

Evaluating Technology Integration in Teaching and Learning: A Survey of Public Senior Secondary Schools in Rivers State, Nigeria

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Abstract

This study evaluated the extent of technology integration in teaching and learning in public senior secondary schools in Rivers State, Nigeria. A descriptive survey research design was employed, and data were collected through a structured questionnaire. The study population consisted of 6,557 teachers across 302 public senior secondary schools in the state. A sample of 700 respondents comprising 60 principals and 640 teachers was selected using simple and stratified random sampling techniques. The reliability of the instrument was established using the Pearson Product Moment Correlation (PPMC), while face and content validity were confirmed by experts in Educational Management and Educational Technology. Data were analyzed using mean and standard deviation. Findings revealed that while some ICT tools were available in the schools, their integration into classroom teaching was generally low, with over 80 percent of the mean usage scores falling below the criterion mean of 2.5 on a 5-point scale. Although teachers demonstrated moderate to high ICT proficiency, they lacked the institutional support, regular training opportunities, and enabling infrastructure necessary for consistent application in pedagogical practice. Key challenges identified included erratic power supply, poor internet connectivity, limited availability of ICT tools, and the absence of technical support personnel. Based on these findings, the study recommended that the government intensify the implementation of the National ICT-in-Education Policy by equipping schools with adequate infrastructure, ensuring ongoing teacher professional development, and providing dedicated technical support systems. These measures are essential for fostering sustainable and effective technology integration in public senior secondary schools across Rivers State.

Keywords: Technology Integration, Teaching and Learning, Information and Communication Technology, Public Secondary Schools, Rivers State, Nigeria.

Introduction

Technology has undergone remarkable innovation and transformation, reshaping how people think, work, and learn (Grabe & Grabe, 2022). In response to this global shift, educational institutions are expected to equip students with the skills needed to thrive in a knowledge-based, digital society. One vital pathway toward this goal is the integration of Information and Communication Technology (ICT) into teaching and learning processes (Ghavifekr, 2020). Teachers, as pivotal facilitators of classroom instruction, play a critical

role in utilizing ICT tools to create dynamic, interactive, and learner-centered environments (Arnseth & Hatlevik, 2012). The application of modern technologies offers a variety of tools that enhance teaching quality, improve student engagement, and foster deeper learning (Bruniges, 2017).

ICT integration refers to the purposeful embedding of technology into teaching and learning practices. Numerous studies have affirmed that when properly implemented, ICT can significantly improve instructional methods and student academic performance. It supports learners in acquiring the digital competencies required for success in the 21st century, while also fostering critical thinking, creativity, and independent learning (Grabe, 2022). In this digital age, technological literacy is no longer optional but essential for both learners and educators.

In Nigeria, the national education strategy underscores the importance of producing a technologically adept, globally competitive workforce (Suhaimi et al., 2020). Consequently, ICT integration into the secondary school curriculum has emerged as a strategic imperative. However, systemic challenges such as inadequate infrastructure, insufficient teacher training, poor connectivity, and unreliable electricity have impeded the full implementation of ICT-enhanced education (Ghavifekr, 2020). Research has shown that successful ICT integration requires not only policy commitment but also sustained investment, strategic planning, and institutional readiness (Ben Youssef & Dahmani, 2017).

Despite national ICT-in-education policies, there remains a paucity of empirical data focused specifically on Rivers State. This gap hinders the development of evidence-based strategies that reflect the unique challenges and opportunities within the state. A focused investigation into the extent, effectiveness, and barriers of ICT integration in Rivers State's public senior secondary schools is therefore both timely and necessary. Such a study will provide critical insights for policymakers, educational administrators, and stakeholders seeking to bridge the digital divide and enhance the quality of teaching and learning across the state.

While global studies have highlighted the potential of ICT in improving academic outcomes (Carle et al., 2017; Fairlie & London, 2017), others caution that technology alone does not guarantee success. Factors such as teacher competence, student motivation, and purposeful use of technology are equally vital (Chen & Chen, 2019). In developing contexts like Nigeria—where research often concentrates on better-resourced urban centers—the realities of under-resourced public schools remain underexplored (Balasubramanian et al., 2019). Moreover, emerging tools such as smart classrooms and mobile learning technologies are still at the margins of mainstream education, despite their growing global relevance (El-Gayar et al., 2020).

This study, therefore, seeks to assess the extent of ICT integration in teaching and learning in public senior secondary schools in Rivers State, examine the challenges affecting its implementation, and propose actionable strategies to enhance its effective use. The findings aim to contribute to local education policy and inform scalable models for technology integration across similar under-resourced contexts.

Statement of Problem

The integration of technology into teaching and learning has become a global imperative, with increasing emphasis on the role of digital tools in enhancing instructional delivery, promoting learner engagement, and improving academic outcomes. In response to this global trend, Nigeria has adopted several policy frameworks, notably the National Policy on ICT in Education, to promote the use of technology in schools as a means of preparing learners for 21st-century demands and addressing longstanding issues of equity, quality, and access.

At the subnational level, the Rivers State government has expressed similar commitments, particularly through efforts to improve ICT infrastructure in public senior secondary schools. However, anecdotal evidence and preliminary observations suggest that the mere presence of technology in schools does not guarantee its effective or meaningful integration into classroom teaching and learning. While some public schools may possess digital tools and infrastructure, the extent to which these resources are routinely and effectively used by teachers and students remains unclear. In many cases, disparities in digital literacy among teachers, insufficient training opportunities, and infrastructural limitations such as unreliable electricity and poor internet access continue to hinder progress.

If not properly addressed, these gaps could undermine the realization of educational objectives, result in the misallocation of public resources, and perpetuate outdated teaching methods that limit learners' potential and global competitiveness. These concerns prompted the researchers to investigate: *To what extent is technology genuinely integrated into teaching and learning in public senior secondary schools in Rivers State? Do teachers possess the necessary competencies to utilize digital tools effectively in instruction? Are schools adequately equipped to support sustained ICT-based learning experiences?*

This study, therefore, seeks to fill the empirical gap by assessing the actual level of ICT integration in the teaching and learning processes within public senior secondary schools in Rivers State. The findings are expected to inform education policymakers, school administrators, and teacher development agencies on where interventions are most needed. Practically, the study will support targeted teacher capacity-building, informed resource allocation, and strategic planning to optimize technology use for improved instructional outcomes.

Aim and Objectives of the Study

The aim of this study is to examine the extent to which technology is integrated into teaching and learning processes in public senior secondary schools in Rivers State, Nigeria. Specifically, the study seeks to:

1. Determine the extent to which teachers integrate technology into classroom instruction in public senior secondary schools in Rivers State.
2. Examine the extent to which students utilize technology as part of their learning activities in public senior secondary schools in Rivers State.

3. Assess the availability and adequacy of infrastructure supporting technology integration in public senior secondary schools in Rivers State.

Research Questions

This study was guided by the following research questions:

1. To what extent do teachers integrate technology into classroom instruction in public senior secondary schools in Rivers State?
2. To what extent do students utilize technology in their learning activities in public senior secondary schools in Rivers State?
3. To what extent are infrastructure and digital resources available and adequate to support technology integration in public senior secondary schools in Rivers State?

Literature Review

The integration of technology in education has evolved from being a supplementary tool to a central component in instructional delivery across the globe. Theoretically, the Technological Pedagogical Content Knowledge (TPACK) framework posited by Mishra and Koehler (2006) provides a foundation for understanding the dynamic interplay among technology, pedagogy, and content knowledge. When effectively integrated, technology can enhance instructional quality and student outcomes (Koehler et al., 2013).

In developing contexts such as Nigeria, however, the reality of integrating technology in public secondary schools remains challenged by infrastructural limitations, limited teacher competence, and policy gaps. Studies reveal that while governments invest in ICT infrastructure, such efforts are often undermined by poor maintenance, lack of training, and inconsistent power supply (Ajayi, 2021; Okebukola, 2020). Access to technology is a key determinant of academic success in contemporary educational environments. According to Warschauer (2011), digital inclusion contributes significantly to improved student engagement and learning outcomes. In contexts where internet connectivity and modern instructional devices are prevalent, students tend to demonstrate better cognitive performance and self-directed learning. However, in many Nigerian public secondary schools, access to broadband and computer-based resources remains uneven (Ibrahim, T. A., & Jibia, S. A., 2024).

Furthermore, integrating ICT into the curriculum demands more than equipment provision; it necessitates pedagogical transformation. Research by Tondeur et al. (2017) suggests that teacher beliefs and competence significantly influence the successful adoption of technology in classroom instruction. In the Nigerian context, Adeoye and Wentling (2007) argued that while curriculum reform has introduced ICT literacy as a subject, the actual pedagogical integration remains superficial due to inadequate teacher preparation.

Professional development is thus essential to bridge the competence gap. Ongoing training empowers teachers to meaningfully integrate ICT tools in line with constructivist pedagogies (Ertmer & Ottenbreit-Leftwich, 2013). Several Nigerian states, such as Lagos and Akwa Ibom, have initiated large-scale ICT training programs for educators, with

promising outcomes (Okoroafor & Anyanwu, 2022). However, the systemic adoption of such models across the federation remains inconsistent. This research underscores the importance of sustainable policy implementation. According to the Nigerian National ICT in Education Policy, all public schools are expected to incorporate ICT in both teaching and administration. Yet, weak monitoring frameworks and lack of accountability mechanisms have hindered meaningful progress (Akinola & Ogunode, 2022). Moreover, the reliance on donor-driven initiatives rather than internal capacity building raises questions about long-term sustainability.

Technology Integration by Teachers in Public Senior Secondary Schools

Instructional technology encompasses a wide range of tools and techniques used to enhance the learning experience. These include hardware such as computers, interactive whiteboards, projectors, and software such as learning management systems, educational applications, and virtual reality environments. Teachers are expected to integrate these tools into lesson delivery to improve academic outcomes. However, in many public senior secondary schools in Rivers State, most teachers are still unfamiliar with or untrained in the use of digital tools. As Owonte and Jaja (2021) noted, participation in professional development workshops significantly influences the proper utilization of available ICT tools in secondary schools. A recently concluded survey by the European Commission, as cited in Owonte and Jaja (2021), found that many teachers in 31 countries, including Nigeria, were not familiar with instructional technologies like ICT and used them minimally in their classroom practices. The report emphasized that student success with ICT depends largely on teacher confidence and competence.

The Second International Technology in Education Study (SITES) 2006, as cited in Owonte and Jaja (2021), concluded that teachers who were confident users of ICT, who had undergone professional development, and who faced fewer contextual challenges (e.g., infrastructure deficits), were more likely to integrate technology effectively. Moreover, the study revealed a disparity in ICT usage across subjects, with science teachers showing more frequent ICT integration than their counterparts in mathematics (Law, 2018; Jones, 2018; Kozma & McGhee, 2023). Despite the potential of ICT to support innovative pedagogy, Nweke (2018) argued that many teachers restrict computer use to teaching contexts only, leading to limited digital proficiency. Moreover, Blamire (2017) asserted that ICT enables a shift from teacher-centered to learner-centered instructional approaches, provided the necessary enabling conditions are in place.

Students' Use of Technology in Learning Activities

The integration of technology into student learning processes is vital in promoting engagement, collaboration, and personalized learning. According to Owonte and Jaja (2021), technologies such as computers, tablets, audio and video tools, simulations, and online learning platforms can enrich student experiences. However, students in many public

senior secondary schools in Rivers State are reportedly not benefiting from these opportunities due to lack of access and poor teacher facilitation.

Jones (2018) emphasized that when teachers lack the skills or motivation to facilitate technology use, students are similarly restricted in their engagement with digital learning tools. Similarly, Kozma & McGhee (2023) identified the subject matter as a determinant of how much students interact with ICT, with STEM subjects generally fostering higher engagement levels.

Moreover, Nweke (2018) highlighted a persistent disconnect between the ICT competencies of students and the instructional capabilities of their teachers. This gap often leads to underutilization of instructional technologies, with students unable to maximize the benefits of digital learning resources.

Infrastructure and Resources Supporting Technology Integration

The successful implementation of ICT in education is dependent on the availability of adequate infrastructure and resources. Owonte and Jaja (2021) observed that many public schools in Rivers State that received computers through government initiatives do not use them for teaching, learning, or even administrative functions. This results in the underutilization of technological investments and missed educational opportunities.

Common infrastructural challenges include insufficient funding (Owonte & Jaja, 2023), epileptic power supply, limited access to the internet, lack of technical know-how among staff, and inadequate ICT infrastructure (Law, 2018; Igbozurike et al., 2025). Other constraints include technophobia, high import duties on ICT equipment, poor maintenance culture, and the conservative attitudes of teachers and administrators (Ali & Ahmed, 2019). Ejike (2022) highlighted how efforts by the past Rivers State government to establish computer labs have been largely ineffective due to inadequate awareness and lack of teacher competence. Orlich (2017) and Aubusson et al. (2018) further stressed the need for curriculum integration of ICT, increased access to broadband internet, and ongoing professional development as solutions to these infrastructural challenges.

Despite these barriers, international support initiatives such as the One Laptop per Child (OLPC) project and governmental investments in ICT capacity building provide hope for improved infrastructure in the long term. Curriculum reforms, teacher training, and improved electricity supply have also been identified as crucial interventions (Owonte & Jaja, 2023; Shih, 2020).

The Technology Available for Integration in Public Secondary Schools

Secondary schools are expected to use technological tools in delivering lessons and other roles. This appears not to have been the case in most secondary schools in Rivers State since most of the teachers are naïve about the use of digital tools. To this end, participation in professional development workshops was identified as a relevant factor for proper utilization of available ICT tools in secondary schools (Owonte and Jaja, 2021).

Some of the areas where Secondary school teachers can use or adopt information and communication technologies according to Owonte & Jaja (2021) include:

Medium	Technologies for Delivery	Instructional approach
Face to face	Overhead projector (manual or electronics)	1. Seminars, tutorials, classes, workshops and lectures. 2. Conferences 3. One-to-one interaction, either between educator and learner, learner and learner, or learner and mentor.
Text (including graphics)	Print	4. Textbooks, booklets, and pamphlets. 5. Study guides, written either as stand-alone material or as wrap-around guides to already published materials. 6. Workbooks intended for use in conjunction with other media materials (for example, audio or video cassettes or computer-based learning. 7. Newspaper, articles, periodicals, periodicals, newsletters, and magazines. 8. Printed learner support materials (for example, self-tests, project guides, notes on accreditation requirements or other aspects of courses, typed materials or comments passing between learners and Secondary school teachers. 9. Maps, charts, photographs, and posters. 10. Printed or written correspondence. 11. Teacher-learner assessment ease for example computation of students' result using the spreadsheet.
	Facsimile/Emailing	12. On-multi point distribution 13. Using the email to communicate students' tests, projects without necessarily printing and correcting on hardcopy.
Audio	Audio Cassettes	14. Audio programmes (music, talk radio, documentary, literature review, teaching, panel discussion news, current affairs, debate drama.
	Telephone	15. Telephone tutoring 16. Information or enquiry service 17. Telephone conference 18. Multi-media sound
Video	Television broadcasting (terrestrial, satellite or	19. Video programmes (music, talk shows, documentary, literature review, lecture, panel

	cable, digital or analogue transmission, including narrowcast educational television)	discussions, news, current affairs, debates, game shows, drama, films, etc. 20. Simulations of procedures and processes. 21.
Internet/intranet Networked Linking computer-based workstation		22. Presentation of information or knowledge sharing 23. Interactive exercise 24. Presentation of material and/or resources integrating all above media (text, audio and video) and possible application. 25. Assignment submission, assessment and feedback 26. Conference data, audio video.

- i) **Computers and Tablets:** Used for delivering online courses, accessing educational software, and facilitating research.
- ii) **Audio and Video:** Can be used to create engaging and informative learning materials.
- iii) **Simulations:** Allow students to practice skills and explore concepts in a safe and controlled environment.
- iv) **Online Learning Platforms:** Provide access to a wide range of educational resources, including courses, articles, and videos.
- v) **Print Materials:** While often considered traditional, printed materials can still be a valuable part of instructional technology, especially when combined with other digital resources.
- vi) **Interactive Whiteboards:** Allow for dynamic presentations, collaborative activities, and engaging lessons.
- vii) **Projectors:** Used to display content on a larger screen, enhancing visibility for the whole class.
- viii) **Audio/Video Equipment:** Enables the use of audio and video resources for instruction, such as podcasts, lectures, and demonstrations.
- ix) **3D Printers:** Can be used to create physical models for hands-on learning experiences.
- x) **Smart Classroom Technologies:** Integrate various technologies to create an interactive learning environment. Some educational software include the following:
 - a. **Learning Management Systems (LMS):** Platforms like Moodle, Blackboard, and Canvas, which provide a central location for course materials, assignments, and communication.
 - b. **Educational Apps:** Offer interactive lessons, games, and assessments for various subjects.

- c. **Virtual Reality (VR) and Augmented Reality (AR):** Provide immersive learning experiences, allowing students to explore environments and concepts in a realistic way.
- d. **Adaptive Learning Systems:** Tailor content and activities to individual student needs and learning styles.
- e. **Web-based Programs:** Offer online learning resources, simulations, and interactive exercises.
- f. **Game-based Learning Platforms:** Utilize games to make learning more engaging and fun.

Other Notable Technologies:

- 1. **Social Learning Platforms:** Facilitate collaboration and communication among students.
- 2. **Mobile Learning:** Utilizes mobile devices for learning on the go.
- 3. **Student Response Systems (Clickers):** Allow for real-time feedback and engagement during class.
- 4. **Web conferencing and video conferencing:** Facilitates live interaction and collaboration between remote participants.
- 5. **Learning Analytics:** Provides data on student learning to inform instructional decisions.

The Effect of Technology Integration on Academic Performance

Studies have shown valuable and interesting insights into how technology-based instruction and administrative practices contribute to the students' academic performance. Several studies have indicated that teachers who engaged in technology supported instructional delivery demonstrated a high level of ICT competence. This result reinforces the position advanced by Monserate (2018), who argued that classrooms that are enriched with multimedia platforms and interactive teaching tools significantly enhanced instructional quality and deepened students' engagement. Abedi (2024) reported that clarity of lessons and student attentiveness was instrumental in improving technology-integrated classrooms, suggesting thus that teachers who adopt digital tools more effectively tend to grow in technological competence over time.

It also resonates with Gause et al. (2022), who noted that teachers gradually evolve as digital learning facilitators, especially when they are supported with the necessary skills and opportunities to innovate within their instructional spaces. Teachers who used Google Classroom and attendance tracking apps were better able to streamline their workflow and enhance their technical proficiency in the process (Wang & Lu, 2024). Awaji and Solaiman (2022) corroborated the finding, having said that technological solutions such as blockchain-based systems in record management can enhance data accuracy, transparency, and security, thereby improving the overall efficiency and reliability of educational record-keeping processes. This supports the notion that administrative practices can serve as an important training ground for reinforcing digital literacy among

teachers, particularly when supported by reliable infrastructure and institutional encouragement.

Technology has a key role to play in enabling the education sector to manage complex information flows and to integrate them towards effective educational planning and development. Although ICT holds great potentials in supporting and augmenting existing education as well as national development efforts in Nigeria, several challenges remain.

Challenges of Technology Integration in Public Secondary Schools

Several critical challenges impede the integration of instructional technology in Nigeria's public secondary schools, particularly in Rivers State. These include:

1. **Inadequate Funding:** The integration of educational technologies is hindered by limited financial investment. The high cost of modern instructional devices makes them inaccessible to many schools and households. Government priorities often lean towards security and other sectors, leaving educational technology underfunded.
2. **Unreliable Power Supply:** Most technological devices require stable electricity. However, the persistent epileptic power supply in Nigeria discourages the acquisition and effective use of such resources. Consequently, users resort to low-tech alternatives like battery-powered radios, which limit interactivity.
3. **Lack of Technical Expertise:** There is a shortage of trained personnel to install, operate, and maintain instructional technologies. This gap in human resources significantly slows down the development and adoption of educational technologies.
4. **Limited Internet Access:** Many rural and remote areas suffer from poor or no internet connectivity due to inadequate network infrastructure. Language barriers, particularly the dominance of English on the web, further marginalize non-English-speaking users.
5. **Technophobia and Resistance to Change:** Fear of technology failure, cyber theft, and a general reluctance to adopt unfamiliar systems contribute to low usage. Many individuals prefer traditional methods, perceiving them as safer and more reliable.
6. **Cybersecurity Concerns:** Frequent data breaches and poor cyber protection measures discourage the use of digital platforms in education. These concerns further reduce trust in online instructional technologies.
7. **High Production and Import Costs:** The reliance on imported technologies, coupled with high import duties and production costs, limits affordability. The scarcity of locally made alternatives exacerbates the problem.
8. **Poor Maintenance Culture:** Inadequate maintenance and repair practices lead to the abandonment of faulty equipment, resulting in resource wastage and discontinuity in technology use. (Aduka & Musa, 2022)

9. **Conservatism and Institutional Apathy:** Resistance from educators and institutions to transition from traditional to tech-driven pedagogies poses a significant challenge. Many schools lack proactive strategies or government support for technology adoption (Igbozuruike et al., 2025).
10. **Import Tariffs:** Excessive import levies on technological tools discourage acquisition, thereby reducing the penetration and effectiveness of instructional technology in schools.

Technology Integration to Improve Academic Performance

Investment in Infrastructure and Resources

Maximizing the impact of technology in public secondary schools in Rivers State demands strategic investment in ICT infrastructure. Functional computer laboratories, stable internet access, and instructional digital tools are essential. While some schools have benefited from government interventions, many remain underutilized due to insufficient technical support and limited teacher ICT proficiency (Ejike, 2022; Okoroafor & Anyanwu, 2022). The One Laptop Per Child (OLPC) initiative and similar efforts have shown that early exposure to technology can enhance digital literacy in developing contexts.

Curriculum Integration

Embedding ICT across the curriculum is critical. Students' access to academic databases such as JSTOR, EBSCOhost, and Google Scholar can improve digital competencies and research skills. Integrating ICT into core subjects at all levels will promote more meaningful engagement with technology (Adebayo & Olayemi, 2021). Contributions from returning professionals and ongoing national reforms are also gradually improving access and quality in educational technology.

Need for Teacher Training

Sustainable ICT adoption depends heavily on teacher training and digital pedagogical skills. Continuous professional development, supported by both government and NGOs, is necessary to build teacher capacity in this area. As noted by Onwuagboke and Singh (2016), many teachers still lack the skills to integrate ICT effectively into instruction, despite available equipment. National efforts such as the Akwa Ibom State ICT training of over 700 civil servants underscore the growing commitment to digital education. Furthermore, introducing ICT-based competitions and awards can foster innovation and improve student performance across public secondary schools (Adesola, 2020).

Methods

This study adopted the descriptive survey design to investigate the extent of technology integration in teaching and learning in public senior secondary schools in Rivers State, Nigeria. The design was considered appropriate for collecting and analyzing data from a large population to describe existing conditions without manipulating any variables.

The target population comprised all teachers in the 302 public senior secondary schools across the 23 Local Government Areas of Rivers State, totaling 6,557 teachers. Given the nature of the study, principals and classroom teachers were chosen as the respondents because they are the primary implementers and facilitators of teaching and learning activities, as well as the direct users and overseers of digital tools in instructional delivery. Students were not included because the study sought to examine systemic integration and institutional readiness, rather than user (student) experience or learning outcomes.

A structured questionnaire developed by the researchers was the sole instrument for data collection. The questionnaire was titled "*Technology Integration in Secondary Schools Questionnaire (TISSQ)*". It consisted of items structured around the research questions and was designed using a 4-point Likert scale ranging from Very High Extent (4) to Very Low Extent (1).

To ensure validity, the instrument was subjected to face and content validation by experts in the Departments of Educational Management and Educational Technology at the Ignatius Ajuru University of Education, Port Harcourt. Their input helped refine the clarity, relevance, and coverage of items. For reliability, a pilot test was conducted with 30 teachers outside the study sample. The internal consistency of the instrument was measured using the Pearson Product Moment Correlation (PPMC), yielding a reliability coefficient of 0.81, indicating that the instrument was reliable for data collection.

In adherence to ethical procedures, informed consent was obtained from all respondents. Participants were assured that their responses would be treated with strict confidentiality, and they were informed of their right to withdraw at any point. Data collected were anonymized, and no personal identifiers were linked to responses. The study conformed to ethical standards outlined by the University Research Ethics Committee.

Data collected were analyzed using descriptive statistics such as frequency counts, percentages, means, and standard deviations to answer the research questions.

A sample questionnaire item is provided in the Appendix to illustrate the structure and content of the data collection tool.

Results and Discussion

Research Question 1

To what extent do teachers integrate technology into classroom instruction in public senior secondary schools in Rivers State?

Table 1: Mean and Standard Deviation of the Extent of Teachers' Integration of Technology into Classroom Instruction

S/N	Item	Principals (N = 60)			Teachers (N = 640)		
		Mean	SD	Decision	Mean	SD	Decision
1	Teachers use multimedia presentations to deliver lessons	2.65	0.82	High	2.49	0.89	Low
2	Teachers use online resources and videos to supplement content	2.73	0.76	High	2.58	0.84	High
3	Teachers assign and collect homework via digital platforms	2.44	0.81	Low	2.32	0.79	Low
4	Teachers demonstrate concepts using interactive whiteboards	2.52	0.79	High	2.26	0.74	Low
5	Teachers use technology for real-time student feedback during class	2.49	0.83	Low	2.13	0.72	Low

Discussion of Findings

The findings in Table 1 and Figure 1 reveal a notable discrepancy between principals' and teachers' perceptions of technology integration in classroom instruction across public senior secondary schools in Rivers State. While principals rated the integration of multimedia presentations ($M = 2.65$), online resources ($M = 2.73$), and interactive whiteboards ($M = 2.52$) above the decision threshold (mean ≥ 2.50), teachers' responses painted a more conservative picture. Only the use of online resources ($M = 2.58$) marginally crossed the benchmark, while other indicators—such as real-time feedback ($M = 2.13$), digital homework platforms ($M = 2.32$), and even interactive whiteboards ($M = 2.26$) were rated below the threshold, implying limited classroom-level implementation.

This divergence in perception may reflect a systemic disconnect between policy-level advocacy and classroom-level realities. Principals, often more involved in infrastructural oversight and reporting, might equate the mere availability or acquisition of digital tools with their active utilization. Teachers, however, are positioned at the frontlines of pedagogical engagement, where actual application is tempered by challenges such as low digital literacy, lack of technical support, large class sizes, and curriculum constraints (Aduka & Musa, 2022; Owonte & Jaja, 2021). This discrepancy aligns with the "implementation gap" noted in several educational technology studies, where administrative enthusiasm does not translate into classroom transformation (Tondeur et al., 2017).

The relatively low mean scores for interactive pedagogical tools, such as digital homework platforms and real-time feedback mechanisms, are particularly telling. These technologies

represent student-centered, formative practices that require not just familiarity with ICT tools but also pedagogical redesign and comfort with non-linear, feedback-rich instruction (Voogt, Erstad, Dede, & Mishra, 2013). Furthermore, the findings substantiate Owonte and Jaja's (2021) conclusion that teachers' ICT use is often hindered by lack of training, inadequate follow-up support, and inconsistent policy enforcement. Even when digital resources are available, teacher confidence and competence are critical determinants of integration, a view supported by more recent studies such as Ifinedo et al. (2021), who found that teacher digital self-efficacy and school support climate significantly predicted ICT usage.

The study also resonates with Technological Pedagogical Content Knowledge (TPACK) theory (Koehler & Mishra, 2009), which emphasizes that effective integration requires more than access to tools, teachers must develop synergistic knowledge of pedagogy, content, and technology. In contexts where training focuses heavily on operational ICT skills without pedagogical adaptation, the result is often low-level application and minimal student engagement (Kafyulilo, 2020). Conclusively, these findings reflect a troubling asymmetry between administrative optimism and classroom realities. While infrastructure development and ICT acquisition may have improved, actual pedagogical transformation is lagging, suggesting the need for more targeted professional development, teacher mentoring, and systemic incentives that support not just usage, but effective and sustained integration.

Research Question 2

To what extent do students utilize technology in their learning activities in public senior secondary schools in Rivers State?

Table 2: Mean and Standard Deviation of the Extent of Students' Utilization of Technology in Learning Activities

S/N	Item	Principals (N = 60)			Teachers (N = 640)		
		Mean	SD	Decision	Mean	SD	Decision
6	Students use school computers for research and assignments	2.61	0.79	High	2.41	0.83	Low
7	Students participate in technology-assisted class activities	2.57	0.82	High	2.35	0.81	Low
8	Students access online educational resources during study	2.69	0.76	High	2.48	0.85	Low
9	Students submit assignments through digital platforms	2.46	0.81	Low	2.28	0.79	Low

10	Students use mobile apps or e-learning tools for revision	2.51	0.78	High	2.39	0.76	Low
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Discussion of Findings

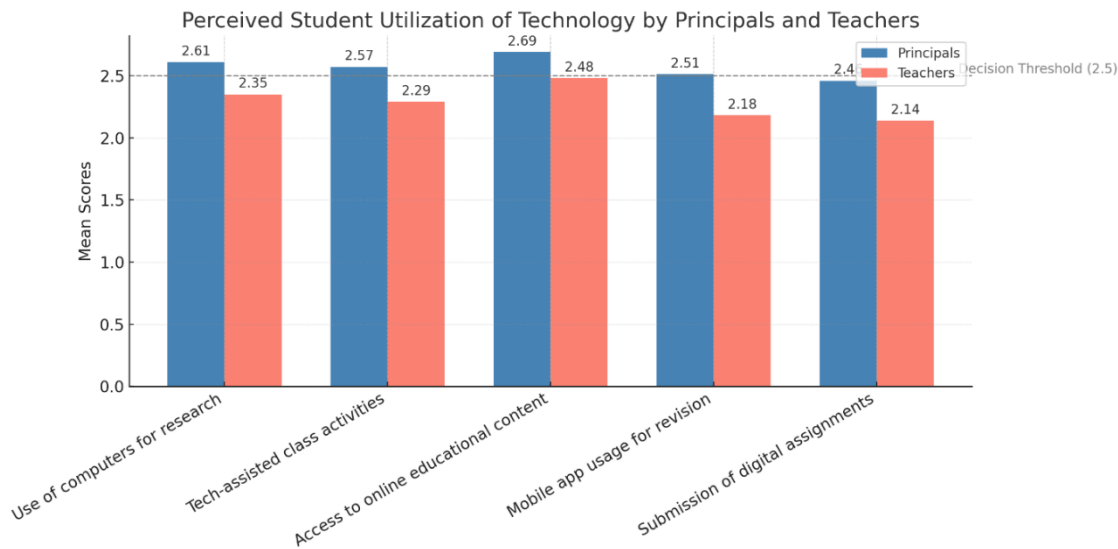


Figure 1: Perceived student utilization of technology by principals and teachers

The findings in Table 2 demonstrate a notable divergence in perception between principals and teachers regarding the extent of student utilization of technology in classroom learning. Principals perceived a high level of integration in four out of five indicators (means ≥ 2.50), suggesting optimism about student engagement with digital tools such as computers for research ($M = 2.61$), online educational content ($M = 2.69$), and mobile apps for revision ($M = 2.51$). Conversely, teachers rated all five indicators below the decision threshold, suggesting that student engagement with technology is limited or inconsistent in day-to-day instructional practice. The highest mean among teachers was for online resource usage ($M = 2.48$), still marginally below the benchmark.

This perception gap may stem from differences in administrative visibility and classroom-level realities. As suggested by Trust and Whalen (2021), school leaders may observe structural provisions for technology (e.g., hardware availability, internet access), whereas teachers assess actual student engagement and integration during lessons, which may be hindered by digital skill gaps or instructional design limitations.

The results resonate with Monserrate (2018), who argued that access to technology does not equate to effective utilization. Students may have physical access to devices, but without deliberate pedagogical strategies and scaffolding by teachers, the integration remains superficial. Similarly, Abedi (2024) emphasized that student engagement with educational technology is contingent on teacher digital fluency and instructional intentionality: factors that appear lacking in the current study context.

Moreover, the findings raise questions about student agency and digital readiness. While principals may assume that Gen Z learners are "digital natives," research by Bayor. (2022) indicated that proficiency in entertainment-focused technology does not translate into academic digital competence. This mismatch may explain why teachers, who interact directly with students during lessons, perceive lower levels of engagement with learning technologies.

Critically, the gap observed also reflects a policy-practice disconnect, common in many school systems. Leaders may roll out edtech initiatives or procure devices under national ICT-in-education programs, but without targeted teacher training and curriculum-aligned integration, such efforts fall short of transforming student learning experiences (Ololube et al, 2013).

The implications are significant. First, there is a need for coordinated efforts to ensure that digital resources are not only available but are used purposefully to enhance teaching and learning. Second, continuous professional development must prioritize instructional technology integration strategies. Third, a monitoring and feedback mechanism that includes both teachers' and students' voices can help bridge the perception divide and drive more evidence-based decision-making.

In conclusion, while infrastructural provision appears promising from an administrative standpoint, actual classroom-level integration remains weak. The findings underscore the urgency of aligning policy, teacher capacity, and student-centered practices to close the digital utilization gap.

Research Question 3

To what extent are infrastructure and digital resources available and adequate to support technology integration in public senior secondary schools in Rivers State?

Table 3: Mean and Standard Deviation of the Extent of Availability and Adequacy of Infrastructure and Digital Resources

S/N	Item	Principals (N = 60)			Teachers (N = 640)		
		Mean	SD	Decision	Mean	SD	Decision
11	Availability of functioning ICT/computer laboratories	2.48	0.81	Low	2.29	0.78	Low
12	Adequacy of internet access across school facilities	2.36	0.84	Low	2.10	0.80	Low
13	Regular electricity supply to support ICT tools	2.27	0.75	Low	2.13	0.74	Low
14	Availability of digital instructional tools (projectors, smartboards, etc.)	2.51	0.78	High	2.33	0.79	Low

15	Availability of maintenance and technical support for ICT equipment	2.44	0.82	Low	2.18	0.76	Low
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Discussion of Findings

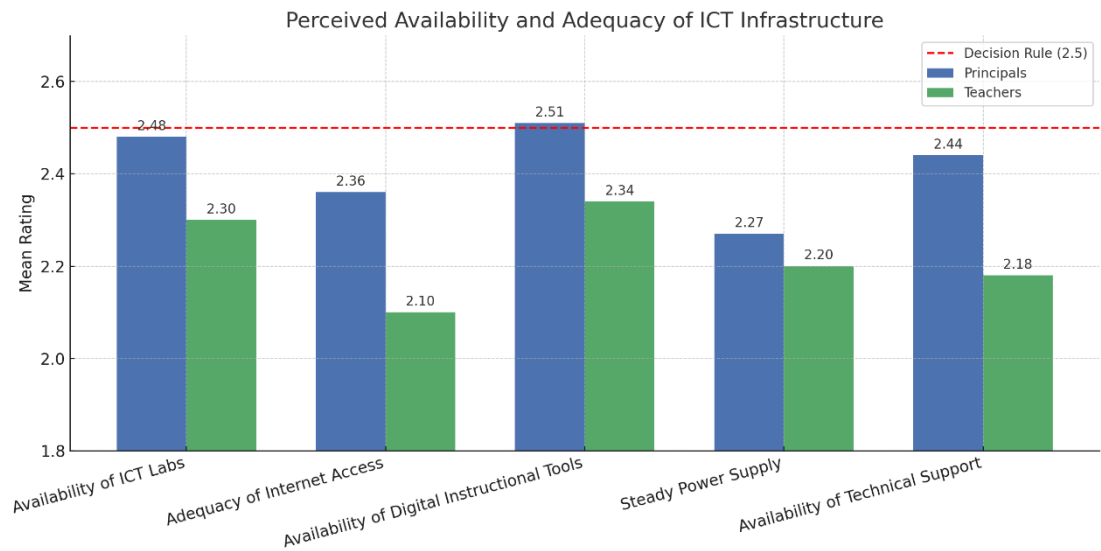


Figure 2: Perceived availability and adequacy of ICT infrastructure

The findings from Table 3 underscore a shared perception of infrastructural inadequacy among both principals and teachers, a challenge that substantially constrains the depth and effectiveness of ICT integration in public senior secondary schools. While principals slightly acknowledged the presence of digital instructional tools (mean = 2.51), all other items—such as ICT labs, internet access, electricity, and maintenance support—were rated below the 2.50 decision rule. Teachers were even more critical, rating all five indicators below the threshold, highlighting an especially dire view of internet adequacy (mean = 2.10) and technical support (2.18).

These results confirm the systemic nature of infrastructural deficiencies, consistent with prior research. Owonte and Jaja (2021) found that despite policy-level investments in ICT infrastructure, schools in Rivers State often suffer from erratic power supply, outdated equipment, and lack of maintenance culture. Similarly, Ejike (2022) documented that newly deployed ICT tools were either underutilized or non-functional due to insufficient training and the absence of routine technical support.

Crucially, the perception gap between principals and teachers, though narrower here than in earlier tables, raises questions about decision-making and communication in resource allocation. Principals’ slightly more optimistic ratings may stem from their access to procurement records or policy documentation, whereas teachers’ responses reflect on-the-ground realities in day-to-day instruction.

From a broader perspective, this reinforces Ali and Ahmed’s (2019) assertion that infrastructure is not merely a background condition, but a determinant factor in shaping

pedagogical choices. Teachers cannot be expected to integrate technology into their instruction when foundational elements such as power, internet, or basic hardware are missing or inadequate.

Furthermore, school leadership training should emphasize data-driven infrastructure planning and feedback loops that incorporate teacher input. The minor discrepancy in principal-teacher perceptions here points to a gap in stakeholder dialogue, which may lead to misinformed planning or underutilized investments.

Conclusion

This study successfully examined the extent of instructional technology integration in public senior secondary schools in Rivers State, with a focus on how such integration enhances teaching, learning, and academic performance. The findings affirm that while there is growing awareness of the importance of technology in modern education, actual utilization remains below expected levels. Teachers were found to engage technology in classroom instruction to a moderate extent, while students' access and application of digital tools were limited. Furthermore, infrastructural deficits such as inadequate ICT tools, poor internet connectivity, and erratic power supply continue to impede effective technology use in schools.

This is not merely a matter of resource distribution but reflects a broader concern about educational equity, innovation, and preparedness for the digital age. The study reveals that strategic integration of instructional technology must go beyond device availability; it should involve a transformation of pedagogical culture, teacher competence, and infrastructural sustainability.

Making instructional technology a central pillar in secondary education planning and classroom practice is essential for shaping a learning environment that is not only academically productive but also digitally inclusive, adaptive, and forward-looking.

One major limitation of this study is its reliance on self-reported data, which may introduce bias due to social desirability or subjective interpretation by respondents. Furthermore, the study did not include student perspectives, which could have provided a more holistic view of technology integration in the learning process.

The study underscores the urgent need for policy makers to revisit the ICT-in-Education policy by ensuring adequate infrastructure provision, equitable access across schools, and consistent power and internet connectivity. School administrators should establish mechanisms for regular ICT training and appoint technical support staff to sustain integration efforts. These actions are necessary for transforming digital policies into classroom realities.

In preparing learners for a technology-driven world, schools must become centers of innovation and digital literacy. The integration of instructional technology when supported with vision, training, and investment will empower both educators and students to thrive in a rapidly evolving global landscape.

Recommendations

Based on the findings of the study, the following recommendations are made to strengthen the integration of instructional technology in public senior secondary schools:

1. **Strengthen Teacher Capacity:** Continuous and targeted professional development programs should be provided to equip teachers with both technical and pedagogical skills needed for meaningful integration of instructional technology into their classroom practice.
2. **Improve Infrastructure:** Government and relevant stakeholders should invest in the provision of functional ICT facilities—such as internet access, projectors, educational software, and alternative power supply systems—to create enabling environments for digital learning.
3. **Promote Student Access to Technology:** Schools should ensure that students are not only exposed to digital tools but are guided on how to use them effectively for academic activities. This includes providing structured ICT-based learning opportunities across subjects.
4. **Institutionalize Technology Integration Policies:** School leadership and educational policymakers should develop and enforce clear policies that prioritize the integration of instructional technology into curriculum delivery and school operations.
5. **Monitor and Evaluate ICT Utilization:** Mechanisms should be established to periodically assess the extent and effectiveness of technology use in schools, in order to identify gaps, measure progress, and refine strategies for sustained implementation.

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APPENDIX

"Technology Integration in Secondary Schools Questionnaire"

Evaluating Technology Integration in Teaching and Learning: A Survey of Public Senior Secondary Schools in Rivers State, Nigeria

SECTION A: RESPONDENT'S DATA

Instruction: Tick (✓) as appropriate

Name of School: _____

1. Gender: Male ☐ Female ☐
2. Status: Principal ☐ Teacher ☐
3. Qualification: NCE ☐ BSC ☐ B.ED ☐ M.SC ☐ M.ED ☐ P.HD ☐
4. Years of experience: 1-7yrs ☐ 8-14 yr ☐ 15-22 yrs ☐ 23yrs above ☐

SECTION B: Questionnaire Items

RQ1	Extent of Teachers' Integration of Technology into Classroom Instruction	VHE 4	HE 3	LE 2	VLE 1
1	Teachers use multimedia presentations to deliver lessons				
2	Teachers use online resources and videos to supplement content				
3	Teachers assign and collect homework via digital platforms				
4	Teachers demonstrate concepts using interactive whiteboards				
5	Teachers use technology for real-time student feedback during class				
RQ2	Extent of Students' Utilization of Technology in Learning Activities	VHE 4	HE 3	LE 2	VLE 1
6	Students use school computers for research and assignments				
7	Students participate in technology-assisted class activities				
8	Students access online educational resources during study				
9	Students submit assignments through digital platforms				
10	Students use mobile apps or e-learning tools for revision				
RQ3	Extent of Availability and Adequacy of Infrastructure and Digital Resourc	VHE 4	HE 3	LE 2	VLE 1
11	Availability of functioning ICT/computer laboratories				
12	Adequacy of internet access across school facilities				
13	Regular electricity supply to support ICT tools				
14	Availability of digital instructional tools (projectors, smartboards, etc.)				
15	Availability of maintenance and technical support for ICT equipment				