Exploring the use of Assistive Digital Resources in Enhancing Learning for Students with Intellectual Disabilities in Cross River and Akwa Ibom States, Nigeria

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Abstract: *Aim*: Understanding how these digital resources are being utilized in special education contexts is essential to improving learning outcomes and bridging the digital divide for students with intellectual disabilities. The study examined the use of assistive digital resources to enhance learning for students with intellectual disabilities in Cross River and Akwa Ibom States, Nigeria. Five study objectives were stated to guide the research. Five research questions were formulated, and three hypotheses were stated. A literature review was conducted in line with the study variables.

Method: This study adopted a descriptive survey research design. The area of the study is Cross River and Akwa Ibom States. The population of this study comprises all six special education and inclusive schools in Cross River and Akwa Ibom States—709 teachers, school heads, and education officers were directly involved in teaching or supporting students with intellectual disabilities—3,020 Students with intellectual disabilities (where possible, for observational data). A multi-stage sampling technique was used. A purposive sampling was used to select 4 LGAs, stratified sampling was used, and a simple random sampling technique was used. The instrument for data collection is a questionnaire, which was validated by experts in Measurement and Evaluation at the University of Uyo. The instrument was subjected to test reliability using the Cronbach Alpha reliability method. The test result revealed a reliability index of 0.81. Data from the questionnaire was analyzed using descriptive statistics (mean, frequency, percentage) and inferential statistics (Pearson correlation, independent t-test) to test the hypotheses.

Results: The results revealed a significant relationship between the availability of assistive digital resources and their utilization level in teaching students with intellectual disabilities. There is also a significant relationship between the use of assistive digital resources and the learning outcomes of students with intellectual disabilities. There is a significant difference between urban and rural schools in the availability of assistive digital learning tools for students with intellectual disabilities.

Conclusion: Based on the study's results, it was concluded that there is a significant relationship between the availability of assistive digital resources and their level of utilization in teaching students with intellectual disabilities. There is also a significant relationship between the use of assistive digital resources and the learning outcomes of students with intellectual disabilities. There is a significant difference between urban and rural schools in the availability of assistive digital learning tools for students with intellectual disabilities.

Recommendation: Schools and disability support centers should implement peer-mentoring programs and anti-drug clubs that empower students to resist negative peer pressure.

Keywords: Assistive digital resources, students with intellectual disabilities, learning, students, cross river state, akwa ibom states, inclusive education, special schools.

INTRODUCTION

Education is a fundamental human right and a powerful instrument for promoting social inclusion, particularly for individuals with disabilities. For students with intellectual disabilities, failure to meet expected learning outcomes can result in frustration, low self-esteem, and limited opportunities for personal and societal fulfillment. These students often require specially designed instructional strategies and tools—core elements of special education—to meet their unique learning needs.

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Assistive digital technologies, such as speech-generating devices, text-to-speech software, and interactive educational apps, offer adaptive support that enhances engagement and comprehension for learners with intellectual disabilities. Globally, these tools have proven effective in promoting inclusive education by reducing barriers to learning [1,2]. However, in Nigeria, especially in states like Cross River and Akwa Ibom, the adoption and integration of such technologies remain limited and under-researched.

Intellectual disability (ID) is characterized by significant intellectual functioning and adaptive behavior limitations, with onset before age 18 [3]. Learners with ID benefit from technology-enhanced strategies that support their access to and participation in education. While many developed countries have embedded digital assistive technologies into educational policies and Individualized Education Plans (IEPs), Nigerian schools often face systemic barriers such as poor infrastructure, limited teacher training, low digital literacy, and weak policy implementation [4,5].

Cross River and Akwa Ibom States in Nigeria's South-South region present a mixed urban-rural landscape with varying educational challenges. Though schools and centers exist to serve students with disabilities, the extent of digital support for learners with intellectual disabilities remains unclear. Traditional teaching methods still dominate, and there is a lack of empirical data on how assistive technologies are accessed, utilized, and perceived within these learning environments [6].

Given the global momentum toward inclusive, technology-driven education, this study aims to explore the availability, use, and effectiveness of assistive digital resources in selected special and inclusive schools in Cross River and Akwa Ibom States. The findings seek to inform policy and practice by addressing the existing knowledge gap in Nigeria's inclusive education landscape.

Statement of the Problem

Although assistive digital technologies have proven to enhance educational access and learning outcomes for students with intellectual disabilities, their integration into teaching and learning practices in many Nigerian schools remains inconsistent. In Cross River and Akwa Ibom States, many students with intellectual disabilities continue to be taught using traditional methods that do not cater to their cognitive and adaptive learning needs.

There is limited access to assistive digital tools, and where such resources exist, there may be a lack of skilled personnel to operate and utilize them effectively. Additionally, poor infrastructure, limited funding, and inadequate policy implementation continue to hinder the adoption of digital innovations in special education [4,7]. Nigeria has made efforts to promote inclusive education through its National Policy on Education [8], which emphasizes education for all. However, implementation remains challenging due to inconsistencies between policy and practice, especially in rural and underserved areas [9].

The absence of systematic data and research on how these tools are used in the region further complicates efforts to develop inclusive educational strategies. Without a clear understanding of the current use and impact of assistive digital resources, it becomes difficult for educators, administrators, and policymakers to design interventions that truly meet the needs of learners with intellectual disabilities. Therefore, this study is necessary to explore the current practices, challenges, and potential of assistive digital resources in enhancing learning for this marginalized group of students in Cross River and Akwa Ibom States.

Objectives of the Study

The main objective of this study is to examine the use of assistive digital resources in enhancing learning for students with intellectual disabilities in Cross River and Akwa Ibom States, Nigeria.

The specific objectives are to:

1. Identify the types of assistive digital resources available in schools for students with intellectual disabilities.
2. Determine the extent to which teachers and students utilize these digital resources.
3. Assess the perceived effectiveness of assistive digital resources in enhancing the learning outcomes of students with intellectual disabilities.
4. Investigate the challenges faced by teachers and schools in implementing assistive digital technologies.
5. Suggest strategies for improving the integration and utilization of assistive digital resources in special and inclusive education settings.

Research Questions

To guide the study, the following research questions were addressed:

1. What assistive digital resources are available for students with intellectual disabilities in the selected states?
2. How frequently and effectively are these resources utilized in classrooms?
3. What is the perceived impact of these assistive digital resources on students' learning outcomes?
4. What challenges do teachers and schools face when using assistive digital technologies?
5. What strategies can be adopted to enhance the effective use of assistive digital resources in teaching students with intellectual disabilities?

Research Hypotheses

The study tested the following hypotheses at a 0.05 level of significance:

- **H_{01}:** There is no significant relationship between the availability of assistive digital resources and their utilization level in teaching students with intellectual disabilities.
- **H_{02}:** There is no significant relationship between using assistive digital resources and the learning outcomes of students with intellectual disabilities.
- **H_{03}:** There is no significant difference between urban and rural schools in the availability of assistive digital learning tools for students with intellectual disabilities.

Significance of the Study

This study is significant for several stakeholders in the education sector:

For Educators and Special Education Teachers: It may provide valuable insights into the current use and effectiveness of assistive digital resources in the classroom. Findings may help teachers understand which technologies work best and how to integrate them into lesson planning and individualized education programs (IEPs).

For School Administrators and Policy Makers: The study may highlight gaps in infrastructure, teacher training, and resource availability, offering evidence-based recommendations that can inform educational policies and funding priorities in Cross River and Akwa Ibom States and possibly across Nigeria.

For Government and Non-Governmental Organizations (NGOs): It can help identify key areas where interventions and support (such as donations of digital tools or teacher capacity building) are needed to strengthen inclusive education practices.

For Researchers and Academics: The findings may contribute to the growing body of knowledge on inclusive education, digital learning, and assistive technologies in the Nigerian context, providing a basis for further studies on technological support for learners with intellectual disabilities.

For Students with Intellectual Disabilities and Their Families: Ultimately, the research aims to enhance learning experiences and outcomes for students with intellectual disabilities, promoting equity and social inclusion in education.

Scope of the Study

This study is delimited to examine the availability, utilization, and effectiveness of assistive digital resources used in educating students with intellectual disabilities in Cross River and Akwa Ibom States, Nigeria. It focuses on:

- Special education schools and inclusive mainstream schools where students with intellectual disabilities are enrolled.
- Teachers, school administrators, and special education officers are involved in teaching or managing students with intellectual disabilities.
- Types of assistive digital tools such as text-to-speech software, communication apps, visual learning aids, educational games, and other adaptive technologies.
- Factors affecting the use of these technologies include access, teacher competence, infrastructural support, and policy environment.

The study did not cover other categories of disabilities (e.g., physical, visual, or hearing impairments) unless they are comorbid with intellectual disabilities. Also, the study is limited to selected schools within the two states and may not attempt to generalize findings to the entire country.

Operational Definition of Terms

To avoid ambiguity, the following key terms are defined as they are used in this study:

- Assistive Digital Resources: Any software, hardware, or digital tool specifically designed or adapted to support the learning of students with intellectual disabilities. Examples include text-to-speech applications, screen readers, digital flashcards, interactive educational apps, and adaptive communication tools.
- Students with Intellectual Disabilities: Learners who exhibit significant limitations in intellectual functioning and adaptive behavior, diagnosed before the age of 18, and who require special educational support to achieve academic goals (AAIDD, 2010).
- Utilization: The degree to which teachers and students actively use assistive digital resources for teaching and learning activities in the classroom.
- Learning Outcomes: Measurable changes in knowledge, skills, behavior, or academic performance due to using assistive digital resources.
- Special Education: A form of education that is specifically designed, staffed, and resourced to support learners with disabilities, including intellectual disabilities.
- Inclusive Education: An educational approach where students with and without disabilities learn together in the same classrooms with necessary support to ensure full participation.
- Cross River and Akwa Ibom States: These two states in Nigeria's South-South geopolitical zone were selected for this study due to their existing special and inclusive education programs.

LITERATURE REVIEW

Conceptual Framework

Intellectual Disabilities

Intellectual disability (ID) is characterized by significant limitations in both intellectual functioning (reasoning, learning, problem-solving) and adaptive behavior (social and practical skills), originating before the age of 18 [3]. Students with ID often require tailored instructional methods and assistive support to succeed academically.

According to the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5), intellectual disability involves deficits in general mental abilities, such as abstract thinking, judgment, and academic learning, as well as impairments in adaptive functioning, which determine how well individuals cope with everyday life demands [10]. The DSM-5 categorizes intellectual disability into four severity levels: mild, moderate, severe, and profound, based on the level of support required by the individual.

The World Health Organization [11] defines intellectual disability as “a significantly reduced ability to understand new or complex information and to learn and apply new skills (impaired intelligence), resulting in a reduced ability to cope independently (impaired social functioning).” These difficulties are usually lifelong and can impact an individual’s educational performance, social participation, and personal independence.

The causes of intellectual disabilities are diverse and may include genetic conditions (e.g., Down syndrome), prenatal exposure to toxins, birth complications, infections, malnutrition, and environmental factors [12]. Despite these challenges, individuals with intellectual disabilities have the capacity to learn and develop skills when provided with appropriate support, instruction, and learning resources, including the use of assistive digital technologies. It is increasingly recognized that with inclusive educational strategies and the integration of technology-based support systems, individuals with intellectual disabilities can achieve improved academic and social outcomes. As such, understanding the nature of intellectual disabilities is essential for developing effective interventions tailored to the needs of this population.

Assistive Digital Resources

Assistive digital resources refer to technology-based tools designed to enhance the functional capabilities of individuals with disabilities. Examples include text-to-speech applications, speech-generating devices, interactive whiteboards, and learning management systems with accessibility features [13].

Access is a foundational determinant of use. When assistive digital tools—such as text-to-speech software,

interactive whiteboards, adapted tablets, and specialized learning apps—are accessible, teachers are more likely to incorporate them into daily instructional routines [14]. Limited availability often translates to underutilization, regardless of teacher awareness or willingness to integrate technology.

Akintunde A [15] emphasized that the presence of digital learning tools in inclusive classrooms is a strong predictor of their use in supporting differentiated instruction and individualized learning plans. UNESCO [16] stresses that while teacher training and positive attitudes are crucial, the actual presence of devices and digital infrastructure remains the most critical factor influencing utilization. Inclusive education advocates the integration of students with disabilities into mainstream classrooms with adequate support. Digital technologies serve as enablers, providing students with ID access to learning materials and activities at their own pace and level [17].

Empirical Review

Global Trends in the Use of Assistive Technologies

Research globally has demonstrated that assistive technologies significantly enhance learning outcomes and independence among students with intellectual disabilities [18]. In developed countries, integration into curricula is often mandated by law. This finding aligns with Ajuwon [4], who noted that access to assistive technology in Nigeria is limited due to insufficient funding and infrastructural deficits. It also reflects the technological divide between urban and rural schools in developing contexts.

Utilization of Digital Resources

Respondents reported that even where tools were available, utilization was inconsistent. Teachers cited lack of training and familiarity with the devices as major barriers. This supports Adeoye IA and Adeoye AO [18], who found that low digital literacy among special educators hinders the effective use of technology. The limited use also challenges the full implementation of inclusive education policies.

Effectiveness on Learning Outcomes

Students who had access to and used assistive digital tools exhibited improved engagement, attention, and communication skills. This corresponds with Rose DH and Meyer A [17] and Chai CS et al. [19], who argued that digital resources tailored to students' individual needs can significantly improve their learning outcomes. Teachers also observed better classroom participation when tools were integrated properly.

Challenges Encountered

Key challenges identified include lack of devices, poor power supply, absence of ICT support, and limited teacher training. These barriers mirror those found in earlier studies [13,18], highlighting the structural and professional gaps that persist in implementing assistive technology in education across low-resource environments.

Studies in Nigeria and Sub-Saharan Africa

In Nigeria, the adoption of assistive technology remains low due to limited infrastructure, inadequate teacher training, and insufficient funding [4]. Some studies have reported that where digital tools are available, they are underutilized or used incorrectly. Akintunde A [15] noted that students with disabilities in urban regions of Nigeria have more access to assistive learning devices than their rural counterparts. Similarly, UNESCO [16] emphasized the importance of equity in digital education, especially in resource-constrained settings. Urban schools are often more likely to benefit from government initiatives, non-governmental interventions, and private sector donations to enhance inclusive education through digital means [15,16].

This finding implies that students in rural areas may be at a disadvantage in terms of access to tools that can enhance their learning experience, potentially widening the educational gap between urban and rural learners with intellectual disabilities. This calls for targeted policies and strategic interventions to bridge the digital divide and promote equitable access to assistive technologies across all geographical locations [24]. Assistive digital tools have been shown to enhance communication, attention, and engagement among learners with ID [19]. However, effectiveness depends on contextual factors such as availability, usability, and teacher competency.

Gaps in the Literature

- A lack of region-specific studies on assistive digital technology in Nigeria's South-South zone.
- Few empirical studies examine the effectiveness of such technologies for students with ID.
- Inadequate documentation of teacher readiness and challenges in Nigerian schools.

MATERIALS AND METHODS

Experimental Setting

This study adopted a descriptive survey research design. This design is appropriate for collecting and analyzing data that describe the current status of phenomena—in this case, the availability, use, and effectiveness of assistive digital resources in supporting learners with intellectual disabilities.

Area of Study

The area of the study is Cross River and Akwa Ibom States.

Participants/Sample

The population of this study comprises:

- All six special education and inclusive schools are in Cross River and Akwa Ibom States.
- 709 teachers, school heads, and education officers directly involved in teaching or supporting students with intellectual disabilities.
- 3,020 Students with intellectual disabilities (where possible, for observational data).

The study's sample comprised 184 participants, including 150 teachers, 4 school heads, and 30 special education officers.

Sampling Technique

A multi-stage sampling technique was used: Stage 1—Purposive Sampling was used to select 4 LGAs (Local Government Areas) in Cross River and Akwa Ibom States known to have special and inclusive schools.

Stage 2—Stratified Sampling: Schools were stratified into two categories:

(i) special schools and

(ii) inclusive mainstream schools.

Stage 3—Random Sampling: Two schools were randomly selected from each stratum. Teachers and administrators were then sampled proportionally.

Estimated Sample Size: 184 participants, including 150 teachers, 4 school heads, and 30 special education officers directly involved in teaching or supporting students with intellectual disabilities, and Observations of classroom practices involving 40 students with intellectual disabilities (non-intrusive observation only).

Instrument for Data Collection

The study uses a quantitative instrument:

The use and availability of these assistive technologies were measured using a structured questionnaire titled *"Assistive Digital Resource Utilization Questionnaire (ADR-UQ)"* administered to teachers of students with intellectual disabilities in selected schools across Cross River and Akwa Ibom States, Nigeria. The questionnaire included both closed- and open-ended items.

It consists of sections on:

- Demographics
- Types of assistive digital tools used
- Frequency of use of assistive digital tools
- Perceived effectiveness of assistive digital tools
- Challenges faced

Observation Checklist: To validate responses, a classroom observation checklist was used to note the availability and application of assistive technologies. The data on usage were based solely on self-reports from teachers, as they were deemed most knowledgeable about both the availability and day-to-day use of these tools within their classrooms.

Validation of Instruments

Three experts in special education and educational measurement and evaluation validated the instruments. Based on their feedback, necessary corrections were made to ensure content and face validity.

Reliability of Instruments

A pilot study was conducted using 10 respondents from a school not included in the main study. The Cronbach Alpha method was used to test the questionnaire's internal consistency, with a reliability coefficient of 0.81, which is considered acceptable.

Method of Data Collection

Permission was sought from the Ministries of Education in both states.

Ethical clearance was obtained.

Questionnaires were distributed in person with support from school administrators.

Observations were done with minimal disruption to class activities.

Method of Data Analysis

Data from the questionnaire was analyzed using descriptive statistics (mean, frequency, percentage) and inferential statistics (Pearson correlation) to test the hypotheses. All analyses were conducted using SPSS (Statistical Package for the Social Sciences version 23).

Expected Outcomes

This study is expected to:

Identify the range of assistive digital resources currently available and in use in selected schools in Cross River and Akwa Ibom States.

Determine the extent and effectiveness of using these technologies to improve educational engagement and performance among students with intellectual disabilities.

Reveal existing challenges—such as lack of infrastructure, teacher training gaps, and policy inadequacies—hindering the effective implementation of digital assistive technologies.

Provide practical recommendations for stakeholders (teachers, school administrators, government, and NGOs) on improving the accessibility, integration, and use of assistive digital tools in special and inclusive classrooms.

Contribute to local and national educational policy development in inclusive education and special needs technology support.

Inclusion Criteria

These are the conditions that must be met for individuals or institutions to be eligible to participate in the study:

Special and Inclusive Schools: Only schools that serve students with intellectual disabilities—either as fully special education schools or inclusive institutions—are located in Cross River or Akwa Ibom States.

Teachers and Educators: Participants must be teachers, special educators, or instructional aides who have direct teaching or support responsibilities for students with intellectual disabilities.

Minimum Teaching Experience: Teachers must have at least one year of experience working with students with intellectual disabilities.

School Administrators and Support Staff: Heads of schools, ICT coordinators, or special education coordinators directly involved in deploying or supervising assistive technology use may participate.

Use or Awareness of Assistive Digital Resources: Participants must have at least basic awareness or exposure to assistive digital tools (e.g., text-to-speech software, AAC devices, learning apps, etc.).

Exclusion Criteria

These are the factors that disqualify individuals or institutions from participating in the study:

General Education Schools Without Inclusion Programs: Schools that do not enroll or cater specifically to students with intellectual disabilities were not included.

Non-Teaching Staff: Security personnel, cleaners, drivers, or any school personnel not involved in teaching or educational support were excluded.

Educators with No Experience in Special Education: Teachers who have never taught or interacted with students with intellectual disabilities were excluded.

Parents and Students: This study focuses on educators and administrators only, so students with disabilities and their parents are not direct participants.

Schools Outside the Study Area: Schools not located in Cross River or Akwa Ibom States are outside the scope and were excluded.

Diagnosis of Students with Intellectual Disabilities

- Educational assessments
- Teacher observations
- Developmental history
- Parental input. This diagnosis was made by multidisciplinary teams comprising psychologists, special educators, speech and language

therapists, and medical professionals who collaborated over the years to ensure a holistic and culturally sensitive evaluation.

Treatment of Students with Intellectual Disabilities

- Individualized Education Program (IEP): Students diagnosed with intellectual disabilities are usually provided with an Individualized Education Program (IEP), which outlines personalized learning goals, instructional methods, and support services. The IEP is developed collaboratively by a team including educators, special needs professionals, and parents [20].

- Assistive Technology and Digital Resources: Recent advances in digital tools have provided effective support mechanisms for students with intellectual disabilities. Assistive technologies such as speech-to-text applications, audiobooks, visual scheduling tools, and interactive learning platforms help make content more accessible and engaging [13]. These tools are especially beneficial in improving communication, enhancing memory, and fostering independent learning.

- Behavioral and Therapeutic Interventions: Cognitive-behavioral therapy (CBT), occupational therapy, speech therapy, and social skills training are often used to support cognitive and emotional development. These interventions are important for managing behavioral challenges, improving communication, and enhancing adaptive skills.

- Inclusive and Supportive Learning Environments: When appropriate, inclusion in mainstream classrooms has positively affected the academic and social development of students with intellectual disabilities. Teachers are encouraged to use differentiated instruction, visual aids, and multisensory approaches to cater to diverse learning needs [16].

- Family and Community Involvement: Parental involvement and community-based support services play a critical role in the educational success and psychosocial well-being of students with intellectual disabilities. Family counseling and parent education programs are often recommended to build supportive home environments.

Ethical Considerations

This research adhered strictly to ethical standards for research involving human participants. The following considerations guided the study:

- **Informed Consent:** All participants (teachers, administrators, and education officers) were informed of the study's purpose and voluntarily consented to participate.

- **Confidentiality:** Respondents' identities and responses were kept confidential. Data were used solely for academic purposes.

- **Non-maleficence:** The study ensured that participants did not suffer psychological, emotional, or professional harm.

- **Right to Withdraw:** Participants had the right to withdraw from the study at any point without any consequences.

- **Permissions and Approvals:** Relevant institutional review boards provided ethical approval, and the State Ministries of Education granted permission.

RESULTS

The result in Table **1** presents the demographic distribution of the respondents who participated in the study. Out of the total 184 respondents, the majority were male (142 respondents, representing 78.02%), while 42 (22.8%) were female. This indicates a male-dominated representation among the participants involved in teaching or supporting students with intellectual disabilities. The age distribution reveals that 76 respondents (41.30%) were aged 15 years and below, 35 (19.02%) fell within the age range of 16-20 years, and 73 (39.68%) were aged 21 years and above. This suggests a fairly even distribution between the younger (≤15) and older (≥21) age groups, with fewer participants in the mid-range. Regarding professional experience, 67 respondents (36.41%) had 10 years or less of experience working with students with intellectual disabilities (ID), 71 (38.58%) had between 11-20 years of experience, and 46 (25.1%) had 21 years or more. This distribution suggests that most of the respondents have moderate to extensive experience in the field, enhancing their perspectives' reliability.

A large proportion of the respondents were classroom teachers (150 respondents, 81.52%),

Table 1: Demographic Variables of Respondents

Variable		Frequency	Percentage
Sex	Male	142	78.02
	Female	42	22.8
	Total	184	100
Age	≤15 years	76	41.30
	16-20 years	35	19.02
	≥21 years	73	39.68
	Total	184	100
Years of teaching experience with students with ID	≤10 years	67	36.41
	11-20 years	71	38.58
	≥21 years	46	25.1
	Total	184	100
Position	Teacher	150	81.52
	Headteacher	4	2.17
	Special education officer	30	16.30
	Total	184	100
Types of school	Special	2	50.0
	Inclusive	2	50.0
	Total	184	100

Source: Fieldwork (2024).

followed by special education officers (30 respondents, 16.30%), and a small number were head teachers (4 respondents, 2.17%). This indicates that most insights in the study were drawn from professionals with direct classroom interaction with students with ID. Only 4 schools were identified in the study: 2 were special schools, and 2 were inclusive schools, each representing 50% of the total. While the frequency here appears low relative to the total number of respondents (184), this likely reflects that multiple respondents were drawn from the same institutions.

Test of the Research Question

Research question one: What assistive digital resources are available for students with intellectual disabilities in the selected states?

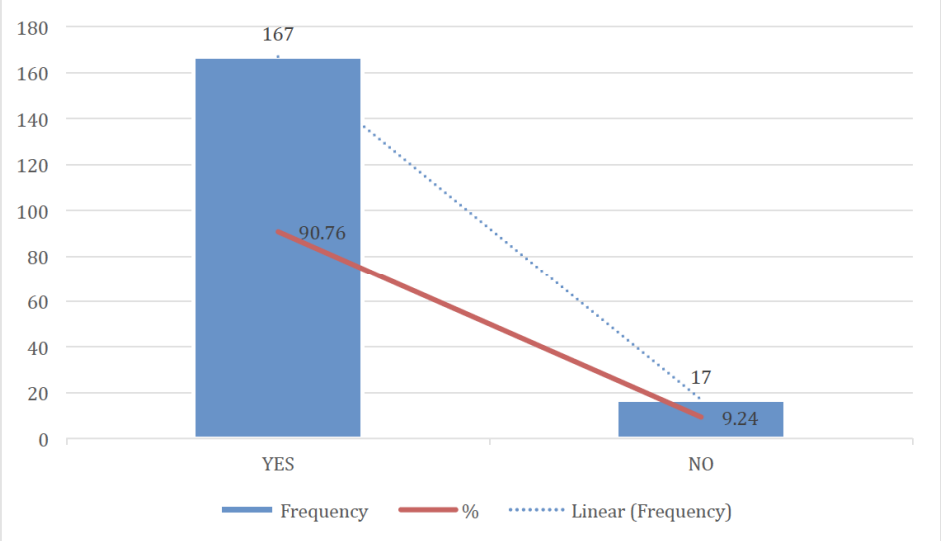

Figure 1: Are assistive digital tools available in your school?

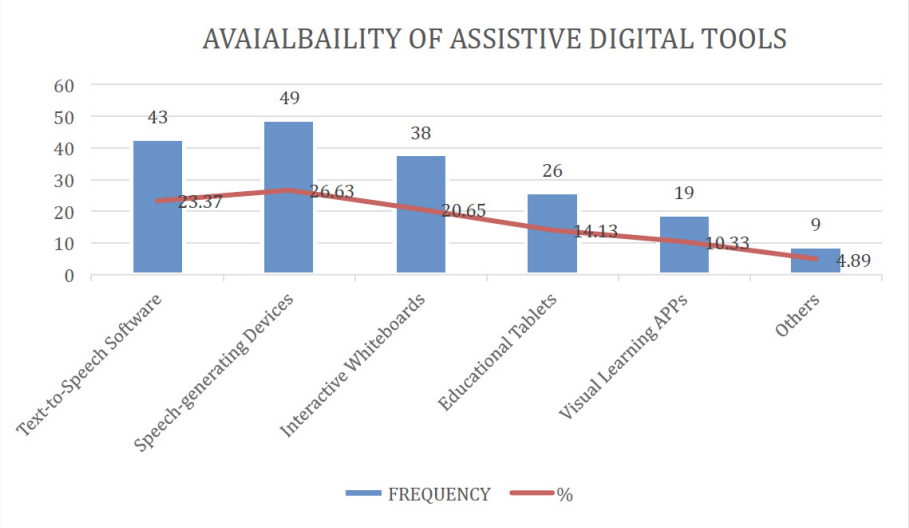

Figure 2: Availability of assistive digital tools in schools.

Are assistive Digital Tools Available in your School?

When asked about the availability of digital tools in their schools, 167(90.76%) agreed yes, while 17(9.24%) disagreed.

Which of the Following Tools are Available in Your School?

Respondents were asked to identify the types of technologies currently in use in their institutions to assess the availability of assistive digital tools in special education schools. The results are summarized in Figure **2**. Figure **2** shows that Speech-generating Devices were the most commonly available tool, reported by 49 respondents (26.63%). This strongly emphasizes enhancing communication abilities among students with speech or language impairments. Text-to-speech software followed closely, mentioned by 43 respondents (23.37%), indicating its widespread use for supporting reading and auditory learning.

Interactive Whiteboards were identified by 38 respondents (20.65%), reflecting their growing popularity as engaging instructional tools that support both visual and tactile learning styles. Educational Tablets were available in 26 schools (14.13%), showing a moderate level of integration of mobile technology for personalized learning. Visual Learning Apps were reported by 19 respondents (10.33%), highlighting a relatively lower presence, possibly due to limited access to compatible devices or software licenses. A small portion of respondents (9 respondents, 4.89%) indicated the presence of other assistive tools, which may include braille devices, audiobooks, or custom communication aids.

Overall, the data reveals a moderate to high level of availability of communication-focused assistive technologies, with relatively less emphasis on interactive and visual learning tools. These findings emphasize the need for balanced investment in a wider variety of assistive technologies to cater to the diverse learning needs of students with intellectual disabilities.

Research question two: How frequently and effectively are these resources utilized in classrooms?

Respondents were asked to indicate how frequently assistive resources are utilized in their special education classrooms. The results are presented in Figure **3**. The result indicates that most respondents (97, representing 52.72%) reported that assistive resources are used frequently in their classrooms. This suggests a commendable level of integration of assistive tools in day-to-day teaching and learning activities, reflecting a growing commitment to inclusive education practices.

Additionally, 18 respondents (9.78%) indicated that assistive tools are always used, pointing to a small yet significant group of classrooms where technology use is deeply embedded and consistently applied. However, 33 respondents (17.93%) reported that assistive tools are used sometimes, while 24 respondents (13.04%) said they are rarely used. A small proportion of the respondents (12, or 6.52%) stated that assistive resources are never utilized. These figures suggest variability in the adoption and

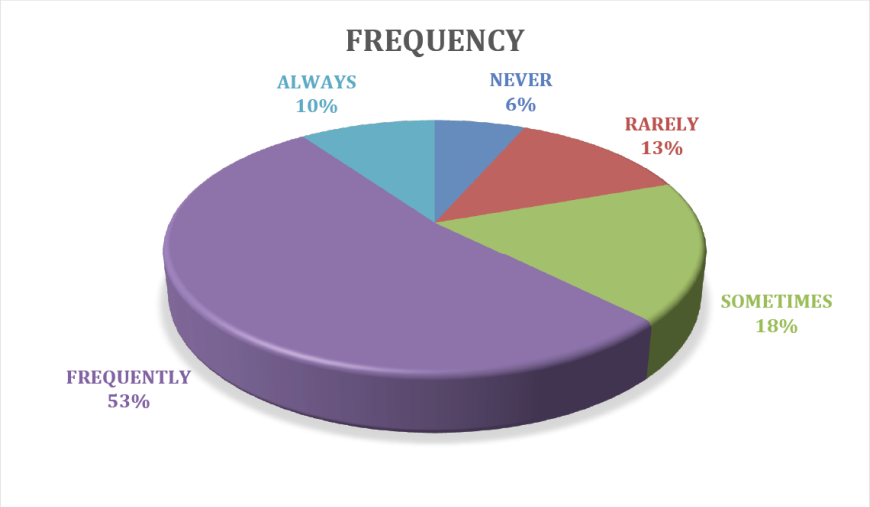

Figure 3: Frequency and effectiveness of utilization of these resources.

consistent use of assistive technologies, which may be due to differences in teacher training, resource availability, or administrative support.

Overall, while more than half of the respondents use assistive resources frequently, the data also highlights the need for more uniform implementation and targeted efforts to ensure that all special education classrooms consistently and effectively leverage assistive technologies for improved learning outcomes.

Who Primarily uses these Tools?

Respondents were asked to indicate who primarily uses the available assistive tools in their special education schools. The responses are summarized in Figure **4**. Figure **4** reveals that a majority of the respondents (104, representing 56.52%) reported that students with assistance primarily use assistive tools. This suggests that while assistive technologies are being integrated into classroom practices, many students with intellectual disabilities still require guided support from teachers or aides to effectively utilize these tools.

A notable proportion of the respondents (57, or 30.98%) indicated that students are able to use assistive tools independently, demonstrating that a significant number of learners have developed the capacity to interact with these technologies with minimal supervision. This is an encouraging sign of autonomy and digital adaptability among students with intellectual disabilities. Conversely, a small percentage of respondents (23, or 12.5%) noted that assistive tools are used by teachers only, which may point to either limited student engagement with the technology or the

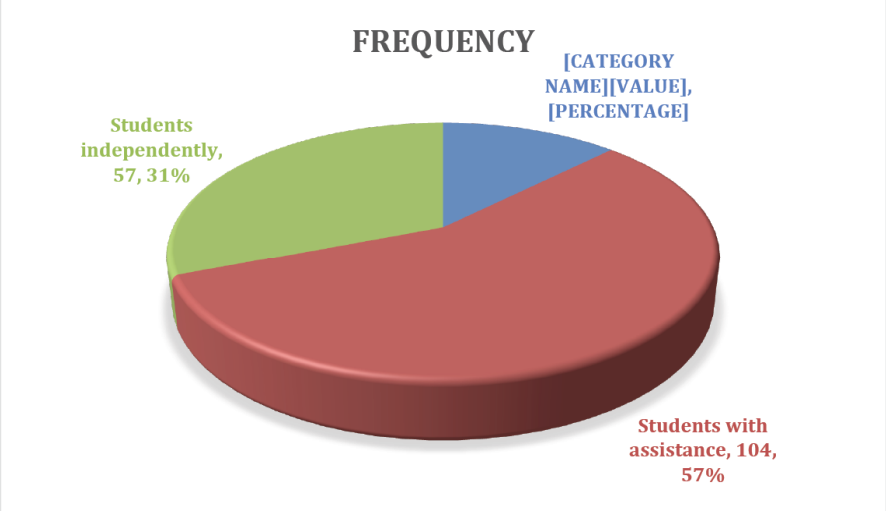

Figure 4: Frequency of utilization of assistive tools by students with intellectual disability.

use of tools primarily as teaching aids rather than for direct student interaction. Overall, the data suggest that while assistive technologies are accessible to students, there remains a need for continued training and support to promote more independent use and to maximize the benefits of these tools in fostering student learning and inclusion.

Test of Research Hypothesis

Hypothesis one: There is no significant relationship between the availability of assistive digital resources and their utilization level in teaching students with intellectual disabilities. The independent variable is the availability of assistive digital resources, while the dependent variable is the utilization level in teaching students with intellectual disabilities. Pearson's Product Moment Correlation Coefficient Analysis test statistic was employed to test the hypothesis for this study. As shown in Table **2**, the Pearson correlation coefficient (r) is 0.972, with a corresponding p-value of 0.002. Since the p-value is less than the significance level of 0.05, the result is statistically significant. Based on this, the null hypothesis, which stated that there is no significant relationship between the availability of assistive digital resources and their level of utilization in teaching students with intellectual disabilities, was rejected, indicating that there is a significant relationship between the availability of assistive digital resources and their level of utilization in teaching students with intellectual disabilities. This finding indicates a strong positive relationship between the availability of assistive digital resources and their level of utilization in classrooms.

Hypothesis two: No significant relationship exists between using assistive digital resources and the learning outcomes of students with intellectual disabilities. The independent variable uses assistive digital resources, while the dependent variable is the learning outcomes of students with intellectual disabilities. Pearson's Product Moment Correlation Coefficient Analysis test statistic was employed to test the hypothesis for this study. As indicated in Table **3**, the Pearson correlation coefficient (r) is 0.860, and the p-value is 0.000. Since the p-value is less than the conventional alpha level 0.05, the result is statistically significant at the 5% level. The degree of freedom (df) associated with this test is 182.

The correlation coefficient of 0.860 indicates a very strong positive relationship between using assistive digital resources and the learning outcomes of students with intellectual disabilities. This suggests that higher utilization of assistive digital tools is associated with improved academic and functional performance among students with intellectual disabilities.

Hypothesis three: There is no significant difference between urban and rural schools in the availability of assistive digital learning tools for students with intellectual disabilities. The independent variable, location, was categorized into urban and rural schools, while the dependent variable is the availability of

Table 2: Pearson's Product Moment Correlation Coefficient Analysis of the Relationship between the Availability of Assistive Digital Resources and their Level of Utilization in Teaching Students with Intellectual Disabilities (N=184)

Variables:	x	S.D	$\bar{r}$	P-value
Availability (x):	24.09	5.05		
			0.972	0.002
Utilization (y):	32.01	7.88		

*Significant at 0.05 level; df= 182.

Table 3: Pearson's Product Moment Correlation Coefficient Analysis of the Relationship between the use of Assistive Digital Resources and the Learning Outcomes of Students with Intellectual Disabilities (N=184)

Variables:	$\bar{x}$	S.D	r	P-value
Use of assistive digital resources (x):	13.43	3.11		
			0.86	0.000
The learning outcomes of students with intellectual disabilities (y):	17.98	5.0		

*Significant at 0.05 level; df= 182.

Table 4: Independent t-Test Analysis of the Difference between Urban and Rural Schools in the Availability of Assistive Digital Learning Tools for Students with Intellectual Disabilities (N=184)

Gender	N	Mean	SD	t-value	p-level
Urban	136	8.03	3.88	0.667	0.003
Rural	48	7.77	3.02		

*Significant at .05 level; p<0.05.

assistive digital learning tools for students with intellectual disabilities. The hypothesis was analyzed using an independent t-test analysis at 0.05 significance levels, as presented in Table **4**.

Table **4** presents the results of an independent t-test conducted to examine the difference in the availability of assistive digital learning tools for students with intellectual disabilities between urban and rural schools. The result shows that the mean score for urban schools (M = 8.03, SD = 3.88) is slightly higher than that of rural schools (M = 7.77, SD = 3.02). The calculated t-value is 0.667, with a corresponding p-value of 0.003. Since the p-value is less than the 0.05 significance level ($p < 0.05$), the result indicates a statistically significant difference in the availability of assistive digital learning tools between urban and rural schools. This suggests that students with intellectual disabilities in urban schools have greater access to assistive digital learning tools than their rural school counterparts. The disparity may be attributed to factors such as better funding, infrastructure, and technological integration typically associated with urban educational environments. Urban schools are often more likely to benefit from government initiatives, non-governmental interventions, and private sector donations to enhance inclusive education through digital means.

This finding implies that students in rural areas may be at a disadvantage in terms of access to tools that can enhance their learning experience, potentially widening the educational gap between urban and rural learners with intellectual disabilities. This calls for targeted policies and strategic interventions to bridge the digital divide and promote equitable access to assistive technologies across all geographical locations. This finding aligns with previous research indicating regional disparities in access to educational resources and technologies. Akintunde [15] noted that students with disabilities in urban regions of Nigeria have more access to assistive learning devices than their rural counterparts. Similarly, UNESCO [16] emphasized the importance of equity in digital education, especially in resource-constrained settings. Urban schools are often more likely to benefit from government initiatives, non-governmental interventions, and private sector donations to enhance inclusive education through digital means [15,16].

This finding implies that students in rural areas may be at a disadvantage in terms of access to tools that can enhance their learning experience, potentially widening the educational gap between urban and rural learners with intellectual disabilities. This calls for targeted policies and strategic interventions to bridge the digital divide and promote equitable access to assistive technologies across all geographical locations [14].

DISCUSSION OF RESULTS

The result of hypothesis one revealed a significant relationship between the availability of assistive digital resources and their utilization level in teaching students with intellectual disabilities. This finding indicates a strong positive relationship between the availability of assistive digital resources and their level of utilization in classrooms. In practical terms, as the availability of these resources increases, their use in teaching students with intellectual disabilities also tends to increase. This suggests that teachers with better access to assistive tools are more likely to incorporate them into their instructional practices. This result implies that increasing the supply and accessibility of assistive technologies in special education settings is likely to enhance their regular and effective use, ultimately supporting improved teaching and learning outcomes for students with intellectual disabilities.

This finding supports the notion that access is a foundational determinant of use. When assistive digital tools—such as text-to-speech software, interactive whiteboards, adapted tablets, and specialized learning apps—are accessible, teachers are more likely to incorporate them into daily instructional routines [14]. Conversely, limited availability often translates to underutilization, regardless of teacher awareness or willingness to integrate technology.

The significant relationship identified in this study aligns with the findings of Akintunde [15], who emphasized that the presence of digital learning tools in inclusive classrooms is a strong predictor of their use in supporting differentiated instruction and individualized learning plans. Similarly, UNESCO [16] stresses that while teacher training and positive attitudes are crucial, the actual presence of devices and digital infrastructure remains the most critical factor influencing utilization.

This result has important implications for educational policy and planning. To promote the effective use of assistive technologies in inclusive classrooms, especially for students with intellectual disabilities, education authorities must ensure the adequate provision of such tools across both urban and rural settings. Inadequate supply not only limits learning outcomes but also reinforces systemic inequality, as students in resource-poor environments may be denied opportunities to benefit from technology-enhanced learning.

The result of hypothesis two revealed a significant relationship between using assistive digital resources and the learning outcomes of students with intellectual disabilities. The correlation coefficient of 0.860 indicates a very strong positive relationship between using assistive digital resources and the learning outcomes of students with intellectual disabilities. This suggests that higher utilization of assistive digital tools is associated with improved academic and functional performance among students with intellectual disabilities. The implication of this finding is clear: effective integration of assistive technologies in the classroom significantly contributes to enhanced learning experiences and better educational outcomes for students with intellectual disabilities. This underscores the need for continued investment in digital assistive tools and teacher training to optimize their impact in special education settings.

This result supports the growing body of literature emphasizing the transformative role of technology in inclusive education, particularly for learners with special educational needs. The significant relationship implies that students with intellectual disabilities who have access to and effectively utilize assistive digital resources tend to demonstrate improved academic performance, better engagement with learning tasks, and enhanced cognitive development compared to their peers who do not use such tools. These digital resources—ranging from text-to-speech applications, interactive learning software, and audiobooks to customized educational games—appear to provide alternative pathways for understanding, retaining, and applying knowledge.

This finding aligns with the assertions of Akintunde [15], who posits that assistive digital technologies bridge the gap between teaching objectives and students' unique learning needs by reducing barriers to communication and comprehension. Additionally, it corroborates the research of Obi and Salawu [14], who found that integrating digital tools into classroom instruction significantly improves attention span, motivation, and academic retention among students with intellectual disabilities.

Moreover, the study's results suggest that when appropriately implemented, assistive digital resources can foster inclusive learning environments that promote equity and individualized support. These tools not only enhance accessibility but also encourage independence and active participation among students who might otherwise struggle in conventional educational settings. However, while the findings are promising, it is important to recognize that the effective use of assistive digital resources requires adequate training for educators, availability of infrastructure, and continuous support for both students and teachers. Without these, the potential benefits of these resources may not be fully realized.

In conclusion, the significant relationship established in this study underscores the importance of incorporating assistive digital resources into instructional strategies for students with intellectual disabilities. It also highlights the need for policymakers, school administrators, and educators to invest in and prioritize digital inclusion to improve educational outcomes for all learners.

The result of hypothesis three indicates a statistically significant difference in the availability of assistive digital learning tools between urban and rural schools. This suggests that students with intellectual disabilities in urban schools have greater access to assistive digital learning tools than their rural school counterparts. The disparity may be attributed to factors such as better funding, infrastructure, and technological integration typically associated with urban educational environments. Urban schools are often more likely to benefit from government initiatives, non-governmental interventions, and private sector donations to enhance inclusive education through digital means.

This finding implies that students in rural areas may be at a disadvantage in terms of access to tools that can enhance their learning experience, potentially widening the educational gap between urban and rural learners with intellectual disabilities. This calls for targeted policies and strategic interventions to bridge the digital divide and promote equitable access to assistive technologies across all geographical locations. This finding aligns with previous research indicating regional disparities in access to educational resources and technologies. Akintunde [15] noted that students with disabilities in urban regions of Nigeria have more access to assistive learning devices than their rural counterparts. Similarly, UNESCO [16] emphasized the importance of equity in digital education, especially in resource-constrained settings. Urban schools are often more likely to benefit from government initiatives, non-governmental interventions, and private sector donations to enhance inclusive education through digital means [15,16].

This finding implies that students in rural areas may be at a disadvantage in terms of access to tools that can enhance their learning experience, potentially widening the educational gap between urban and rural learners with intellectual disabilities. This calls for targeted policies and strategic interventions to bridge the digital divide and promote equitable access to assistive technologies across all geographical locations [14].

Implications of the Study to Students with Intellectual Disabilities

The study establishes that integrating assistive digital resources—such as text-to-speech software, interactive learning applications, audio-visual aids, and adaptive input devices—significantly enhances the learning experiences of students with intellectual disabilities. These tools provide alternative and accessible modes of instruction that are better aligned with the cognitive capacities and learning styles of such students. As a result, students are more likely to engage actively with learning materials, retain information more effectively, and demonstrate improved academic performance. Using assistive digital technologies fosters a sense of autonomy and independence among students with intellectual disabilities. By enabling them to interact with learning content at their own pace and through modes they find most accessible, these tools reduce dependency on one-on-one teacher support and encourage self-directed learning. This can potentially enhance their confidence, self-esteem, and motivation toward academic tasks.

The study's outcomes reveal that assistive digital resources can promote greater social inclusion within mainstream and special education settings. Students with intellectual disabilities equipped with appropriate digital tools are more likely to participate meaningfully in class activities and group projects, thereby enhancing peer interactions and reducing social isolation. This contributes to a more inclusive and accepting learning environment. The study implies that assistive digital technologies can serve as a gateway to lifelong learning and skill development. Early exposure to these tools may help students acquire foundational digital literacy skills critical for future vocational training, employment opportunities, and independent living. Thus, the long-term benefits extend beyond the classroom and into broader personal and social development aspects. The study underscores the transformative potential of assistive digital resources in improving not only the academic achievements but also the emotional, social, and developmental outcomes of students with intellectual disabilities. It calls attention to the urgent need for their widespread availability and appropriate application in educational settings across Cross River and Akwa Ibom States and, by extension, throughout Nigeria.

Implications for Educational Policy

- The study underscores the need for stronger policy frameworks prioritizing the systematic provision, equitable distribution, and sustained availability of assistive digital learning tools in schools catering to students with intellectual disabilities. The positive association between availability and usage indicates that ensuring access is a key prerequisite to effective implementation.
- The significant disparity between urban and rural schools also calls for targeted rural education policies. These policies should aim to close the digital divide by investing in ICT infrastructure, reliable power supply, internet access, and procurement of specialized assistive tools for rural settings.
- Furthermore, a National Assistive Technology Integration Strategy is needed to provide standardized guidelines and funding mechanisms for the implementation and

evaluation of assistive technologies in Nigerian schools.

Implications for Teacher Training and Professional Development

The study reveals that the effective use of assistive digital resources is significantly related to positive learning outcomes for students with intellectual disabilities. This finding supports the need for comprehensive pre-service and in-service training for teachers on integrating assistive technologies in teaching and learning processes.

Teacher education programs should incorporate modules on:

- Identification and selection of appropriate assistive technologies,
- Instructional design for inclusive learning using digital tools,
- Strategies for monitoring and evaluating student progress using digital aids.

Increased access to opportunities in rural areas through mobile training teams, virtual learning platforms, and regional workshops should ensure no teacher is left behind.

CONCLUSION

Based on the study's results, it was concluded that there is a significant relationship between the availability of assistive digital resources and their level of utilization in teaching students with intellectual disabilities. There is also a significant relationship between the use of assistive digital resources and the learning outcomes of students with intellectual disabilities. There is a significant difference between urban and rural schools in the availability of assistive digital learning tools for students with intellectual disabilities.

The findings from this study underscore the critical role that assistive digital resources play in supporting the education of students with intellectual disabilities. However, their potential is significantly undermined by poor access, limited teacher preparedness, and institutional barriers. While there is growing awareness among educators of the benefits of such technologies, more needs to be done to create an inclusive digital learning environment. The realization of inclusive education goals in Nigeria depends heavily on addressing the infrastructural and professional capacity gaps identified in this study.

Effective diagnosis and intervention are foundational to supporting the educational and developmental needs of students with intellectual disabilities. A multidisciplinary, student-centered approach—integrating medical, educational, technological, and psychosocial strategies—offers the most promising outcomes. This study emphasizes the importance of expanding access to assistive digital resources as part of a holistic treatment and learning plan for students with intellectual disabilities in Cross River and Akwa Ibom States, Nigeria.

RECOMMENDATIONS

Based on the findings of the study, the following recommendations are made:

1. The strong correlation between the availability and utilization of assistive technologies suggests that schools must go beyond token provision. For classroom-level impact: Digital tools should be embedded into daily lesson plans rather than treated as optional or supplementary. Teachers need structured access—including classroom-based devices, shared resource banks, and centrally managed tools—rather than sporadic or one-off distributions.
2. Teachers should be trained to match specific tools to specific student needs, such as text-to-speech apps for students with reading difficulties or interactive story apps for developing cognitive and communication skills.
3. Increased Government Investment: Ministries of Education in Cross River and Akwa Ibom States should prioritize procuring and equitably distributing assistive digital tools to schools catering to students with intellectual disabilities.
4. Teacher Training and Capacity Building: Regular workshops and professional development programs should be organized to equip teachers with the necessary skills to use assistive technologies effectively in the classroom.
5. Partnerships with NGOs and Tech Firms: Collaboration with technology companies and nonprofit organizations can help supply affordable devices and training, especially in underserved communities.

6. Development of ICT Policy for Inclusive Education: A specific policy framework should be developed to address integrating assistive digital technologies into the special education curriculum.

CONFLICTING INTERESTS

The authors hereby declare that there is absolutely no conflicting interest. The publishers can proceed with the publication of the paper.

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