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Research Paper

Role of assistive technology in enhancing learning outcomes for students with learning disabilities: a comparative study of urban and rural schools in plateau state, nigeria

Patricia Kwalzoom Longpoe[1*], Leah Homsuk Menta[2]
[1*,2]Department of Special Education & Rehabilitation Sciences, University of Jos. Nigeria.

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ABSTRACT

By improving academic achievement and classroom engagement, assistive technology (AT) incorporation into classroom instruction offers substantial potential to serve children with learning difficulties. Disparities in the accessibility, availability, and efficient use of AT, especially between Nigerian urban and rural areas, continue to be a major concern. This study compares urban and rural schools in Plateau State, Nigeria, to investigate how assistive technology can improve learning results for students with learning difficulties. The project will use a mixed-methods approach to gather data from pre-selected rural villages in the state as well as public and private schools in Jos, which is an urban area. Teachers and school administrators will be given standardized questionnaires to complete in order to collect quantitative data, and parents and educators will be interviewed in order to obtain qualitative information. The purpose of the study is to assess variations in the accessibility of assistive technology, instructor proficiency, student involvement, and academic performance of students who use it. According to preliminary research, urban schools are more likely to have access to AT because of superior funding and infrastructure, while rural schools encounter major obstacles such poor policy implementation, a lack of devices, and insufficient training. Despite these obstacles, creative and neighbourhood-based solutions might be found in rural areas, providing chances for flexible tactics. The findings of the study will guide the creation of policies, the fair allocation of resources, and focused teacher preparation initiatives.

Corresponding Author:
Patricia Kwalzoom Longpoe
Department of Special Education & Rehabilitation Sciences, University of Jos. Nigeria.
Email: patricialongpoe@gmail.com

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1. INTRODUCTION

Everyone agrees that education is an essential human right and the foundation of both social and economic advancement. However, access to inclusive and equitable education is still a long way off for millions of children with learning difficulties, particularly in developing nations like Nigeria. A variety of neurological disorders that impair a person's capacity to read, write, talk, or execute mathematical computations are referred to as learning impairments. For them to successfully access the curriculum, students with learning difficulties frequently need specialised teaching methods and resources, such assistive technology (AT).

Any equipment, software, or gadget that enables persons with impairments to carry out tasks that would otherwise be challenging or impossible is referred to as assistive technology. From low-tech devices like pencil grips and graphic organisers to high-tech options like audio books, interactive learning apps, and speech-to-text software, assistive technology (AT) can be used in educational settings [1]. It has been demonstrated that these tools greatly boost involvement, improve communication, and improve academic results for children with learning difficulties [2]. Their application varies by location and educational setting, though.

The topic of inclusive education has become more well-known in Nigeria, particularly after the Discrimination Against Persons with Disabilities (Prohibition) Act was passed in 2018 and the nation ratified the United Nations Convention on the Rights of Persons with Disabilities (UNCRPD) in 2007 [3]. All students, including those with impairments, must get an accessible education under these legislative frameworks. Due in large part to poor infrastructure, a lack of teacher preparation, and lax enforcement of policies, the inclusion of kids with learning difficulties in mainstream education is still insufficient despite these advancements.

Based on studies, one of the broadest gaps in Nigeria's practice of inclusive education is the absence of utilization of assistive technology, particularly in public and rural schools [4]. While Lagos and Abuja city schools are integrating AT into classrooms, schools in rural communities in states like Plateau have multiple limitations such as less funding, undertraining of teachers, and less awareness of AT solutions, finds study. Nigeria is not the only place where such urban-rural disparity is present. Disparities in access to assistive technologies globally tend to mirror broader socioeconomic and geographic disparities.

In addition, studies establish that the level of institutional support and teacher preparation strongly impacts the advantages of AT. Teachers' attitudes, skills, and training are essential to be successfully implemented in classroom practices. But in Nigeria, the majority of pre-service and in-service teachers are not exposed to inclusive education practices during training, therefore low competency and self-confidence in catering for the needs of students with disabilities [5]. One of the reasons for the slow adoption of this technology is a lack of locally and culturally specific assistive technology solutions. The majority of the technology purchased commercially were Western-developed and might not be compatible to accommodate the pedagogical, linguistic, or infrastructure conditions of schools in Nigeria [6]. Therefore, context-specific research must analyze the kind of assistive tools that are possible and practical to implement in Nigerian schools. Due to such challenges, there is a general agreement that it is critical to carry out research that is relevant to a given location in a bid to understand the advantages and disadvantages of employing AT for inclusive education.

In trying to provide the response to that cry, this research explores the application of assistive technology within Nigeria's Plateau State urban and rural schools. To uncover gaps, establish best practice, and recommend ways to facilitate AT integration, it contrasts teachers' and students' experience in the two divergent settings. This research is extremely relevant as it can possibly mold empirical data into education resource allocation, teacher training course, and education policy. This research on inclusive education in Nigeria seeks to bridge the policy intention-classroom practice gap by examining the implementation of assistive technologies in different contexts. Neurological conditions referred to as learning disabilities (LDs) disrupt the brain's ability to receive, process, store, and react to information [7].

LDs are responsible for the majority of all disability students experience globally and affect their learning, particularly in executive functioning, literacy, and numeracy. Inclusive education is one of the

ways to global education reforms that puts learners with special needs, such as learning disabilities, in regular classes. Systemic, infrastructural, and attitudinal impediments in Nigeria hinder real practice to policy frameworks such as the discrimination against persons with disabilities (Prohibition) act (2019) and the National Policy on Education (NPE, 2014) [8]. "Any device, equipment, or product system that has the sole purpose to facilitate or enhance functional abilities for a person with a disability" is referred to as assistive technology (AT) [9].

They range from high-technology such as electronic communication boards and speech-to-text programs to low-technology such as pencil grips and audio books. Globally, AT has been discovered to possess the potential of improving academic performance, independence, and motivation to solve the learning discrepancies among learners with disabilities. Learning-disabled students who used individualized support technologies reported significant improvement in writing production and understanding, as noted. There is still extremely low AT usage and awareness in Sub-Saharan Africa, Nigeria included. Research points to a lack of contextually relevant equipment, underfunding, and inadequate experienced personnel as constraints [10]. Rural communities are particularly infamous for suffering from these constraints. There is enough evidence to demonstrate the urban-rural divide in learning. Schools in urban centers in Nigeria tend to have better facilities, more qualified instructors, and greater exposure to external resources.

On the other hand, underfunding, congestion, and poor access to instructional materials, including AT, are some of the issues rural schools have to contend with. Rural special-needs students were 40% less likely to be provided with assistive devices than their counterparts in urban settings, according to [11] study. Learning disparities are also heightened by rural teachers who are poorly trained in the use of inclusive learning technologies, as it was uncovered by [12]. The professionalism of a teacher is required for AT to be effectively incorporated. Nigerian teachers, particularly those working in public schools, lack or have limited formal training in assistive technology, as research has confirmed by. Doubt and ignorance tend to restrict the utilization of resources available.

Even more so in rural areas [13]. Far less than 20% of the rural teachers in Plateau State ever utilized AT while teaching in classrooms, have discovered. On the other hand, due to some exposure to peer learning networks and staff development, teachers in city schools were more positive in perception [14]. Use of AT in Nigerian schools also depends on stigmatization of disability and cultural beliefs. In certain cultures, intervention technology support is weaker since they view learning disorder as a social or spiritual illness. Progress is also slowed down by scarce data, weak policy, and institutional resistance. Despite the reality that Nigeria's policies uphold inclusive education, posit that the lack of monitoring systems, insufficient teacher support, and administrative procrastination undermine implementation. Political will and public accountability also rank weaker among rural communities, and this institutional gap is larger [15].

Assistive technology has also been evidenced in much foreign research to improve academic achievement, decrease school dropout, and increase the academic engagement of students with learning disabilities. In a Lagos study by LD students who used digital audiobooks achieved a 28% increase in reading comprehension score [16]. However, there are few if any empirical studies conducted in Nigeria. More robust data are required to answer how well AT improves learning outcomes in national settings, particularly rural vs. urban school systems, as measured by [17]. Much of what is already in print tends to extrapolate results from one region of Nigeria to the whole of the country without taking account of context or regional differences. Plateau State offers a representative case study for examining the role of geography and infrastructure in AT adoption and student outcomes as it has cosmopolitan and very rural places.

The state capital, Jos, is a comparably urbanized city with a high concentration of technology facilities and schools. In contrast, low rates of school enrollment, poor facilities, and a lack of special education support hamper rural areas of the state. These differences raise significant questions regarding the availability and effectiveness of assistive technology for students with learning disabilities in various communities.

2. RELATED WORK

Parents, teachers, and researchers across Plateau State and other Nigerian contexts report that assistive technology (AT), from low-tech tools (manipulatives, large-print materials) to computer-based aids and specialised software, can improve engagement and measurable learning outcomes for students with learning disabilities, particularly in reading, writing and numeracy [18]. Empirical studies conducted in Jos and Plateau State show significant pre-post-test gains when AT is appropriately integrated into instruction, with teachers and special-education practitioners noting improved task completion, faster remediation of specific skill gaps, and higher learner motivation.

However, comparative research highlights a pronounced urban–rural divide: urban schools (often in Jos and other towns) report greater access to AT, electricity, trained personnel, and demonstration centres, while rural schools face shortages of devices, unreliable power, limited teacher training, and weaker maintenance/repair systems, all of which blunt AT's impact on learning outcomes in rural settings. Studies of teacher perceptions in several Nigerian regions identify cost, lack of skills, and infrastructural constraints as the main barriers to scaling high-tech AT these barriers are consistently more severe in rural schools, where contextual adaptations (offline digital content, solar power, community repair hubs) are required but seldom implemented [19].

The literature therefore converges on pragmatic recommendations for translating AT gains into sustained learning improvements across both urban and rural Plateau schools: (a) invest in teacher training and pre-service AT exposure, (b) priorities low-cost, context-appropriate devices alongside scalable digital resources, (c) fund maintenance, power and connectivity solutions for rural schools, and (d) embed AT policies into state education plans with monitoring of learning outcomes to guide scale-up. Recent Nigerian reviews and regional studies underscore that when these system-level enablers are present, AT not only enhances individual student outcomes but also narrows urban–rural learning gaps for learners with learning disabilities.

2.1. Statement of the Study

All students, including those with disabilities, should have equitable access to high-quality education and opportunities for lifelong learning, as stated in international frameworks such as the UN Sustainable Development Goal 4. However, implementing inclusive concepts remains a significant challenge in Nigeria, particularly for children with learning difficulties [20]. One of the most underutilized but potentially ground-breaking instruments in this endeavour is assistive technology (AT). Despite the fact that AT has been shown to improve learning outcomes and increase classroom engagement for children with learning disabilities in a variety of contexts.

The distinction between urban and rural schools is more pronounced in such areas as Plateau State. Urban schools are likely to have improved infrastructure, easier access to trained staff, and external financing that supports the purchase and use of AT. Rural schools, though, continue to deal with challenges over the lack of basic resources, general unfamiliarity with assistive technologies, and poor teacher training. These gaps threaten to erase the learning disability gap in education. Additionally, even at the municipal level, Nigeria's existing policies that promote inclusive education and rights of people with disability are mostly not implemented. Although they are critical to guaranteeing effective utilization of AT, educators commonly lack sufficient confidence and preparedness to use these tools. Inadequate accessible, culturally compatible AT options considerably worsens the situation by further limiting access to such students in underserved communities. Regardless of these issues, empirical studies into the use, or lack of use, of AT in Nigerian schools, both rural and urban, are lacking.

2.2. Purpose of the Study

In order to establish the effect of assistive technology (AT) on achievement in learning for students with learning disabilities, this study examines the usage and effectiveness of AT in urban and rural Plateau State schools in Nigeria. Specific aims of the research are to:

1. Explore the type and availability of assistive technology applied to enable learners with learning disabilities in selected urban and rural schools.

2. Assess the preparedness and ability of teachers to integrate assistive technology into urban and rural classrooms.
3. Contrast the learning achievement of children with learning disabilities with access to assistive technologies in urban schools compared to rural schools.
4. Identify the challenges in applying assistive technology effectively into inclusive education among learning disability students, particularly in rural schools.
5. Observe the infrastructure, institutional, and sociocultural conditions influencing the use and adoption of assistive technology in both settings.
6. Evaluate the perceptions of special education stakeholders, teachers, and school administrators regarding the use of assistive technology in inclusive classrooms.
7. Present strategies for enhancing assistive technology use and access, specifically in underserved rural schools, to promote equal learning outcomes.

2.3. Research Questions

The following are the research questions that this study seeks to answer:

1. What are the assistive technologies available and used in supporting students with learning disabilities in rural and urban schools in Plateau State?
2. How prepared and trained are rural and urban school teachers to use assistive technology in supporting students with learning disabilities?
3. What are the differences in learning outcomes for students with learning disabilities who use assistive technology between urban and rural schools?
4. What are the major barriers and issues preventing the easy implementation of assistive technology in inclusive education, especially in rural schools?
5. How are institutional, societal, and infrastructural aspects exacerbating the adoption of assistive technologies in Plateau State?
6. What do teachers and school leaders perceive in terms of incorporating assistive technology into inclusive education?
7. How can assistive technology become accessible and functional for special children, particularly for those in remote schools?

3. METHODOLOGY

3.1. Design

A descriptive survey research design with a comparative design was utilized in the current study, and the design was appropriate for investigating the prevalence and impact of assistive technology (AT) in both urban and rural school environments. The design enables the researcher to collect data systematically, examine trends, and establish differences in usage and impacts of AT between school types. The comparative approach assists in illustrating how geography and infrastructural availability impact the utilization and operation of assistive technology in inclusive education [19]. The aim of the study, that is, to assess the impact of assistive technology on learning outcomes of children with learning disabilities in Plateau State, Nigeria, is adequately captured using this technique.

3.2. Study Area

Plateau State, in Nigeria's North-Central zone, was the site of the study. Because of its sociocultural diversity, Plateau State presents a great platform to study how there is a disparity in the educational success of more rural, impoverished communities like Bokkos and Langtang North and urban areas like Jos North and Jos South. While rural schools tend to be lacking in infrastructure, urban schools tend to have more resources. A proper comparison of the impact of context on the availability, effectiveness, and accessibility of assistive technologies in schools was facilitated by this spatial variation.

3.3. Population and Sample

Pre-service and in-service teachers who work with students who have learning disabilities, students who have been identified as having learning disabilities based on school records and assessments, school administrators in charge of ensuring that inclusive education policies are followed, education officers, and special education specialists from Plateau State's Ministry of Education comprised the study's population. This group was chosen to guarantee that the viewpoints of those who deliver inclusive education as well as those who receive it were sufficiently represented. The Plateau State Ministry of Education reports that more than 50 schools in the state's rural and urban districts are implementing inclusive education.

Table 1. The Sample for the School

Category	Urban	Rural	Total
Schools	8	8	16
Teachers	80	80	160
Students (LD)	40	40	80

As shown in Table 1 the sample for the study was considered representative enough to generalize findings to similar settings within the region.

3.4. Instruments for Data Collection

The following were created and used:

1. **Teachers' Structured Questionnaire (SQAT):** This was intended to collect quantitative data on the following: teacher demographics (age, gender, education, experience) kinds of assistive technology utilized, intention and frequency of use, perceived effectiveness of assistive technology, availability of professional growth and training and difficulties faced in using AT. A 5-point Likert scale, ranging from Strongly Disagree to Strongly Agree, was utilized in the development of the SQAT.
2. **Students' Learning Outcomes Checklist (SLOC):** Academic achievement of students was tracked and compared across two terms utilizing this checklist. In order to assess the effect of AT on academic development, it measured major literacy and numeracy skills.
3. **Classroom Observation Checklist:** Through observations of actual classroom practices, the researcher was in effect able to confirm the reported utilization of assistive technology. Observed elements were student participation and interest, incorporation of AT into education, and types of AT utilized (e.g., audio books, speech-to-text programs, Braille equipment).

3.5. Method of Data Collection

Three main phases of data collection were conducted over an eight-week period. After receiving the SQAT, classroom teachers completed the SLOC with the students' performance records with the assistance of the researchers. The researcher conducted non-intrusive observations in each of the 16 schools for at least one full day in order to record the usage of AT in several lessons. Two to three teachers and one administrator took part in FGDs at each school. Each session lasted around 45 to 60 minutes, and audio recordings were made for analysis and transcription.

3.6. Method of Data Analysis

Descriptive statistics such as means, standard deviations, percentages, and frequencies were used to describe the data. Inferential statistics were used to contrast urban and rural schools on the basis of independent sample t-tests. To determine if categorical variables-like training and availability of AT-are associated, use chi-square tests. ANOVA to assess the impact of different types of AT on the achievement of students. The results of focus group discussions were coded using the thematic content analysis. The transcripts were coded carefully to identify crucial themes that were in alignment with research questions. Direct quotes were used to give it more meaning and authenticity.

4. RESULTS AND DISCUSSION

Research Question 1: What types of assistive technologies are available and used in urban and rural schools for students with learning disabilities in Plateau State, Nigeria?

Table 2. Availability and Use of Assistive Technologies in Urban and Rural Schools

Assistive Technology Type	Urban (n=80)	% Used	Rural (n=80)	% Used	Mean Usage Score (Urban)	Mean Usage Score (Rural)	Std. Dev. (Urban)	Std. Dev. (Rural)
Audio Books	68	85.0%	32	40.0%	4.12	2.45	0.76	1.02
Speech-to-text software	52	65.0%	20	25.0%	3.72	2.12	0.81	0.93
Braille kits	38	47.5%	28	35.0%	3.45	2.96	0.89	0.86
Visual aids (e.g., projectors)	70	87.5%	30	37.5%	4.20	2.30	0.64	1.10
Digital tablets	42	52.5%	15	18.8%	3.30	1.80	1.00	0.92

The results showed that urban schools had much higher access and use of assistive technology than rural schools, as revealed in Table 2. Even though Braille kits were used more, though less, in rural classrooms, visual aids and audio books represented the most common AT in urban schools. Urban and rural schools also differed extensively in use and access to assistive technology (AT) as per the study. Urban schools reported much more use of tools like audio books, speech-to-text software, and visual supports, whereas rural schools reported little access and use, with most relying on basic Braille kits for the most part. Who emphasized how the technological contrast between urban and rural schools hinders fair inclusive education from being practiced [21]. Urban school students where AT was more prevalent touted significantly higher academic performance than rural school students. This finding aligns with existing research demonstrating how the incorporation of assistive technology can enhance learning-disabled students' academic achievement, content accessibility, and cognitive engagement.

Research Question 2: What is the effect of assistive technology on the learning outcomes of students with learning disabilities in urban and rural schools?

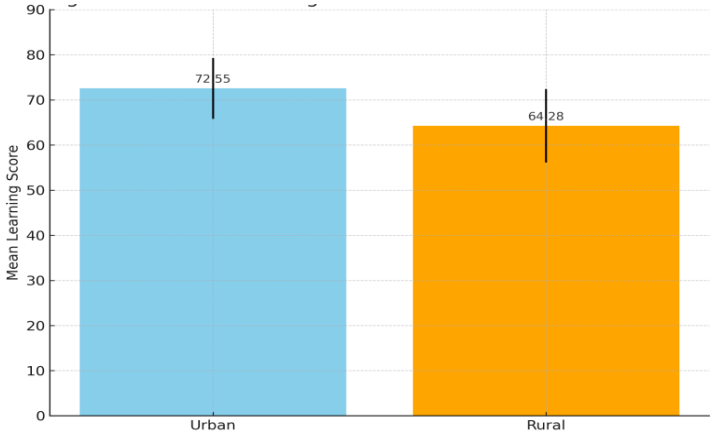


Figure 1. Student Learning Outcomes in Urban and Rural Schools

Students in urban schools with greater exposure to AT performed visibly higher than their rural counterparts, as illustrated by Figure 1. This can be understood as implying that learning in integrated classrooms and access to AT are directly related. According to the results, rural schools face greater obstacles in form of limited infrastructure, insufficient training for educators, unstable power supply, and

the very expensive nature of AT acquisition. These are similar to the constraints listed, who listed similar structural weaknesses in inclusive education settings in Cameroon. The majority of Nigerian rural schools lack functional ICT facilities, reports the Universal Basic Education Commission, which is also behind Nigeria's persisting digital alienation [22].

Research Question 3: What are the barriers to effective use of assistive technology in urban and rural schools?

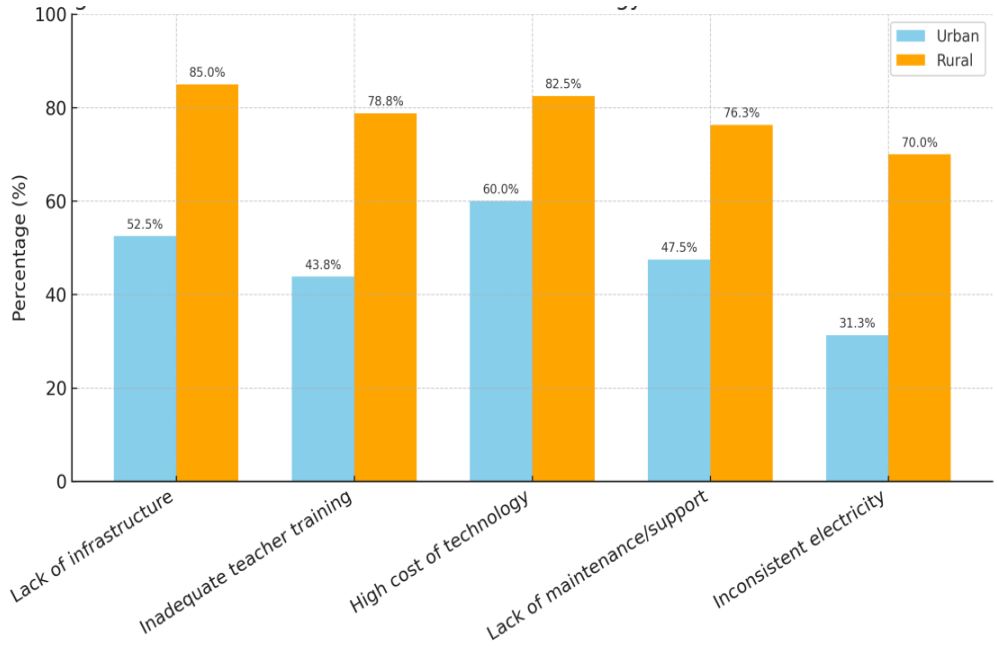


Figure 2. A Bar Chart Illustrating the Perceived Barriers to Assistive Technology use in Urban and Rural Schools

As can be seen in Figure 2 the findings showed that rural schools were facing a wider range of more significant barriers to effective AT implementation. Lack of infrastructure, poor training, and financial problems were some of the most common ones. Urban teachers showed higher levels of preparedness, self-efficacy, and usage frequency in adopting assistive technologies than rural teachers. conclusions, which suggested that thorough AT modules are commonly not included in pre-service and in-service teacher training in Nigeria, especially for teachers working in rural schools, align with this. Well-trained teachers are able to differentiate instruction more, identify the needs of their students, and utilize technology well [23]. The results show how necessitous targeted professional development opportunities and continuous continuing professional development (CPD) activities are required to prepare all teachers, especially those in impoverished communities, with the tools they can utilize in order to access AT effectively.

Research Question 4: What is the level of teacher preparedness and training regarding the use of assistive technology in both urban and rural settings?

Table 3. Level of Teacher Preparedness and Training

Preparedness Variable	Urban (%)	Rural (%)	Mean Score (Urban)	Mean Score (Rural)	Std. Dev.
Received formal AT training	71.3%	28.8%	4.01	2.32	0.89
Use AT weekly in class	65.0%	31.3%	3.90	2.41	0.93
Confidence in using AT	60.0%	26.3%	3.75	2.10	1.01
Know how to integrate AT in lesson	62.5%	30.0%	3.85	2.20	0.97

Table 3 findings state that urban teachers felt more confident and well-equipped when they utilized assistive technology. Formal training for almost 29% of rural teachers highlights the need for embracing more expert capacity building in rural areas. This study has revealed the significance of the impact of assistive technology (AT) on enhancing the learning achievement of children with learning disabilities, in particular concerning urban-rural inequalities between Plateau State schools in Nigeria. The study revealed that urban schools make more extensive use of and have better access to assistive technology, subsequently resulting in enhanced student engagement and academic performance. The rural schools are confronted with very serious problems due to insufficient funding for AT materials, unskilled manpower, and inadequate infrastructure. Properly implemented assistive technology minimizes the obstacles to learning, facilitates individualized learning, and makes students with disability more independent. It is therefore an essential instrument for inclusive education. The influence of AT, however, is highly reliant on extrinsic factors such as socioeconomic status, school policy, school climate, and teacher training.

Research Question 5: How do students perceive the impact of assistive technology on their learning experiences?

Table 4. Student Perceptions of Assistive Technology (Likert Scale Mean Ratings)

Perception Statement	Urban Mean	Rural Mean	Std. Dev (Urban)	Std. Dev (Rural)
AT helps me understand lessons better.	4.35	3.25	0.71	1.01
I feel more confident when using AT.	4.20	3.05	0.83	0.96
My learning has improved because of AT.	4.40	3.10	0.68	1.05
I like using technology to learn.	4.50	3.30	0.60	0.92
Teachers help me use the tools properly.	4.22	2.98	0.77	1.10

As shown by Table 4 results pointed out that urban students gave more positive impressions regarding the usefulness of AT. The figures show that the use of AT enhances learning outcomes as well as students' motivation and confidence, especially when integrated with highly trained instructors. Urban students significantly gave more positive evaluations of assistive technology, showing that it enhanced their understanding, confidence, and level of motivation for learning. These align with conclusions, which indicated how students' attitude and involvement both improve when students are given suitable technology [24]. Similarly, the alignment of AT to students' needs and context improves academic involvement as well as autonomy, as indicated by study on the SETT model (Student, Environment, Task, and Tools). The poorer experience among the rural students means that learning-disabled students feel disconnected and less skilled in the absence of proper resources and teaching support, which decreases their level of educational motivation and self-esteem [25], [26], [27].

5. CONCLUSION

The study also identified that teachers in urban areas are more qualified and confident to use assistive technology, whereas teachers in rural areas are overall poorly prepared, mere because they have limited access to training and inclusive education tactics. This difference in the ability of teachers impacts largely on the quality and consistency of inclusive practices within the state. To bridge the educational gap between urban and rural students with disabilities, concerted legislative effort, prudent infrastructural expenditure, and extensive teacher training programs are long overdue. Nigeria must shift towards inclusive education with accessible inclusive education comprising the use of assistive technology in its national inclusive education policy and fulfill its commitments under the UN Convention on the Rights of Persons with Disabilities (UNCRPD). Finally, providing access to the use of assistive technology in the classroom so that all students, no matter geography or ability, have an equal opportunity to access high-quality instruction is a fundamental human right and an education policy issue.

5.1. Recommendations

The following are the recommendations recommended for enhancing the use of assistive technology (AT) among children with learning disabilities in urban and rural contexts based on the conclusions and findings from the study:

1. Urban and rural schools should be equipped with assistive technologies, which should be provided by the government through the Federal and State Ministries of Education. The purchasing and maintenance of AT devices in economically poor rural areas should have special funds allocated.
2. Institutionalizing pre-service and in-service training programs for teachers on the usage of assistive technology is a great idea. Digital learning platforms, workshops, and mobile training vehicles must be specifically designed for rural teachers. Such initiatives can be scaled up through partnerships with NGOs and teacher training institutions.
3. Priority should be given to incorporating assistive technology into inclusive education policy. Nigeria's National Policy on Inclusive Education and international guidelines such as the UNCRPD should be monitored and maintained by state boards of education. Input from grassroots stakeholders should be incorporated into regular policy review.
4. Rural schools require infrastructure development, in the form of ICT facilities, internet access, and availability of electricity, urgently. This will create an environment conducive to successful deployment and utilization of assistive technologies.

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Author Contributions Statement

Name of Author	C	M	So	Va	Fo	I	R	D	O	E	Vi	Su	P	Fu
Patricia Kwalzoom Longpoe	✓	✓	✓	✓	✓	✓		✓	✓	✓			✓	
Leah Homsuk Menta		✓			✓	✓		✓	✓	✓	✓	✓	✓	

C : **C**onceptualization
M : **M**ethodology
So : **So**ftware
Va : **Va**lidation
Fo : **Fo**rmal analysis
I : **I**nvestigation
R : **R**esources
D : **D**ata Curation
O : Writing - **O**riginal Draft
E : Writing - Review & **E**diting
Vi : **Vi**sualization
Su : **Su**pervision
P : **P**roject administration
Fu : **Fu**nding acquisition

Conflict of Interest Statement

Author state no conflict of interest.

Informed Consent

All references used for the writeup of this paper have been adequately acknowledged under references.

Ethical Approval

This study adhered strictly to ethical standards, including ethical clearance from the Plateau State Ministry of Education and the University of Jos Research Ethics Board. Informed consent obtained from all participants. Assent obtained for student participants and consent from their parents or guardians. Confidentiality and anonymity were guaranteed for all respondents. Data were used solely for academic purposes and stored securely.

Data Availability

The data that support the findings of this study are available on request from the corresponding author, [Menta, H. M.]. The data, which contain information that could compromise the privacy of research participants, are not publicly available due to certain restrictions.

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BIOGRAPHIES OF AUTHORS



Patricia Kwalzoom Longpoe, is a Senior lecturer in the Department of Special Education and Rehabilitation Sciences, University of Jos. She obtained her B.Sc. Ed, M.Ed., and Ph.D Ed in Special Education from University of Jos. Dr. Patricia Kwalzoom Longpoe has a number of journals to her credit, he has attended a number of conferences in Nigeria. Her interests include inclusive education policies, early intervention strategies for children with disabilities. She loves working with children with disabilities and working closely with the women in the church, in addition

	to her teaching and research. She is happily married and blessed with children. Email: patricialongpoe@gmail.com
	**Leah Homsuk Menta**, is an assistant lecturer in the Department of Special Education and Rehabilitation Sciences, University of Jos. Leah obtained her B.Sc.Ed, M,Ed in Special education from University of Jos. Menta Leah has a number of journals to her credit, she has attended a number of conferences in Nigeria. Her interests include inclusive education policies, early intervention strategies for children with disabilities, and Speech Pathology. She is happily married and blessed with children. Email: leahmenta44@gmail.com