learners may experience repeated academic difficulties despite consistent classroom instruction. Assistive technology can help compensate for some of these difficulties by enabling learners to perform academic tasks in alternative and more accessible ways (Alper & Raharirina, 2006; Perelmutter et al., 2017). Rather than guaranteeing learning success, technological supports can provide greater flexibility, interactivity, accessibility, and independence when they are appropriately matched to individual learner needs and integrated into effective instructional practices (WHO & UNICEF, 2015). Thus, assistive technology has considerable potential to help narrow achievement and participation gaps between learners with learning disabilities and their peers, although its effectiveness depends on appropriate selection, implementation, training, and continued support (Perelmutter et al., 2017; WHO & UNICEF, 2022).

Notably, despite the recognized benefits of assistive technology in supporting students with learning disabilities, its effective integration in educational settings remains challenging because of limited access to appropriate devices, insufficient teacher training, and variations in teachers' knowledge, confidence, and perceptions regarding AT use (Atanga et al., 2020; Abu-Alghayth, 2022). Evidence from Nigeria similarly indicates significant limitations in the availability of assistive technology. Yusuf et al. (2012), for example, found that many Nigerian educational institutions lacked the assistive technologies required to support students with disabilities, while Samaila et al. (2020) reported that 56% of the high-tech assistive technology resources considered necessary in the special education schools they examined in North-West Nigeria were unavailable and that the available resources were generally inadequate. These findings demonstrate that access to appropriate AT remains an important resource and implementation issue within the Nigerian educational context.

Ideally, inclusive schools should provide learners with reasonable access to appropriate assistive technologies as well as teachers and support personnel who have the knowledge required to select and implement these technologies effectively. However, barriers to assistive technology utilization are complex and multidimensional and may operate at the learner, teacher, school, policy, financing, and broader systems levels (Atanga et al., 2020; WHO & UNICEF, 2022). Resource shortages, inadequate funding, limited professional development, insufficient technical support, and poor access to suitable devices can substantially restrict the integration of AT into classroom instruction (Abu-Alghayth, 2022; Samaila et al., 2020). Furthermore, teachers' perceptions, knowledge, confidence, training, and readiness are important determinants of whether available technologies are actually incorporated into instructional practices (Atanga et al., 2020; Abu-Alghayth, 2022). Therefore, simply providing technological devices is insufficient; sustainable AT implementation requires adequate infrastructure, professional development, institutional support, and alignment between technology and learners' individual educational needs.

Nevertheless, barriers to the effective utilization of assistive technology can be reduced through coordinated and sustained efforts involving governments, schools, teachers, families, service providers, development organizations, and learners with disabilities themselves (WHO & UNICEF, 2015, 2022). Improving AT access requires not only investment in devices but also appropriate policies, financing mechanisms, assessment and service-delivery systems, teacher preparation, technical support, maintenance, and stakeholder partnerships (WHO & UNICEF, 2022). Such efforts are particularly important for reducing the digital and accessibility divide that restricts learners with disabilities from fully participating in educational opportunities. Against this background, the present study investigates the availability, utilization, benefits, barriers, and potential strategies for improving the use of assistive technology for pupils with learning disabilities.

Statement of the Problem

Nigeria's education sector faces persistent challenges in delivering effective support for pupils with learning disabilities, particularly due to limited resources, inadequate infrastructure, and unequal access to appropriate assistive technologies (Yusuf et al., 2012; Samaila et al., 2020; Alimi et al., 2022). Evidence from Nigerian educational institutions indicates that many of the assistive technologies required to support learners with disabilities remain unavailable or inadequate, limiting opportunities for meaningful participation in teaching and learning activities (Yusuf et al., 2012; Samaila et al., 2020). A recent report from the Lagos State Ministry of Education (2023) revealed that only 35% of primary schools have basic assistive technology tools such as computers and tablets. More advanced tools, such as speech synthesizers and optical character recognition devices, are virtually absent. This shortage significantly impacts the ability of teachers to meet the diverse learning needs of students with learning disabilities and reflects a broader challenge in ensuring equitable access to assistive products and services (World Health Organization [WHO] & United Nations Children's Fund [UNICEF], 2022). Globally, access gaps are particularly pronounced in low- and middle-income countries, where inadequate financing, availability, service provision, and awareness continue to restrict access to assistive technology.

The challenges faced by teachers in using assistive technology are multifaceted. Teachers often report a lack of training and familiarity with available technological tools, resulting in low utilization rates even when resources are present (Windschitl & Sahl, 2002; Atanga et al., 2020; Okolo & Diedrich, 2014). Teachers' beliefs, knowledge, perceived competence, and institutional support can substantially influence whether technology is successfully integrated into classroom practice (Windschitl & Sahl, 2002; Atanga et al., 2020). Moreover, the absence of continuous professional development programs exacerbates this issue, leaving many teachers ill-prepared to select, adapt, and integrate assistive technology effectively into teaching practices (Abu-Alghayth, 2022; Atanga et al., 2020; Okolo & Diedrich, 2014). Research involving educators has consistently identified inadequate professional development, insufficient access to appropriate technologies, and limited funding as major obstacles to AT implementation (Okolo & Diedrich, 2014). Similarly, Abu-Alghayth (2022) found that lack of AT devices and insufficient training were among the most commonly reported barriers to technology use among special education teachers. Systemic barriers, including

restricted school budgets, insufficient technical support, weak service-delivery systems, and inconsistent implementation of inclusive policies, further constrain the sustainable adoption of assistive technology (Samaila et al., 2020; WHO & UNICEF, 2022).

Nigeria's National Policy on Education emphasizes the provision of appropriate educational opportunities and support for learners with special needs (Federal Republic of Nigeria, 2013). Nevertheless, a substantial gap can remain between policy aspirations and actual implementation when schools lack adequate resources, trained personnel, and appropriate technologies (Yusuf et al., 2012; Samaila et al., 2020). The sixth edition of Nigeria's National Policy on Education was issued in 2013 and provides the national framework for educational administration and special-needs education. Schools with sufficient resources have reported significant improvements in student performance when assistive technology is employed (Edyburn, 2020). More broadly, empirical evidence indicates that appropriately selected assistive technologies can improve particular academic outcomes among learners with learning disabilities, although their effectiveness varies according to the technology, learner characteristics, and implementation context (Perelmutter et al., 2017). Conversely, inadequate access to appropriate technologies may restrict educational participation, independence, and opportunities for learners with disabilities, thereby contributing to persistent disparities in educational outcomes (WHO & UNICEF, 2022). This policy-to-practice discrepancy underscores the need for targeted interventions that combine adequate resource provision, teacher capacity building, institutional support, and sustainable implementation mechanisms in Nigerian classrooms.

Inclusive education and the strategic use of assistive technology are essential for improving learning opportunities, participation, independence, and social inclusion among students with disabilities (WHO & UNICEF, 2022). Research indicates that when appropriately matched to students' needs and effectively integrated into instruction, assistive technology can enhance specific academic outcomes among learners with learning disabilities (Perelmutter et al., 2017). For instance, assisted reading with digital audiobooks has been associated with improvements in reading fluency among students with reading disabilities (Esteves & Whitten, 2011), while a meta-analysis found that text-to-speech and related read-aloud technologies produced a positive effect on reading comprehension among students with reading difficulties (Wood et al., 2018). Speech-recognition technology can also support aspects of writing, particularly spelling and text drafting, for some students with high-incidence disabilities (Ok et al., 2022). These findings demonstrate that AT can provide compensatory pathways that enable learners to access text, express ideas, and participate more independently in academic tasks. However, technology effectiveness is not uniform, and implementation must account for individual learner characteristics, instructional goals, and the suitability of particular technologies (Perelmutter et al., 2017; Wood et al., 2018). Yet, despite these benefits, teachers may remain uncertain about the practicality, functionality, or instructional value of AT because of limited exposure, insufficient training, inadequate technological support, and gaps in AT-specific knowledge and competence (Abu-Alghayth, 2022; Atanga et al., 2020; Okolo & Diedrich, 2014). These persistent challenges reinforce the need to investigate not only the availability and utilization of assistive technology but also

the conditions that facilitate or impede its effective application for pupils with learning disabilities.

Purpose of study

The purpose of this study is to assess the perception of teachers on the availability and utilization of assistive technology for children with learning disabilities in Eti-Osa local government area of Lagos State. Specifically, the purpose of the study is to investigate: What are the perceptions of teachers on the availability of assistive technologies for pupils with learning disabilities and What are the perceptions of teachers on the utilization of assistive technology for pupils with learning disabilities?

Hypotheses

The following hypotheses were posed and tested at 0.05 level of significance:

1. There is no significant difference in perception scores of the utilization of assistive technology for pupils with learning disabilities in private and public schools.
2. There is no significant difference in perception scores of the benefits of assistive technology for pupils with learning disabilities in private and public schools

METHODS

This study adopted an ex post facto research design, in which researchers examine existing conditions or outcomes retrospectively to identify possible antecedent factors or relationships without manipulating the independent variables (Cohen et al., 2018). Ex post facto research, often referred to as after-the-fact research, was appropriate for this study since the availability and utilization of assistive technology had already occurred in the selected schools without interference from the researcher. This design was particularly suited to investigate differences in the availability and utilization of assistive technology between public and private primary schools in Eti-Osa, Lagos State.

The study population comprised 2,396 primary school teachers in private and public schools in Eti-Osa Local Government Area, Lagos State. From this population, a sample of 191 teachers was selected using purposive sampling. The teachers were drawn from seven schools, consisting of four public schools and three private schools, with at least 25 teachers from each school. These schools were chosen based on evidence of inclusive education policies and practices.

Instrumentation

The instrument for data collection was a self-developed questionnaire titled the Assistive Technology in the Classroom Questionnaire (ATCQ). The development of a questionnaire specifically aligned with the objectives and constructs of a study is consistent with established recommendations for instrument development, which emphasize clear domain specification, systematic item generation, expert review, pretesting, and psychometric evaluation (Artino et al., 2014; Boateng et al., 2018; DeVellis & Thorpe, 2021). Section A collected respondents' socio-demographic information, including gender, educational qualifications, and type of school.

Section B contained 28 items organized into five sub-sections reflecting the major dimensions examined in the study. Questions 1 to 6 gathered information on the inventory and availability of assistive technology tools for different areas of learning disabilities. Questions 7 to 12 assessed teachers' perceptions of the utilization of

assistive technology using a 5-point Likert-type response scale. Likert-type scales are widely used for measuring respondents' attitudes, perceptions, and levels of agreement, while the number and structure of response categories should be aligned with the construct being assessed and the intended interpretation of scores (Likert, 1932; Boateng et al., 2018). Questions 13 to 28 elicited information about the perceived benefits, barriers, and facilitating factors associated with assistive technology using a 4-point response scale. Provision was also made for respondents to provide additional information they considered relevant. Systematic organization of questionnaire items around predefined domains is important for ensuring adequate representation of the constructs being measured and reducing construct underrepresentation (Boateng et al., 2018; DeVellis & Thorpe, 2021).

The instrument's validity was established through a review process involving experts in special education and educational technology. Expert review is an established approach to evaluating content validity because subject-matter specialists can assess whether questionnaire items adequately represent the intended content domain in terms of relevance, representativeness, clarity, and technical quality (Boateng et al., 2018; Polit et al., 2007). Content validity was therefore addressed by aligning the questionnaire items with the study objectives, relevant literature, and the conceptual domains of assistive technology availability, utilization, benefits, and barriers. Methodological guidance recommends that content-validation procedures involve qualified experts who evaluate whether individual items adequately represent the construct being measured (Boateng et al., 2018; Polit et al., 2007).

A pilot test was subsequently conducted with 19 primary school teachers in Oyo State who were not included in the main study population. Pilot testing is an important stage of questionnaire development because it provides an opportunity to identify potential problems with item interpretation, response options, administration procedures, and preliminary psychometric performance before the instrument is administered to the main study sample (Artino et al., 2014; Boateng et al., 2018; Johanson & Brooks, 2010). The internal consistency of the ATCQ was evaluated using Cronbach's alpha, a commonly used coefficient for estimating the extent to which items intended to measure the same construct produce internally consistent responses (Tavakol & Dennick, 2011). The reliability analysis yielded an overall coefficient of $\alpha = .87$, while the subscale reliability coefficients were $\alpha = .83$ for the availability of assistive technology and $\alpha = .80$ for the utilization of assistive technology. These coefficients indicate satisfactory internal consistency for the scores obtained from the instrument in the pilot sample (Tavakol & Dennick, 2011).

Data Collection

The data collection process was carried out over one week. A letter of introduction from the Department of Special Education, Faculty of Education, University of Ibadan, was presented to the heads of the selected schools to obtain permission for administering the questionnaire. The researcher and trained research assistants administered the questionnaire on scheduled dates. This approach allowed the researcher to clarify any questions raised by the respondents and ensured that the questionnaires were completed accurately. To enhance the credibility of the data, research assistants were trained on

the administration process, emphasizing the importance of neutrality and accuracy. The completed questionnaires were collected immediately after completion to avoid loss

or damage. The responses were then coded and entered into the Statistical Package for Social Sciences (SPSS) for analysis.

Table 1. Summary of the reliability coefficient of ATC

NO	Variable	N	Cronbach' s Alpha
1	Availability of assistive technology	19	0.83
2	Utilization of assistive technology	19	0.80

Data Analysis

The data collected were analyzed using both descriptive and inferential statistics. Descriptive statistics, such as frequency counts and percentages, were used to summarize the socio-demographic characteristics of the respondents and the availability of assistive technology. The independent t-test was used to examine differences in teachers' perceptions of the availability and utilization of assistive technology based on the type of school (public or private). The significance level was set at 0.05 for all statistical tests.

RESULTS

The analysis of the data revealed significant differences in teachers' perceptions of the utilization and benefits of assistive technology for pupils with learning disabilities between public and private schools in Eti-Osa Local Government Area, Lagos State. The results of the independent t-test showed a statistically significant difference in the utilization of assistive technology between public and private school teachers (table 2). Teachers from public schools reported higher utilization scores ($M = 12.79$, $SD = 1.23$) compared to their counterparts in private schools ($M = 7.85$, $SD = 7.37$), with a mean difference of 4.94 ($t(189) = -6.59$, $p < 0.05$). This indicates that teachers in public schools utilize assistive technology more frequently than those in private schools.

The reasons behind this finding may be attributed to differences in the provision of resources and infrastructure between public and private schools. While public schools often benefit from government-supplied assistive technology, private schools may face financial constraints in acquiring these resources. Additionally, public schools may have dedicated support programs for integrating assistive technology, leading to higher utilization rates.

However, despite the reported utilization, the data revealed that only a few assistive technology tools were available across all schools. The most commonly available

tools were iPads and computers, while more specialized tools such as speech synthesizers, optical character recognition devices, and abbreviation expanders were notably absent. This limited range of available tools hinders comprehensive support for pupils with various learning disabilities.

The analysis also revealed a significant difference in teachers' perceptions of the benefits of assistive technology for pupils with learning disabilities between public and private schools ($t(189) = 4.39$, $p < 0.05$). Teachers in private schools reported higher mean scores ($M = 15.79$, $SD = 2.89$) compared to those in public schools ($M = 14.36$, $SD = 1.41$). This finding suggests that while public school teachers may utilize assistive technology more frequently, private school teachers recognize its benefits more extensively, possibly due to exposure to more innovative educational practices (table 3).

Teachers highlighted several key benefits of assistive technology, including improved task completion, increased classroom independence, and enhanced cognitive engagement among pupils with learning disabilities. These benefits align with the findings of Shikden (2015), who emphasized the positive impact of assistive technology on students' academic performance and social integration. Despite these advantages, the underutilization of assistive technology in critical areas such as reading and mathematics remains a significant concern, given that reading difficulties account for a substantial proportion of learning disabilities.

The demographic characteristics of the respondents which revealed that there were more female teacher participants than the male teachers could be an indication that there are more female teachers in the primary schools than male teachers. The demography also indicates that more teachers had bachelor's degrees in education followed by National certificate in Education. In fact, over 86% of the teachers have NCE and above, implying that, most of the participants were qualified teachers drawn from public and private primary schools in Eti-Osa local government area of Lagos State.

Table 2. Summary of independent sample T-test of perception scores between private and public schools on the utilization of assistive technology (N =191)

School type	N	Mean	SD	Df	T	Sig
Assistive Technology Utilization				189	-6.59	.00
Private school	91	7.85	7.37			
Public school	100	12.79	1.23			

Table 3. Summary of Independent samples t-test of perception scores between private and public schools on the benefits of assistive technology (N=191)

School type	N	Mean	SD	Df	T	Sig
Benefits of Assistive Technology				189	4.39	.001
Private school	92	15.79	2.89			
Public school	99	14.36	1.41			

This study took inventory of Assistive technology devices available in schools for pupils with learning disabilities. Many AT tools for the different areas of learning disabilities such as written language, reading, memory deficit and executive functioning, attention, spelling and handwriting and mathematics were considered. The analyses revealed that not all the tools required for addressing the different areas of learning disabilities were available in all schools. For written language disabilities, there were no speech synthesizers and abbreviation expanders while talk spell checks, word predictions programs and proof reading were barely available, iPad and computers were mostly available.

DISCUSSION

The findings of this study provide valuable insights into the availability and utilization of assistive technology (AT) for pupils with learning disabilities in Eti-Osa, Lagos State. The significant differences observed between public and private schools highlight disparities in resource allocation, which can be directly linked to the theoretical framework emphasizing inclusive education as a key pathway to equity in learning outcomes (Federal Republic of Nigeria, 2013; UNESCO, 2020). Inclusive education requires not only the physical placement of learners with disabilities in mainstream educational settings but also the provision of appropriate resources, accessible learning environments, trained personnel, and technologies that enable meaningful participation (UNESCO, 2020; World Health Organization [WHO] & United Nations Children's Fund [UNICEF], 2022). Assistive technology plays a vital role in removing learning barriers and enhancing both academic and social experiences for students with learning disabilities (Edyburn, 2020). Research further suggests that appropriately selected AT can improve access to curriculum content, participation, independence, and academic performance among learners with disabilities (Alper & Raharirina, 2006; Perelmutter et al., 2017). Despite the recognized importance of these tools, the present study revealed widespread inadequacies in their availability, particularly for critical learning areas such as reading, memory deficits, executive functioning, attention, spelling, handwriting, and mathematics. This finding is consistent with evidence that access to appropriate assistive products remains uneven, particularly in resource-constrained settings where financing, availability, awareness, infrastructure, and trained personnel remain important barriers (WHO & UNICEF, 2022).

In the domain of reading, essential tools such as Inspiration software and Kurzweil 3000 were found to be unavailable in all the surveyed schools. The only commonly available tools for supporting reading difficulties were iPads, computers, and tape recorders. This limited range of tools significantly constrains the ability of teachers to provide targeted interventions for pupils with reading disabilities, which constitute a substantial proportion of learning disabilities (Orim & Ezekiel, 2017; Yang et al., 2022). Developmental dyslexia and other reading-related difficulties are among the most common manifestations of specific learning disabilities, underscoring the importance of providing technologies specifically designed to facilitate reading access (Yang et al., 2022). Research on text-to-speech and related read-aloud technologies indicates that these tools can produce positive effects on reading comprehension among students with reading difficulties, although the magnitude of benefit varies according to learner characteristics and implementation conditions

(Wood et al., 2018). For students struggling with memory deficits and executive functioning, graphic organizers were also notably absent. This is important because graphic organizers have been shown to support vocabulary acquisition, comprehension, inferential knowledge, and content learning among students with learning disabilities (Dexter & Hughes, 2011). The dominant AT tools for these learning needs were again restricted to iPads and computers, with other types of AT tools being barely available.

This lack of diversity in available tools can be attributed to several interconnected factors. One primary reason is the high cost of specialized devices, which limits their acquisition, particularly in schools operating under constrained budgets. Global evidence shows that high costs, inadequate financing, limited availability, insufficient awareness, and shortages of trained personnel remain major barriers to assistive technology access (WHO & UNICEF, 2022). Similar problems have been documented in school-based AT research, where insufficient funding, difficulties procuring and managing equipment, inadequate assessment and planning processes, and limited staff support have impeded effective technology implementation (Copley & Ziviani, 2004). Another contributing factor is the limited awareness and training among educators regarding the availability and utility of specialized AT tools for different learning needs. Research indicates that even when tools are present, teachers may lack the knowledge or confidence to integrate them effectively into classroom practices (Hasselbring & Bausch, 2006; Yusuf et al., 2012). Studies focusing specifically on teachers have similarly demonstrated that knowledge, competence, training, perceived support, and confidence are important determinants of AT adoption and classroom integration (Atanga et al., 2020; Okolo & Diedrich, 2014). Nigerian evidence is particularly relevant: Onivehu et al. (2017) found that although special education teachers demonstrated positive attitudes toward AT, their competence in using the technologies was limited, indicating a substantial need for systematic training and retraining.

The challenges extend to areas such as attention, spelling, and handwriting, where specialized tools were also notably absent. For attention-related difficulties, technologies such as visual timers, auditory reminders, scheduling supports, and other digital organizational tools may assist learners in managing tasks and maintaining engagement. The importance of technological support for executive functioning, reading, writing, and other academic processes has been increasingly recognized within contemporary AT frameworks (Edyburn, 2020; Perelmutter et al., 2017). In spelling and handwriting, specialized tools such as electronic spelling aids, word-prediction programs, speech-to-text systems, and digital writing support systems were almost nonexistent in the surveyed schools. Evidence from systematic reviews suggests that word processing, multimedia tools, speech-to-text, text-to-speech, and other technology-supported interventions can benefit at least some learners with learning disabilities, although effectiveness varies across technologies, skills, and individual characteristics (Perelmutter et al., 2017). The absence of these tools therefore places additional demands on teachers and students and may restrict opportunities to provide individualized accommodations that correspond to specific learning needs.

In mathematics, the available AT tools were primarily limited to computers and talking calculators, with iPads being scarcely available. This limited availability of

mathematical AT tools constrains the ability of educators to provide differentiated instruction that meets the diverse needs of students. The lack of advanced tools such as graphing calculators, digital manipulatives, and mathematics-specific software also limits opportunities for interactive, visual, and scaffolded problem-solving. Evidence supports the potential value of such technologies. For example, Satsangi and Bouck (2015) demonstrated that virtual manipulatives could support the acquisition, maintenance, and generalization of area and perimeter concepts among secondary students with learning disabilities. More broadly, a meta-analysis of digital interventions for children with mathematical learning difficulties found a positive overall effect on mathematical performance (Benavides-Varela et al., 2020). This finding aligns with Samaila et al. (2020), who found that 56% of high-tech AT resources necessary for quality teaching and learning in special education schools in North-West Nigeria were unavailable, while the 44% that were available were grossly inadequate. Taken together, these findings suggest that inadequate availability may prevent schools from taking advantage of technology-supported approaches that have demonstrated educational benefits for students experiencing mathematical difficulties.

The findings of this study are consistent with previous research conducted in similar resource-constrained contexts. For instance, Matter and Eide (2018) investigated access to assistive technology in Botswana and Swaziland and documented substantial unmet needs for AT. Their findings showed that 44% of individuals who needed AT in Botswana did not receive it, while the proportion was approximately 67% in Swaziland. These findings demonstrate that inadequate AT access is not confined to one educational system but forms part of a broader challenge affecting people with disabilities in resource-constrained contexts. Globally, WHO and UNICEF (2022) similarly estimate that billions of people require one or more assistive products and that access gaps are particularly pronounced in low- and middle-income countries. This disparity underscores the persistent challenge of resource scarcity and highlights the need for targeted policies, financing mechanisms, supply systems, and service-delivery strategies to bridge gaps in AT availability (Matter & Eide, 2018; WHO & UNICEF, 2022).

In Nigeria, Yusuf et al. (2012) conducted a comprehensive study on the availability of assistive technologies across primary, secondary, and tertiary institutions. The study involved 1,115 teachers and showed that many institutions lacked the assistive technologies necessary to support learners with disabilities. Although computers were among the more commonly available technologies, the broader pattern demonstrated substantial inadequacies in AT provision (Yusuf et al., 2012). Similar findings have emerged from other parts of Nigeria. Shikden (2015) noted that while computers were widely available in North Central Nigeria, other essential tools such as electronic organizers and talking dictionaries were almost entirely absent. Samaila et al. (2020) likewise documented substantial shortages of high-tech AT resources in special education schools in North-West Nigeria, while Alimi et al. (2022) emphasized the need for adequate governmental funding to improve AT availability for learners with special needs in Ilorin, Kwara State. Chukwuemeka and Samaila (2020) further identified important constraints affecting high-tech AT use among teachers in special education schools in North-West Nigeria. Collectively, these Nigerian studies reinforce the present finding that the availability of general-purpose digital equipment does not necessarily indicate adequate

access to the specialized technologies needed to address diverse disabilities.

The predominance of computers may partly be explained by their multifunctionality, as a single computer can support word processing, spelling and grammar checking, text-to-speech, multimedia learning, online information access, and various specialized educational applications. Evidence from AT intervention research indicates that computer-based word processing, multimedia, hypertext, text-to-speech, and related applications can be useful for learners with learning disabilities when technologies are appropriately selected and integrated into instruction (Perelmutter et al., 2017; Wood et al., 2018). However, reliance on computers alone should not be interpreted as adequate AT provision because students with different functional and learning needs may require different products, software, accommodations, and support services (WHO & UNICEF, 2022). Thus, schools require a broader AT ecosystem rather than a limited inventory dominated by multipurpose digital devices.

A notable finding of this study is the greater variety of assistive technologies available in private schools compared with public schools. This finding may reflect differences in resource mobilization, institutional financing, procurement flexibility, and opportunities to obtain external support. Private schools may have greater capacity in some contexts to mobilize parental contributions or establish partnerships for educational resources, whereas public schools often depend more strongly on governmental allocations. Nevertheless, this interpretation should be considered in the context of the broader evidence showing that funding and resource availability remain major determinants of AT access (Alimi et al., 2022; WHO & UNICEF, 2022). Evidence from Nigerian special education settings similarly shows that inadequate funding is repeatedly associated with shortages of high-tech assistive resources (Chukwuemeka & Samaila, 2020; Samaila et al., 2020). Therefore, disparities between public and private schools should not simply be interpreted as differences in willingness to adopt technology, but also as potential manifestations of structural differences in resource availability, procurement, and institutional support.

The limited availability of specialized AT tools and the overreliance on multipurpose devices such as iPads and computers underscore the urgent need for targeted interventions. Continuous professional development for teachers is crucial to addressing this gap. Training programs should focus not only on operational skills but also on assessing learner needs, selecting appropriate AT, integrating AT into instruction, evaluating its effectiveness, and adapting its use over time. Chen et al. (1999) emphasized that building teacher competencies in ICT is essential for creating flexible learning environments and responding to the contextual dimensions of technology-enhanced learning. Alper and Raharirina (2006) further highlighted the importance of appropriate implementation and professional competence in obtaining educational benefits from AT. More recent research reinforces this position. Atanga et al. (2020) emphasized the importance of AT-specific knowledge and training among teachers of students with learning disabilities, while Abu-Alghayth (2022) identified lack of AT devices and lack of training as major barriers to classroom use. Similarly, Okolo and Diedrich (2014) found that educators reported uneven knowledge of specific AT uses and mixed perceptions of the support available for technology implementation. Nigerian research by Onivehu et al. (2017) also

demonstrates the need for systematic teacher retraining, while Chukwuemeka and Samaila (2020) highlight capacity building as an important response to constraints on high-tech AT use.

This study contributes to the growing body of knowledge on assistive technology in Nigerian schools by providing empirical evidence on disparities in availability and utilization between public and private schools. Its findings complement existing Nigerian studies documenting shortages of assistive resources, variations in utilization, limited teacher competence, funding constraints, and barriers to technology integration (Alimi et al., 2022; Chukwuemeka & Samaila, 2020; Onivehu et al., 2017; Samaila et al., 2020; Yusuf et al., 2012). The study also contributes to the broader international discourse showing that the educational value of AT depends not merely on the presence of devices but on an interconnected system of adequate financing, appropriate products, trained personnel, institutional support, accessibility, and effective implementation (WHO & UNICEF, 2022). By situating the findings within both Nigerian and international evidence, the study provides relevant insights for policymakers, educators, school administrators, and researchers seeking to strengthen inclusive education and expand meaningful access to assistive technology.

Implications for Policy and Future Research

The findings of this study have significant implications for educational policy and practice, particularly in relation to equitable access, resource allocation, and the sustainable implementation of assistive technology (AT) in inclusive educational settings (Fernández-Batanero et al., 2022; World Health Organization [WHO] & United Nations Children's Fund [UNICEF], 2022). Policymakers must prioritize resource allocation to ensure equitable access to assistive technology across all schools, especially because inadequate funding, high costs, limited availability, and insufficient support services remain major barriers to AT access and utilization (Fernández-Batanero et al., 2022; WHO & UNICEF, 2022). Global evidence further indicates that disparities in access are particularly pronounced in low- and middle-income countries, highlighting the need for sustainable financing mechanisms and coordinated policies that integrate AT into education and other public service systems (WHO & UNICEF, 2022).

Special attention should be given to providing schools with a broader range of AT tools that cater to different learning needs, rather than relying primarily on general-purpose technologies. Assistive technology should be selected according to students' functional and educational needs because different technologies produce different educational outcomes, and the effectiveness of particular interventions varies according to the characteristics of learners and the type of technology employed (Perelmutter et al., 2017). Systematic evidence also indicates that AT can enhance accessibility, inclusion, participation, independence, and teaching-learning processes among students with disabilities when appropriate technologies are available and effectively implemented (Fernández-Batanero et al., 2022).

Additionally, teacher training programs must be expanded and regularly updated to reflect advancements in educational technology and emerging best practices. Teachers play a central role in identifying appropriate technologies, supporting students in their use, and integrating AT into classroom instruction; however, inadequate teacher education and training remain among the most frequently reported barriers to effective AT

implementation (Atanga et al., 2020; Fernández-Batanero et al., 2022). Atanga et al. (2020) specifically emphasized the importance of developing teachers' AT knowledge, perceptions, competence, and ability to overcome barriers to classroom integration. Moreover, evidence from a large-scale meta-analysis of professional development for inclusive education indicates that professional development improves teachers' knowledge, skills, and beliefs, with longer-term programs characterized by practical relevance and active learning being particularly conducive to transferring new competencies into school practice (Donath et al., 2023).

Future research should focus on evaluating the long-term impact of assistive technology on student outcomes and identifying strategies for scaling up successful interventions in resource-constrained environments. This is particularly important because existing systematic reviews demonstrate generally positive educational, psychosocial, participation, and inclusion outcomes associated with AT, while also revealing considerable variation in effectiveness across technologies, users, and implementation contexts (McNicholl et al., 2021; Perelmutter et al., 2017). Fernández-Batanero et al. (2022) similarly identified the need for further research to determine which technologies are most appropriate for particular disability-related needs and which instructional strategies maximize their educational effectiveness. Longitudinal and implementation-oriented studies are therefore needed to examine whether improvements associated with AT are sustained over time, how technologies can be maintained and adapted as students' needs change, and which financing, training, service-delivery, and institutional models are feasible for scaling effective AT interventions in low-resource educational settings (WHO & UNICEF, 2022).

CONCLUSION

The findings of this study reveal that the availability and utilization of assistive technology (AT) in primary schools in Eti-Osa Local Government Area, Lagos State, is generally inadequate. Although different types of assistive technologies are available, they are not provided in sufficient quantities to meet the needs of pupils with learning disabilities. This limited availability restricts the full utilization of AT in both public and private schools. However, more than half of the participants in this study acknowledged that assistive technology plays a significant role in facilitating learning by compensating for cognitive deficiencies, ultimately contributing to improved academic performance and a more positive school experience for pupils.

The most commonly used forms of assistive technology identified in this study are iPads and computers. These tools have been associated with several key benefits, including enhancing task completion, promoting classroom independence for students, and improving teachers' sense of teaching effectiveness and success. Despite these benefits, several barriers hinder the optimal use of assistive technology in schools. These include inadequate funding, a lack of training facilities, and limited commitment from educational stakeholders. If these challenges are not addressed, the absence of adequate assistive technology will only widen the educational gap between pupils with learning disabilities and their peers without disabilities. Therefore, it is imperative for educational stakeholders to take urgent action to eliminate these barriers, ensuring

equal participation and opportunities for pupils with learning disabilities to realize their full potential.

Recommendations

The government, non-governmental organizations, educational stakeholders, and well-meaning individuals should commit more resources to provide adequate assistive technologies. This will ensure that pupils with learning disabilities are motivated and given equal access to quality education, especially in inclusive educational settings. Additionally, both public and private organizations should collaborate to provide ongoing in-service training for teachers. This will enhance teachers' capacity to utilize emerging assistive technological tools effectively in classroom instruction. Proper training is essential because poor implementation can undermine even the best strategies.

Teachers should be encouraged to recognize the relevance of assistive technology in enhancing learning outcomes, regardless of their personal beliefs, professional backgrounds, or prejudices. Such biases may negatively influence their willingness to adopt and effectively use available assistive devices. A positive and inclusive attitude among teachers is crucial for maximizing the potential of assistive technology in meeting the diverse needs of pupils with learning disabilities.

Educational institutions should actively seek partnerships with private organizations to secure additional funding for assistive technology. This can be achieved by organizing workshops and demonstrations that highlight how assistive technology can help pupils with learning disabilities. Teachers can also play a key role as advocates and scholars by using their positions to promote inclusive education and improve learning experiences for pupils with learning disabilities. Such advocacy efforts can provide these pupils with equal or near-equal opportunities compared to their peers in inclusive education systems.

More provisions should be made to introduce computers and iPads to children with learning disabilities at an early age. These devices were found to be the most popular and widely used tools for addressing various types of learning disabilities in this study and other related research. Early exposure to these technologies can help build familiarity and confidence among pupils, improving their learning experiences and outcomes over time.

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