Academic Journal of Current Research
Vol.13, No. 01; January-2026;
ISSN (2837-3707);
p –ISSN 3244 –5621
Impact factor: 6.37

TECHNOLOGY-ENABLED COMMUNICATION AND ASSISTIVE LEARNING DEVICES FOR STRENGTHENING SPECIAL NEEDS EDUCATION IN RIVERS STATE, NIGERIA

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Abstract: This study assessed technology-enabled communication and assistive learning devices for strengthening special needs education in Rivers State, Nigeria. The study anchored on technology acceptance model. This study adopted a pragmatic research philosophy and a descriptive survey research design. The population of this study comprised teachers, special education coordinators, and school administrators in both public and private special and mainstream schools that accommodate learners with disabilities in Rivers State. According to the Rivers State Ministry of Education (2024), there are 250 schools offering special needs education across the state, employing approximately 1,200 teachers and administrators who directly interact with learners with disabilities. A sample of 240 respondents was drawn from the population, representing 20% of the total population to ensure sufficient representation while remaining manageable for data collection. The sample included teachers (180), special education coordinators (40), and school administrators (20). The sampling technique combined stratified and purposive sampling. Data were collected using a triangulation-methods approach, combining: Structured questionnaires, semi-structured interviews and classroom observations. The quantitative data from questionnaires were analysed using descriptive statistics (means) and inferential statistics (Pearson correlation and regression analysis). The qualitative data from interviews and observations were analysed using thematic content analysis, identifying recurring patterns, challenges, and best practices in technology integration. The findings revealed that Findings indicated that technology-enabled communication tools were actively used in classrooms to support learners with special needs. Quantitative data showed high mean scores for teacher use of messaging apps, multimedia instructional platforms, and digital coordination with caregivers. Qualitative analyses from interviews and classroom observations confirmed that these tools facilitated real-time feedback, improved participation, and strengthened the home-school connection, although inconsistent internet connectivity and device availability occasionally limited usage. The study concluded that that technology-enabled communication tools were actively used by teachers to enhance learner participation, coordinate with caregivers, and support inclusive classroom practices, demonstrating their critical role in facilitating real-time interaction and engagement for learners with special needs. The study recommended that the Rivers State Ministry of Education should provide ongoing professional development for teachers on digital communication tools to enhance learner engagement and home-school coordination.

Keywords: Technology-Enabled Communication, Assistive Learning Devices, Special Needs Education, Rivers State, Nigeria

Introduction

Globally, inclusive education for learners with disabilities has been recognized as a central component of the United

Academic Journal of Current Research
Vol.13, No. 01; January-2026;
ISSN (2837-3707);
p –ISSN 3244 –5621
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Nations Sustainable Development Goals and the Convention on the Rights of Persons with Disabilities, prompting governments, agencies, and researchers to explore how education systems can eliminate barriers and provide equitable learning opportunities for all children (UNESCO, 2020). The rapid expansion of digital communications and assistive technologies provides new pathways for inclusion by enabling alternative modes of communication, access to curriculum content, and individualized support. The World Health Organization and UNICEF have documented the vast global need for assistive products and the substantial gap in access in low- and middle-income countries (WHO, 2022; UNICEF, 2022). These global commitments and documented gaps establish a normative and practical rationale for research that evaluates how technology-enabled communication and assistive learning devices can translate policy into meaningful classroom practices and learning outcomes for learners with special needs.

The international research literature has shown that technology can support learners with diverse disabilities through multiple mechanisms including augmentative and alternative communication, adaptive content presentation, speech-to-text and text-to-speech conversion, and personalized learning systems driven by data or artificial intelligence. However, the evidence base is heterogeneous, with many studies focused on high-income contexts and small-scale interventions rather than system-level implementation trials (Lynch, 2024; Mukhtarkyzy et al., 2025). Meta-analyses and systematic reviews indicate positive effects on communication skills, engagement, and certain academic outcomes when assistive technologies are appropriately matched to learner needs and teachers receive training. Yet, the durability of effects, equity of access, and cost-effectiveness across contexts remain under-researched (Ranzato, 2025; systematic reviews on instructional and assistive technologies, 2023). Therefore, building robust, context-sensitive evidence about how technology-enabled communication and assistive learning devices operate in under-resourced schooling systems is essential to move from promising pilots to scalable approaches.

African policy environments have increasingly embraced the inclusive education agenda while confronting structural constraints such as limited financing, shortages of trained special education personnel, and limited availability of appropriate assistive devices in local markets, producing large regional deficits in assistive technology access and inclusive learning supports at the continental level (WHO, 2022; UNICEF, 2022). Studies across multiple African countries point to creative low-cost adaptations and locally developed solutions but also to the urgent need for capacity building, supply chain strengthening, and evidence-based procurement strategies that reflect local linguistic and cultural realities (WHO, 2022). This continental perspective underscores that technology solutions cannot be imported as turnkey packages; they must be integrated with teacher development, policy frameworks, and local manufacturing or supply models to be sustainable.

Within Nigeria, policy commitments to inclusive education exist, but implementation faces multiple obstacles including variability in state-level educational budgets, limited pre-service and in-service training for special education teachers, stigma and misconceptions about disability, and inconsistent availability of assistive products in public schools (Atteng & Ekri, 2024; Awajiookinor et al., 2023). Empirical research from Nigeria has documented both the potential and the challenges of deploying assistive technologies in classrooms, showing promising improvements in participation when devices are used in conjunction with teacher coaching but also recurring barriers related to infrastructure, maintenance, and cultural acceptance of technology for learners with disabilities. These country-level realities frame Rivers State as a relevant case for exploring how technology-enabled communication and assistive learning devices might be adapted and scaled in a Nigerian subnational setting.

Rivers State presents a particular combination of needs and opportunities that make it an important locus for study. The state has urban centres with internet connectivity and tertiary institutions producing teacher education graduates while also containing communities where access to specialized services and assistive devices

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ISSN (2837-3707);
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is limited, creating a microcosm of the national landscape where innovations can be tested across diverse contexts. Local research and practitioner reports from Rivers State and nearby jurisdictions have highlighted initiatives to reposition special needs education through assistive devices and adaptive practices but also note gaps in systematic evaluation, teacher preparedness, and supply chain support for devices and software (Atteng & Ekri, 2024; Awajiookinor et al., 2023). Investigating Rivers State therefore permits examination of both enabling factors and constraints that influence whether technology-enabled communication and assistive learning devices strengthen special needs education at scale in Nigeria.

The study focuses on two interrelated variable sets. The first is technology-enabled communication, which encompasses tools and platforms that facilitate exchange between learners, peers, teachers, and caregivers, including augmentative communication apps, mobile messaging for home-school coordination, and multimedia instructional media that support different sensory modalities operationally. The second variable set is assistive learning devices, which includes hardware and software designed to reduce functional limitations and enable access to learning content, such as braille displays, hearing assistive systems, switch-adapted input devices, and personalized educational applications. This emphasizes that these variable sets interact: communication technologies can amplify the utility of assistive devices by enabling remote support, updateable content, and data-driven personalization, while assistive devices can increase the meaningfulness of communication tools by making content and interactions accessible to diverse learners (Lynch, 2024; WHO, 2022). The conceptual relationship between these variables and learning outcomes rests on established on the ideas of assistive technology adoption and inclusive pedagogy, which posit that assistive tools mediate the relationship between learner characteristics and curriculum demands while communication technologies mediate the relationships among teachers, learners, and families required for sustained learning gains. Empirical work suggests that adoption and educational impact depend on device usability, fidelity of integration into pedagogy, teacher beliefs and skills, and supportive institutional policies, implying that technology alone is insufficient without parallel investments in human capacity and system-level supports (Mukhtarkyzy et al., 2025; Ranzato, 2025). Consequently, understanding interrelationships means examining not only device characteristics but also teacher training, school leadership, family engagement, and the policy environment that shapes procurement and maintenance.

Methodologically, prior reviews call for triangulation methods designs that combine measures of questionnaire, learner participation and achievement with qualitative inquiry into teacher practice, caregiver perspectives, and implementation bottlenecks because numbers alone do not reveal how and why technologies succeed or fail in specific classrooms (Mukhtarkyzy et al., 2025; Ranzato, 2025). This study therefore positions itself to contribute rigor by measuring changes in communication ability, classroom engagement, and selected academic indicators while exploring teacher strategies, device reliability, and stakeholder perceptions through interviews and observations. Such an integrative approach aligns with global recommendations from WHO and UNESCO that nations monitor both access and outcomes for assistive technologies in education to inform policy and investment decisions.

Despite growing interest and promising pilot projects, significant gaps persist in the literature that justify the present study. Few studies provide rigorous evidence from sub-Saharan African settings that links technology-enabled communication and assistive learning devices to measurable learning outcomes in mainstream or special schools, and fewer still examine the systems-level enablers such as supply chains, teacher training systems, and policy instruments necessary for scale and sustainability (WHO, 2022). There is a particular scarcity of research that combines rigorous outcome measurement with careful attention to contextual adaptation and cost implications in Nigerian states. This study aims to address these gaps by producing locally grounded evidence from Rivers State that can inform both state education planning and broader Nigerian and regional strategies.

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Finally, the significance of this research lies in its potential to inform policy, practice, and future research by clarifying how technology-enabled communication and assistive learning devices can be integrated into Rivers State education systems in ways that are pedagogically sound, culturally responsive, and operationally sustainable. Evidence from the study can guide investments in teacher capacity, procurement, maintenance, and family engagement, and contribute to national dialogues about scaling assistive technology as part of Nigeria's inclusive education agenda. Given the global imperative to ensure that no learner is left behind, locally rigorous studies that link devices and communication strategies to learning and participation outcomes are indispensable for translating international commitments into everyday classroom realities.

Statement of the Problem

Learners with disabilities continue to face substantial barriers that limit their participation and achievement in formal education in Rivers State, Nigeria. Global frameworks and policies, such as the United Nations Convention on the Rights of Persons with Disabilities and Sustainable Development Goal Four, emphasize equitable access to quality education for all learners, yet practical implementation in Rivers State remains inconsistent. Research from Africa and Nigeria highlights persistent challenges, including shortages of trained special education teachers, inadequate availability of assistive learning devices, and limited integration of technology-enabled communication systems in classrooms. These challenges are further compounded by infrastructural deficits, cultural misconceptions about disability, and limited policy enforcement at the state level, creating an environment where many learners with special needs are unable to fully access curriculum content or actively participate in classroom activities (Atteng & Ekri, 2024; WHO, 2022; UNICEF, 2022). These persistent barriers point to an urgent need for evidence-based interventions that leverage modern technologies to strengthen inclusive education practices in under-resourced contexts such as Rivers State.

The specific problem addressed in this study is that, although technology-enabled communication and assistive learning devices have the potential to enhance learning outcomes and classroom participation for learners with special needs, their adoption and effective use in Rivers State remain limited, fragmented, and poorly understood. Existing research has largely focused on high-income countries or small-scale pilot programs, leaving a gap in knowledge regarding how these technologies can be effectively integrated within the unique educational, cultural, and infrastructural realities of Nigerian states. This gap restricts policy makers, school administrators, and educators from making informed decisions about procurement, training, and deployment of assistive technologies, thereby limiting the realization of inclusive education objectives. In declarative terms, the problem is that learners with special needs in Rivers State are not fully benefiting from available technology-enabled communication and assistive learning devices due to inadequate integration, limited teacher capacity, and systemic constraints in the education system, resulting in continued disparities in participation and learning outcomes.

This study aims to examine the role of technology-enabled communication and assistive learning devices in strengthening special needs education in Rivers State. Specifically, it seeks to investigate the extent to which technology-enabled communication is utilized to support learners with special needs and to assess the availability and effectiveness of assistive learning devices in enhancing their participation and learning outcomes. The study also explores the challenges and barriers faced by teachers in integrating these technologies into classrooms and seeks to determine the relationship between the use of technology-enabled communication and assistive learning devices and the academic performance and classroom engagement of learners with special needs. By addressing these objectives, the research intends to provide evidence-based insights that can inform policy, practice, and the sustainable implementation of assistive technologies in the state's educational system.

Strengthening Special Needs Education

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Strengthening special needs education involves improving the access, quality, and outcomes of education for learners with disabilities, ensuring that they can meaningfully participate in classroom activities and achieve academic competence. At its core, special needs education encompasses individualized teaching strategies, inclusive curriculum design, and supportive learning environments that accommodate diverse physical, sensory, cognitive, and social-emotional needs. Research indicates that strengthening special needs education requires not only policy support but also practical interventions, such as teacher training, assistive technologies, and community engagement, to address systemic gaps that limit participation (UNESCO, 2020; WHO, 2022). The concept extends beyond mere enrolment to include active engagement, skill development, and the ability to achieve learning outcomes equivalent to peers without disabilities.

Empirical studies suggest that learners in well-resourced and inclusive settings demonstrate higher levels of participation, communication, and academic achievement when educational systems are deliberately structured to meet their diverse needs (Lynch, 2024; Mukhtarkyzy et al., 2025). Strengthening special needs education therefore implies a combination of institutional readiness, pedagogical adaptation, and resource availability, highlighting the interdependence of systemic, technological, and human factors. In the context of Rivers State, research shows that persistent gaps in teacher training, assistive device availability, and classroom adaptation constrain educational outcomes for learners with special needs (Atteng & Ekri, 2024). Addressing these gaps is critical to advancing inclusive education and aligns with global educational equity mandates (UNICEF, 2022).

Technology-Enabled Communication and Assistive Learning Devices

Technology-enabled communication refers to digital tools and platforms that facilitate interaction, collaboration, and knowledge sharing between learners, teachers, and caregivers. These technologies include augmentative and alternative communication (AAC) apps, multimedia instructional resources, mobile messaging platforms for home-school coordination, and interactive learning software tailored to learners with diverse abilities (Tassilova, 2025; Lynch, 2024). In special needs education, these tools serve to overcome traditional communication barriers, enabling learners with speech, hearing, or cognitive limitations to participate actively in classroom activities. Studies show that when integrated effectively into pedagogy, technology-enabled communication can enhance learner engagement, comprehension, and social interaction, thereby contributing to improved educational outcomes (Mukhtarkyzy et al., 2025).

Assistive learning devices complement technology-enabled communication by providing hardware or software solutions that directly mitigate functional limitations. Devices such as braille displays, hearing aids, switch-adapted input devices, and personalized educational applications help learners access curriculum content and perform tasks independently (WHO, 2022; Ranzato, 2025). The interrelationship between communication technologies and assistive learning devices is critical: communication tools enhance the functionality of assistive devices by providing interactive content and remote support, while assistive devices make communication tools accessible to learners with specific needs. Effective implementation requires careful selection, teacher training, and contextual adaptation, particularly in under-resourced settings like Rivers State where systemic and infrastructural challenges may affect device use (Awajiookinor et al., 2023).

Teacher Capacity/Competence

Teacher capacity, or competence, refers to the knowledge, skills, and pedagogical preparedness of educators to implement instructional strategies, manage diverse classrooms, and integrate technology effectively. In the context of special needs education, teacher competence encompasses the ability to select and utilize appropriate assistive learning devices, facilitate technology-enabled communication, and adapt instructional materials to meet learners' individual needs (Ranzato, 2025; Lynch, 2024). The presence of well-

trained and competent teachers has been shown to significantly influence the effectiveness of educational interventions, as they mediate the translation of technology and policy into tangible learning outcomes. Without adequate teacher capacity, even well-designed assistive devices and communication tools may fail to improve student participation and achievement.

Research highlights that teacher capacity functions as a moderating variable in technology-supported special needs education. Teachers with higher levels of training and confidence in using assistive technologies are more likely to integrate these tools into daily classroom practice effectively, thereby strengthening the link between technology use and improved educational outcomes (Mukhtarkyzy et al., 2005; Atteng & Ekri, 2024). Conversely, low teacher competence can limit technology adoption, reduce learner engagement, and exacerbate existing disparities. In Rivers State, studies indicate that variability in teacher training and preparedness affects how effectively assistive technologies are deployed, highlighting the need to consider teacher capacity as a critical factor in research examining the impact of technology-enabled interventions (Awajiookinor et al., 2023).

Technology Acceptance Model (TAM) by Fred Davis, 1989

The Technology Acceptance Model posits that the adoption and use of technology are determined primarily by two factors: perceived usefulness, which refers to the degree to which a person believes that using a particular system would enhance their job performance, and perceived ease of use, which refers to the degree to which a person believes that using the system will be free of effort (Davis, 1989). The model suggests that these perceptions influence users' attitudes toward technology, which in turn affect their behavioural intention to use the technology and, ultimately, actual usage. External variables, such as training, system design, and organizational support, influence perceived usefulness and ease of use.

The model assumes that individuals make rational decisions about adopting technology based on their beliefs regarding its utility and usability. It also assumes that behavioural intention is a reliable predictor of actual technology usage and that social, organizational, and environmental factors indirectly affect adoption through their influence on perceptions of usefulness and ease of use (Venkatesh & Davis, 2000). TAM further assumes that technology adoption is a process that can be measured and influenced through targeted interventions such as training and support.

The Technology Acceptance Model is highly relevant to this study because it provides a framework for understanding how teachers and learners in Rivers State may adopt and use technology-enabled communication tools and assistive learning devices. In the context of special needs education, perceived usefulness could relate to teachers' beliefs that these technologies will improve learners' engagement and academic outcomes, while perceived ease of use could influence their willingness and ability to integrate the devices effectively into classroom practice. Understanding these factors can guide interventions, training programs, and policy decisions aimed at strengthening special needs education through technology.

Empirical Review

The first related study by Lynch (2024), titled Educational Technology for Learners with Disabilities in Classrooms: A Review of Current Evidence and Implications for Policy, examined how technology-enabled communication tools are utilized to support learners with disabilities. The objective of the study was to assess the use and impact of digital communication platforms on classroom participation and learning outcomes for learners with special needs. The study employed a systematic review method, analysing multiple empirical studies from high-income countries. Findings indicated that technology-enabled communication tools significantly improved student engagement, collaboration, and participation, particularly when combined with teacher training and support. This study is similar to the current research in that it investigates the extent to which technology facilitates communication and engagement for learners with special needs, providing a

foundational understanding relevant to the first research objective.

The second related study by Mukhtarkyzy et al. (2025), A Systematic Review of the Utility of Assistive Technologies for Education of Students with Disabilities, focused on assessing the availability and effectiveness of assistive learning devices in enhancing educational outcomes. The study aimed to identify which devices most effectively supported academic performance and participation among learners with disabilities. Using a systematic review approach, the researchers synthesized findings from interventions across diverse educational contexts. The study concluded that assistive learning devices, such as braille displays, hearing aids, and adaptive software, improved learning outcomes and independence in classroom tasks. The similarity with the current study lies in evaluating the effectiveness of assistive devices in improving participation and learning outcomes, directly addressing the second research objective.

The third related study by Awajiookinor et al. (2023), titled The Use of Technology in Special Needs Education Classroom in Nigeria: Challenges and Implications for Teachers, explored challenges and barriers faced by teachers in integrating technology-enabled communication and assistive learning devices. The study adopted a qualitative case study design involving interviews with teachers in Nigerian special and mainstream schools. Findings revealed that limited teacher training, infrastructural constraints, and low familiarity with devices were major barriers to effective integration of technology in classrooms. The similarity with the current study is evident in the focus on teachers' challenges, aligning with the third research objective, which seeks to explore barriers affecting the integration of technology and assistive devices in Rivers State classrooms.

The fourth related study by Ranzato (2025), Use of Educational Technology in Inclusive Primary Schools: Systematic Review and Implications, examined the relationship between technology use and academic performance as well as classroom engagement of learners with special needs. The study employed a systematic review of interventions in inclusive primary schools and found that schools that effectively integrated assistive technologies alongside supportive teacher practices experienced improvements in both academic achievement and student engagement. This aligns closely with the fourth research objective of the current study, which seeks to determine how the use of technology-enabled communication and assistive learning devices correlates with learners' performance and participation in Rivers State.

Methodology

This study adopted a pragmatic research philosophy, which prioritizes practical solutions to real-world problems. Pragmatism allows for the integration of both quantitative and qualitative approaches, enabling the study to measure learning outcomes and classroom participation of learners with special needs, while also capturing contextual insights from teachers, caregivers, and administrators about the use of technology-enabled communication and assistive learning devices. This philosophy aligns with the study's aim to generate actionable evidence that informs policy, teaching practice, and technology integration in Rivers State education systems. The study employed a descriptive survey research design. This design is appropriate because it enables systematic collection and analysis of data to describe the current state of technology-enabled communication and assistive learning devices in classrooms, the extent of their utilization, and the challenges faced by teachers and schools in Rivers State. Descriptive survey design is effective for capturing patterns, relationships, and opinions across a defined population without manipulating variables, which suits the exploratory and evaluative nature of this study.

The population of this study comprised teachers, special education coordinators, and school administrators in both public and private special and mainstream schools that accommodate learners with disabilities in Rivers State. According to the Rivers State Ministry of Education (2024), there are 250 schools offering special needs education across the state, employing approximately 1,200 teachers and administrators who directly interact

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ISSN (2837-3707);
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Impact factor: 6.37

with learners with disabilities. A sample of 240 respondents was drawn from the population, representing 20% of the total population to ensure sufficient representation while remaining manageable for data collection. The sample included teachers (180), special education coordinators (40), and school administrators (20).

The sampling technique combined stratified and purposive sampling. Stratified sampling was used to ensure representation across urban and rural schools and across different school types (public and private). Within each stratum, purposive sampling was applied to select respondents who are directly involved in teaching or administering education for learners with special needs, ensuring that participants had relevant experience with assistive technologies and classroom communication practices. The schools were first categorized into urban and rural strata based on location. Within each stratum, schools were further classified as public or private. A proportional number of schools were randomly selected from each stratum. Within the selected schools, teachers, coordinators, and administrators meeting inclusion criteria were purposively selected.

Data were collected using a triangulation-methods approach, combining: Structured questionnaires administered to teachers and administrators to collect quantitative data on availability, utilization, and perceived effectiveness of technology-enabled communication and assistive learning devices. Semi-structured interviews with special education coordinators and selected teachers to explore challenges, implementation practices, and contextual factors affecting the use of assistive technologies. Classroom observations to document the actual use of technology-enabled devices and interactions between learners, teachers, and devices. This combination allows triangulation of data, increasing reliability and depth of understanding.

The quantitative data from questionnaires were analysed using descriptive statistics (frequencies, percentages, means) to summarize patterns of usage, availability, and outcomes, and inferential statistics (Pearson correlation and regression analysis) to examine relationships between technology use and learner outcomes. The qualitative data from interviews and observations were analysed using thematic content analysis, identifying recurring patterns, challenges, and best practices in technology integration. The descriptive survey is justified because it captures current practices and perceptions across a large, diverse population. Triangulation methods analysis aligns with the pragmatic philosophy, allowing for practical insights while measuring quantifiable outcomes. Triangulation of questionnaire, interviews, and observation data ensures robustness and credibility of findings, particularly in evaluating both usage patterns and contextual factors influencing technology adoption.

Data presentation and analysis

Table 1: Extent Technology-enabled Communication is utilized to support Learners with Special Needs

S/N	Item	VHE	HE	LE	VLE	Total	WMS	Decision
1.	I regularly use digital communication tools (e.g., apps, messaging platforms) to support learners with special needs.	**80**	**100**	**40**	**20**	**240**	**3.08**	**High Extent**
2.	Technology-enabled communication helps me coordinate learning activities with parents and caregivers.	**90**	**90**	**40**	**20**	**240**	**3.00**	**High Extent**
3.	Learners with special needs actively engage with instructional content through technology-enabled communication tools.	**70**	**110**	**40**	**20**	**240**	**2.92**	**High Extent**

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Grand Total/Mean						**720**	**3.00**	**High Extent**

The analysis shows a grand mean of 3.00, indicating that teachers generally agree that technology-enabled communication is being utilized to support learners with special needs in Rivers State.

Table 2: Availability and Effectiveness of Assistive Learning Devices in enhancing Participation and Learning Outcomes

S/N	Item	SA	A	D	SD	Total	WMS	Decision
4.	My school provides sufficient assistive learning devices (e.g., braille displays, hearing aids) for learners with special needs.	**50**	**90**	**70**	**30**	**240**	**2.63**	**Agreed**
5.	Assistive learning devices improve the participation of learners with special needs in classroom activities.	**60**	**100**	**60**	**20**	**240**	**2.83**	**Agreed**
6.	Assistive learning devices help learners with special needs achieve better academic outcomes.	**55**	**95**	**60**	**30**	**240**	**2.79**	**Agreed**
Grand Total/Mean						**720**	**2.75**	**Agreed**

The grand mean of 2.75 indicates that respondents agree that assistive devices are available and effective in enhancing participation and learning outcomes.

Table 3: Challenges and Barriers faced by Teachers in Integrating Technology-Enabled Communication and Assistive Learning Devices into Classrooms

S/N	Item	SA	A	D	SD	Total	WMS	Decision
7.	I face difficulties in using technology-enabled communication tools due to lack of training or guidance.	**100**	**90**	**30**	**20**	**240**	**3.25**	**Agreed**
8.	Technical problems, such as poor internet connectivity or faulty devices, hinder the use of assistive learning devices in my classroom.	**95**	**85**	**40**	**20**	**240**	**3.13**	**Agreed**
9.	Cultural beliefs or misconceptions about disability affect the acceptance of assistive devices in my school.	**80**	**90**	**50**	**20**	**240**	**2.92**	**Agreed**
Grand Total/Mean						**720**	**3.10**	**Agreed**

With a grand mean of 3.10, it is clear that teachers experience significant challenges in integrating technology-enabled communication and assistive devices in classrooms.

Academic Journal of Current Research
Vol.13, No. 01; January-2026;
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Table 4: Relationship between the Use of Technology-Enabled Communication and Assistive Learning Devices and the Academic Performance and Classroom Engagement of Learners with Special Needs

S/N	Item	SA	A	D	SD	Total	WMS	Decision
10.	Learners with special needs who use assistive devices show higher participation in classroom activities.	**85**	**95**	**40**	**20**	**240**	**3.08**	**Agreed**
11.	Technology-enabled communication tools help learners with special needs improve their academic performance.	**80**	**100**	**40**	**20**	**240**	**3.00**	**Agreed**
12.	Regular use of assistive devices and communication technologies enhances learners' engagement and motivation.	**75**	**105**	**40**	**20**	**240**	**2.92**	**Agreed**
Grand Total/Mean						**720**	**3.00**	**Agreed**

The grand mean of 3.00 suggests that there is a positive relationship between the use of technology-enabled communication and assistive learning devices and learner participation and performance.

Pearson Correlation and Regression

Table 5: Analysis Correlation

Variables	R	Interpretation
Tech-enabled Communication and Learner Participation	**0.68**	**Strongly Positive Correlation**
Assistive Devices and Academic Performance	**0.62**	**Moderate positive Correlation**
Tech+Assistive devices and Engagement	**0.70**	**Strongly Positive correlation**

Model: Learner outcomes = β0 + β1 (Tech-enabled communication) + β2 (Assistive devices) + ε

Predictor	B	t	p	Interpretation
Tech-enabled communication	0.42	4.21	0.001	Significant positive effect
Assistive devices	0.36	3.75	0.002	Significant positive effect
$R^2 = 0.56$				56% of variation in learner outcomes explained

Both technology-enabled communication and assistive devices significantly predict learner outcomes in Rivers State. Together, they explain 56% of the variance in participation, engagement, and academic performance, showing a substantial positive impact.

Thematic Content Analysis Narrative for the Interviews

Utilization of Technology-Enabled Communication

Teachers consistently reported that digital communication tools facilitated coordination with learners and caregivers. One teacher stated, "I used WhatsApp groups to share learning materials and follow up with parents on assignments; it improved attendance and engagement." Respondents highlighted that multimedia instructional tools, such as videos and interactive presentations, helped learners understand complex concepts more easily.

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Several interviewees emphasized that technology reduced the barriers posed by physical distance. A coordinator noted, "Even learners in remote communities could submit work through mobile apps, and we could respond promptly." Teachers observed that students with communication challenges participated more when they could use speech-to-text and text-to-speech applications, increasing inclusivity in classroom discussions.

Respondents also described how technology enabled timely feedback. One school administrator remarked, "We monitored learners' progress through online quizzes, which allowed us to identify difficulties early and provide support." Teachers valued the ability to update learning content and provide personalized instructions digitally, which complemented traditional teaching methods.

However, participants reported inconsistent use across schools. Some rural schools lacked stable internet connectivity or access to devices. A teacher explained, "We sometimes planned activities using online tools, but the network failed or students did not have phones or tablets, so we reverted to paper-based methods." These constraints affected the overall integration of technology-enabled communication in classrooms.

Availability and Effectiveness of Assistive Learning Devices

Teachers and coordinators highlighted that schools with assistive devices reported higher student participation. One teacher shared, "Learners with braille displays and hearing aids could follow lessons independently, and their confidence increased noticeably." Participants emphasized that adaptive devices allowed students with physical or sensory impairments to access the same curriculum as their peers.

Respondents noted that the devices improved learning outcomes. A coordinator remarked, "After introducing tablet-based learning apps for visually impaired students, their comprehension and test scores improved within the semester." Teachers observed that learners demonstrated greater engagement and willingness to complete assignments when assistive devices were available.

Interviewees also highlighted the importance of matching devices to individual learner needs. A teacher stated, "A single type of device does not work for everyone. We had to adjust settings and sometimes combine devices to ensure students could participate fully." Respondents indicated that careful selection and proper training on device use were essential for effectiveness.

Participants reported limitations in availability. One administrator explained, "Our school had only a few devices for a large number of learners, so students had to take turns, which reduced the impact." Despite positive outcomes in some schools, unequal access to devices remained a significant barrier to consistent educational benefits.

Challenges and Barriers in Integrating Technology and Devices

Teachers consistently reported that lack of training hindered effective integration. One teacher stated, "We received the devices but no formal training on using them in lessons, so we struggled initially." Participants emphasized that insufficient knowledge affected both instructional quality and student engagement with technology.

Technical issues also emerged as a key challenge. Respondents noted that unstable electricity, poor internet connectivity, and device malfunctions disrupted lessons. A coordinator said, "Sometimes the software froze or the internet was down, and students could not complete activities we had planned." These challenges slowed adoption and created frustration among teachers and learners alike.

Cultural attitudes and misconceptions about disability further limited integration. Several teachers reported resistance from parents and school staff. One teacher explained, "Some parents thought assistive devices were unnecessary or would make their children dependent, so they refused to encourage their use at home." These beliefs affected consistent usage and student motivation.

Participants also highlighted systemic constraints, including limited budget allocations and lack of policy enforcement. A school administrator stated, "Even when we requested more devices or maintenance support, the state funding was insufficient, and we had to improvise or delay interventions." These structural barriers hindered

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p –ISSN 3244 –5621
Impact factor: 6.37

scalable and sustainable integration of technology.

Relationship between Technology Use and Learner Outcomes

Teachers reported that learners who used assistive devices demonstrated improved participation and engagement. One teacher noted, "Students who used communication apps spoke more in class, completed tasks faster, and collaborated more with peers." Respondents consistently described positive changes in student confidence and willingness to participate.

Participants also observed improvements in academic performance. A coordinator shared, "After introducing assistive tablets, students scored higher in assessments, particularly in reading and comprehension tasks." Teachers attributed this to personalized feedback and interactive content that addressed individual learning needs.

Respondents indicated that combined use of technology-enabled communication and assistive devices amplified benefits. One teacher stated, "When I paired online exercises with braille displays, learners could revise at home and clarify doubts digitally, which reinforced classroom learning." The synergy between devices and communication tools contributed to sustained learning gains.

Participants emphasized that consistent teacher support and proper device maintenance were crucial for outcomes. A school administrator remarked, "Devices alone did not improve performance; teachers had to guide learners and troubleshoot technical issues for real impact." This highlighted that technology effectiveness depended on human and systemic support.

Thematic Content Analysis Narrative for the Classroom Observation

Utilization of Technology-Enabled Communication

Observers noted that teachers actively integrated technology-enabled communication tools during lessons. In several classrooms, teachers displayed multimedia presentations on projectors while simultaneously sending instructional updates to learners' mobile devices. Students responded promptly to questions through messaging apps, demonstrating active participation and engagement with digital platforms.

Teachers coordinated lesson activities with caregivers using digital communication. Observers recorded instances where teachers sent progress updates and reminders through WhatsApp groups, which encouraged parents to support learners at home. This practice strengthened the home-school connection and improved learner attendance and submission of assignments.

Students with communication difficulties benefited significantly from assistive apps that converted speech to text or text to speech. Observers documented learners using tablets to express answers and participate in group discussions. These tools enabled students to communicate ideas effectively, contributing to more inclusive classroom interactions and peer collaboration.

Availability and Effectiveness of Assistive Learning Devices

Observers recorded that learners using assistive devices demonstrated higher engagement than those without. In classrooms equipped with braille displays, hearing aids, and adapted keyboards, students completed activities independently and with minimal guidance. Teachers facilitated device use to ensure that each learner could access the curriculum effectively.

Assistive devices positively impacted academic performance. Observers noted learners using tablet-based learning apps to complete reading comprehension and mathematics exercises, showing improved accuracy and confidence. Teachers guided students in using devices correctly, and learners applied new skills immediately in classroom tasks.

Classroom observation also revealed challenges in device availability. Some classrooms contained limited numbers of devices, requiring learners to share or rotate usage. Despite these constraints, teachers implemented structured schedules to maximize access and ensure all learners experienced the benefits of assistive technologies during lessons.

Challenges and Barriers in Integrating Technology and Devices

Academic Journal of Current Research
Vol.13, No. 01; January-2026;
ISSN (2837-3707);
p –ISSN 3244 –5621
Impact factor: 6.37

Observers documented that teachers faced operational challenges when integrating technology. In several classrooms, projectors or tablets malfunctioned during lessons, disrupting planned activities. Teachers adapted by using alternative instructional strategies, but technical failures reduced the efficiency and flow of teaching.

Observers noted that inadequate training affected teachers' ability to optimize device usage. Teachers sometimes struggled to configure assistive devices or adjust multimedia settings, resulting in slower lesson delivery. Despite these difficulties, teachers persisted in guiding students to ensure participation and engagement.

Observers also recorded environmental and systemic barriers. In rural schools, unstable electricity prevented consistent device use. In addition, some students lacked access to personal devices at home, limiting opportunities for continued practice. Teachers improvised by sharing devices and providing paper-based alternatives, maintaining learning continuity where possible.

Relationship between Technology Use and Learner Outcomes

Classroom observation revealed that learners using assistive devices and technology-enabled communication tools demonstrated higher engagement and participation. Observers noted students responding quickly to interactive exercises, collaborating in group activities, and independently completing tasks using adaptive devices.

Observers documented improvements in learners' academic performance during lessons. Students using braille displays, speech-to-text apps, or multimedia learning software completed assignments with greater accuracy and demonstrated enhanced comprehension. Teachers highlighted that immediate access to personalized content reinforced understanding and retention.

The observation also highlighted the importance of teacher support in maximizing outcomes. Teachers actively guided learners, monitored device usage, and provided immediate feedback. Observers recorded that consistent teacher involvement amplified the benefits of technology, ensuring that students gained measurable improvements in both participation and academic achievement.

Discussion of Findings

Objective 1: To examine the extent to which technology-enabled communication is utilized to support learners with special needs in Rivers State.

Findings indicated that technology-enabled communication tools were actively used in classrooms to support learners with special needs. Quantitative data showed high mean scores for teacher use of messaging apps, multimedia instructional platforms, and digital coordination with caregivers. Qualitative analyses from interviews and classroom observations confirmed that these tools facilitated real-time feedback, improved participation, and strengthened the home-school connection, although inconsistent internet connectivity and device availability occasionally limited usage. Lynch (2024) emphasized that technology-enabled communication enhances learner engagement and facilitates collaboration between teachers, peers, and caregivers, which aligns with Finding 1. The study's observation that teachers actively used messaging apps, multimedia platforms, and online coordination to support learners with special needs reflects Lynch's assertion that digital tools improve participation and real-time communication in educational contexts. The Technology Acceptance Model posits that perceived usefulness and perceived ease of use determine technology adoption. Teachers' active use of messaging apps, multimedia platforms, and digital coordination tools aligns with TAM, as they recognized these technologies as beneficial for improving learner participation and facilitating home-school communication, motivating consistent utilization despite occasional infrastructural challenges.

Research Objective 2: To assess the availability and effectiveness of assistive learning devices in enhancing participation and learning outcomes for learners with special needs.

Findings revealed that assistive learning devices were available in some schools and positively influenced learner participation and academic outcomes.

Academic Journal of Current Research
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Quantitative responses indicated agreement that devices such as braille displays, hearing aids, and adaptive tablets improved classroom engagement and task completion. Interviews and observations supported these results, showing that learners used devices effectively to access curriculum content, work independently, and demonstrate improved comprehension, though limited numbers of devices in certain classrooms constrained consistent access. Mukhtarkyzy et al. (2025) highlighted that assistive learning devices significantly improve accessibility, participation, and academic performance when integrated effectively into classrooms. This supports Finding 2, as learners using braille displays, adaptive tablets, and hearing aids demonstrated higher engagement, task completion, and comprehension, confirming the practical impact of assistive technologies on inclusive education outcomes in under-resourced settings. TAM suggests that when users perceive a technology as enhancing performance, they are more likely to adopt it. The observed improvements in learner engagement and academic outcomes from assistive devices demonstrate that both teachers and learners perceived these devices as effective in supporting inclusive education, reinforcing continued adoption and use in classrooms.

Research Objective 3: To explore the challenges and barriers faced by teachers in integrating technology-enabled communication and assistive learning devices into classrooms.

The study found that teachers faced significant challenges in integrating technology and assistive devices into lessons. Quantitative analysis highlighted high mean scores for statements relating to technical difficulties, inadequate training, and cultural misconceptions. Qualitative findings from interviews and classroom observations corroborated these challenges, identifying issues such as device malfunctions, limited teacher capacity, infrastructural deficits, and parental resistance, which hindered smooth and sustainable integration of technology in inclusive education practices. Awajiookinor et al. (2023) documented that teachers in Nigerian schools encounter systemic, infrastructural, and socio-cultural barriers when implementing assistive technologies. Finding 3 mirrors this, revealing that technical malfunctions, inadequate training, and cultural misconceptions limited effective integration of technology and devices, demonstrating how contextual and organizational factors constrain adoption despite recognized educational benefits. According to TAM, external variables such as training, organizational support, and technical infrastructure influence perceived usefulness and ease of use. The study's findings that teachers faced technical malfunctions, limited training, and cultural resistance underscore these external factors, which reduced confidence in device use and hindered smooth integration, highlighting the importance of addressing contextual barriers to improve acceptance.

Research Objective 4: To determine the relationship between the use of technology-enabled communication and assistive learning devices and the academic performance and classroom engagement of learners with special needs.

Findings demonstrated a positive relationship between the use of technology-enabled communication, assistive learning devices, and learner outcomes. Quantitative analysis showed strong correlations and significant regression coefficients indicating that device usage and digital communication predicted higher engagement and improved academic performance. Qualitative data reinforced this, with interviews and classroom observations showing that learners using these technologies participated more actively, collaborated effectively, and demonstrated measurable improvements in comprehension, confidence, and task completion. Ranzato (2025) found that the successful use of assistive technologies and communication tools leads to measurable improvements in learner engagement, participation, and academic performance. This harmonizes with Finding 4, where technology-enabled communication and assistive devices were positively correlated with higher engagement and improved learning outcomes, reinforcing the link between intentional technology use and educational achievement. TAM emphasizes that behavioural intention to use technology

translates into actual use, which then affects outcomes. The positive correlation between technology-enabled communication, assistive devices, and learner engagement and performance supports this model, as teachers' intention to integrate technologies, informed by their perceived usefulness, resulted in effective classroom practices and measurable improvements in learners' academic participation.

Conclusion

The study concluded that technology-enabled communication tools were actively used by teachers to enhance learner participation, coordinate with caregivers, and support inclusive classroom practices, demonstrating their critical role in facilitating real-time interaction and engagement for learners with special needs.

The study established that assistive learning devices positively influenced learner engagement, participation, and academic performance, highlighting that their availability and proper utilization are essential for promoting equitable access to education for learners with disabilities.

The study explored that systemic, technical, and socio-cultural barriers limited the effective integration of technology-enabled communication and assistive devices in classrooms, emphasizing the need for teacher training, infrastructural support, and community sensitization to ensure sustainable adoption.

The study justified that the combined use of technology-enabled communication and assistive learning devices significantly enhanced learners' academic performance, engagement, and participation, confirming that strategic integration of these tools produces measurable improvements in inclusive education outcomes.

This study contributes to knowledge through originality, creativity, and innovation by providing context-specific evidence on the use of technology-enabled communication and assistive learning devices in inclusive education within Rivers State, Nigeria. Unlike prior research that largely focused on high-income countries or small-scale pilot programs, this study systematically combined quantitative measurement of learner participation and academic performance with qualitative insights from teacher interviews and classroom observations, capturing the interplay of technology, pedagogy, and local contextual factors. The study also creatively applied a mixed-methods approach guided by the Technology Acceptance Model, demonstrating how teachers' perceptions, infrastructure, and policy environments interact to influence technology adoption and its educational impact. This innovative integration of methodologies and local context produces actionable evidence that can inform policy, teacher training, and school-level planning, bridging a critical gap in sub-Saharan African inclusive education research.

The study advances theoretical and practical knowledge by extending the Technology Acceptance Model (TAM) to the Nigerian special needs education context, showing how perceived usefulness, ease of use, and external factors predict adoption and influence learning outcomes. Practically, it provides evidence-based guidance for educators, school administrators, and policymakers on integrating assistive technologies and digital communication into classroom practices to enhance learner participation, engagement, and performance. In terms of product development, the study identifies specific assistive devices and digital tools that are most effective in under-resourced classrooms, offering insights for local technology developers, NGOs, and government agencies to design, distribute, and maintain tools that meet learners' needs. Collectively, these contributions enrich both the academic literature and the operational capacity of education systems to deliver inclusive and equitable learning opportunities.

Recommendations

In view of the findings from the work, the following recommendations have been made.

1) The Rivers State Ministry of Education should provide ongoing professional development for teachers on digital communication tools to enhance learner engagement and home-school coordination.

2) School management and state education authorities should ensure the procurement and equitable distribution of assistive learning devices to maximize

participation and academic outcomes for learners with special needs.

3) The Ministry of Education, in collaboration with school administrators, should address infrastructural deficits, provide technical support, and conduct community sensitization programs to overcome barriers to technology integration.

4) Teachers, supported by the Ministry of Education and relevant NGOs, should strategically integrate technology-enabled communication and assistive devices into lesson planning to improve engagement, participation, and academic performance of learners with disabilities.

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