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Evaluating the Impact of Technology Integration on Teaching Effectiveness and Students' Learning Outcomes in Osun State Secondary Schools

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Abstract

The integration of Information and Communication Technology (ICT) in education has become essential for improving teaching quality and student learning outcomes, yet its adoption in Nigerian schools remains uneven due to infrastructural and pedagogical challenges. This study examined ICT integration in secondary schools in Osun State using a mixed-methods approach with 240 students, 60 teachers, and 12 administrators from 12 purposively selected urban and rural schools. Data were collected through questionnaires, interviews, and classroom observations. Findings revealed that while 85% of schools had basic ICT facilities, only 33% had functional internet access. Teachers mainly used PowerPoint and YouTube videos, with limited interactive tools, whereas students showed strong motivation and positive attitudes toward ICT-supported learning. Teachers reported moderate confidence and a clear need for further training. Hypothesis testing showed a moderate positive correlation between ICT use and academic performance ($r = .46$, $p < .01$), supporting the rejection of the null hypothesis, and a significant difference in performance between urban and rural students ($t(238) = 5.42$, $p < .001$), with urban students outperforming rural counterparts. Major challenges included inadequate infrastructure, unstable electricity, and insufficient professional development. The study concludes that ICT can significantly enhance secondary education in Osun State, but its potential relies on strengthening infrastructure, teacher training, policy implementation, and equitable access, particularly in rural schools.

Keywords: Technology integration, secondary schools, ICT in education, academic performance

Introduction

Technological incorporation into education is crucial for improving teaching and learning performance in the globe. Technologies like online platforms, mobile applications, and virtual classrooms enhance content delivery and class engagement (Tondeur et al., 2021). In developing countries like Nigeria, it is, however, marred by infrastructural, instructional, and institutional challenges. In Osun State, the majority of secondary schools especially in rural schools lack access to ICT, unreliable power supply, poor internet connectivity, and the absence of qualified teachers (Okebukola., 2022). Although there are government initiatives such as educational tablets and ICT curriculum, their actual impacts have yet to be explored. This study examines the extent of technology integration, methods used, teacher and student attitudes, problems faced, and learning outcome impact in Osun State secondary schools.

Technology integration entails the deliberate use of digital tools to support instructional goals and enhance learning outcomes (Tondeur et al., 2021). It involves embedding technology within pedagogical practices to facilitate meaningful learning experiences rather than simply using devices as add-ons to traditional instruction. Tools such as learning management systems, virtual simulations, multimedia platforms, and educational applications have transformed the teaching and learning environment by supporting personalised, collaborative, and interactive learning experiences (Mishra et al., 2022). Through these tools, learners can engage more deeply with content, collaborate with peers beyond the physical classroom, and receive immediate feedback that promotes continuous improvement.

König et al. (2020) emphasised that effective technology integration relies heavily on teacher competence, institutional support, and pedagogical alignment. When these factors are adequately addressed, the use of technology can significantly improve student engagement, motivation, and academic achievement. The integration of digital technologies in education has thus evolved from being a complementary aspect of instruction to becoming a central pillar of contemporary pedagogy. Among emerging technologies, natural language processing stands out as a rapidly advancing tool that is transforming academic environments by facilitating communication, personalised learning assistance, and accessibility, especially for students across various disciplines. According to the OECD (2020), information and communication technology (ICT) enhances student engagement, critical thinking,

creativity, and problem-solving skills when appropriately applied in instructional contexts. ICT-based learning encourages active participation, supports differentiated instruction, and enables students to learn at their own pace. In Osun State, empirical evidence has linked the use of digital learning tools with improved academic performance, particularly in mathematics and science subjects where visualization and interactivity play crucial roles in comprehension and retention. This suggests that when properly implemented, ICT can bridge learning gaps and foster improved outcomes among students at different educational levels.

Despite these promising outcomes, the implementation of ICT in Nigerian schools still faces considerable challenges. Persistent issues such as insufficient teacher training, inadequate infrastructure, limited access to digital resources, and resistance to pedagogical change continue to hinder effective adoption. Many schools operate under infrastructural constraints such as unreliable electricity supply, inadequate internet connectivity, and outdated technological equipment, which impede consistent ICT utilization. In addition, limited funding at institutional and governmental levels restricts the acquisition of modern digital tools and the maintenance of existing facilities. Okebukola (2022) observed that improper or unsupervised use of ICT tools, particularly exposure to social media distractions, can have a negative effect on student learning outcomes. This indicates that while technology offers numerous benefits, its integration must be guided by well-structured policies and pedagogical frameworks that promote responsible use. Similarly, UNESCO (2022) highlighted that teacher attitudes, digital literacy, and preparedness play a decisive role in determining the success of ICT integration. In Osun State, although many teachers express support for the use of digital technologies in the classroom, a significant number still lack confidence in their ability to apply them effectively due to minimal ICT training and infrastructure-related constraints (Adewale & Ibrahim, 2024). Institutional support has also been identified as a vital enabler of successful technology integration.

Eze et al. (2022) noted that leadership encouragement, continuous technical assistance, and administrative support are critical for sustaining teachers' motivation and competence in ICT adoption. Similarly, Agbatogun (2021) reported that students generally respond positively to digital learning approaches, especially when instruction is delivered through interactive tools such as online quizzes,

simulations, and video tutorials. Such approaches not only increase participation but also make learning experiences more engaging and relevant. However, disparities in access—particularly between urban and rural students—remain a significant barrier, affecting the extent to which all learners can equally benefit from ICT-supported instruction (Olowu & Oke, 2022). Favourable teacher and student attitudes toward technology, while essential, are insufficient on their own to ensure successful implementation. Equitable access to digital resources, robust infrastructure, and supportive institutional frameworks are equally critical. Barriers to ICT integration in Nigerian schools are multifaceted, encompassing infrastructural deficiencies, limited financial investment, gaps in teacher training, and socio-economic inequalities that affect access and continuity (Olajide et al., 2023). Eze et al. (2022) further explained that many educators still lack the necessary digital competence due to inadequate pre-service and in-service training opportunities, resulting in inconsistent application of technology in classroom settings. Moreover, the absence of structured digital literacy programs contributes to misuse among students, reducing the potential educational benefits of technology.

Addressing these multi-layered challenges requires a holistic and systemic approach. Sustainable technology integration depends on the simultaneous development of infrastructure, policy frameworks, teacher capacity building, and community awareness. It also requires strong collaboration among government agencies, educational institutions, and stakeholders to provide the necessary resources, training, and technical support. Only through comprehensive reforms and consistent commitment can the potential of ICT to transform teaching and learning processes in Nigerian schools particularly in in Osun State, be fully realized.

Statement of the Problem

In spite of government ICT policies (FME, 2019), the integration of technology in Nigerian schools remains uneven. In Osun State, inadequate infrastructure, low level of electricity quality, poor internet connectivity, and low teacher capability hinder effective adoption. While some urban schools embrace computer-based learning, most rural schools lack basic tools. Teacher readiness is also another crucial area with minimal ICT training leading to low confidence. Also, there is a lack of empirical evidence on the effects of current ICT practice on student results and teaching effectiveness. This study aimed

to address these research gaps by evaluating ICT usage, user perspectives, challenges, and pedagogical impacts in order to promote more equitable and effective technology integration practices.

Research Questions

1. To what extent is technology integrated into teaching and learning in secondary schools in Osun State?
2. What are technological tools and platforms commonly used by teachers and students?
3. What are the attitudes and perceptions of teachers and students regarding technology use in instruction?
4. What major challenges hinder effective ICT integration in Osun State secondary schools?

Research Hypotheses

1. **H_{01}:** There is no significant relationship between ICT usage and students' academic performance.
2. **H_{02}:** There is no significant difference in academic performance between urban and rural students.

Methodology

This study adopted a mixed-methods approach, combining quantitative and qualitative techniques to gain a comprehensive understanding of ICT integration in secondary schools. A structured questionnaire was employed to assess the extent of technology use and its relationship with student performance, interviews, and classroom observations provided deeper insights into the experiences of teachers and students with ICT. The study population consisted of public and private secondary schools across the three senatorial districts of Osun State: Central, East, and West. A multi-stage sampling procedure was used, beginning with stratified random sampling to ensure representation from each district, followed by purposive selection of 12 schools (4 from each district) that had basic ICT infrastructure. The final sample included 240 students (20 per school), 60 teachers (five per school), and 12 administrators each in a leadership role, with 75% having more than ten years of

experience. Data collection instruments comprised a Structured Questionnaire, Semi-Structured Interviews, and Observation Checklists. A pilot test conducted in two non-participating schools produced a Cronbach's Alpha of 0.82, indicating high reliability. Quantitative data were analysed using SPSS v25, while qualitative responses were examined thematically to capture patterns and insights.

Results

Table 1: Students' Responses on ICT Resources and Usage Patterns (n = 240 Students)

Items	Response Options	Frequency (f)	Percentage (%)
Availability of basic ICT tools	Very Often	120	50.0
	Often	84	35.0
	Rarely	24	10.0
	Never	12	5.0
Availability of functional internet	Very Often	32	13.3
	Often	48	20.0
	Rarely	80	33.3
	Never	80	33.3
Use of ICT for learning (weekly)	Very Often	60	25.0
	Often	80	33.3
	Rarely	60	25.0
	Never	40	16.7
Rare or no use of ICT	Very Often	40	16.7
	Often	60	25.0
	Rarely	80	33.3
	Never	60	25.0

The findings indicated that a majority of students reported that ICT tools are available in their schools, with 85.0% indicating that such tools are either very often or often available. However, access to functional internet remains limited, as a larger proportion of students (66.6%) reported that internet

access is rarely or never available. Regarding usage patterns, over half of the students (58.3%) indicated that they use ICT for learning on a weekly basis, suggesting a moderate level of engagement with digital tools. Nevertheless, a notable proportion of students (41.7%) reported rare or no use of ICT, highlighting persistent gaps in effective utilization. Overall, while ICT tools are physically present in many schools, their effective use is constrained by limited internet access and inconsistent student engagement. This suggests the need for improved infrastructure and policies that promote regular integration of ICT into teaching and learning processes.

Table 2

Teachers' Responses on Types of ICT Tools Used in Instruction (n = 60 Teachers)

ICT Tools	Response Options	Frequency (f)	Percentage (%)
Use of PowerPoint in teaching	Agree	27	45.0
	Disagree	33	55.0
Use of YouTube videos in teaching	Agree	23	38.3
	Disagree	37	61.7
Use of computer-based testing tools	Agree	10	16.7
	Disagree	50	83.3

The responses from the 60 teachers show that the use of ICT tools in instruction is still relatively low. Less than half of the teachers (45%) reported that they use PowerPoint in teaching, while a slightly higher proportion (55%) do not. This suggests that although PowerPoint is one of the most commonly used digital tools, its adoption is not yet widespread among teachers. 38.3% of the teachers indicated that they use YouTube videos, while a majority of 61.7% reported that they do not. This indicates limited use of video-based instructional resources, which could otherwise support visual and engaging learning. The situation is even more pronounced for computer-based testing tools. Only 16.7% of teachers reported using them, whereas a large majority (83.3%) do not. These findings indicate that the

use of digital assessment is limited and that the majority of teachers are not yet fully incorporating ICT tools into their instructional practices.

Table 3

Mean and Standard Deviation of Students' and Teachers' Attitudes and Perceptions on ICT

Statement	Students (M ± SD)	Teachers (M ± SD)
ICT makes learning more interesting	4.41 ± 0.62	4.20 ± 0.68
I feel confident using ICT for academic tasks	4.03 ± 0.71	3.85 ± 0.76
I prefer lessons that involve technology	4.32 ± 0.65	—
I am motivated to learn when ICT is used in class	4.15 ± 0.69	—
I need more training to integrate ICT effectively	—	4.60 ± 0.58

The results showed that both teachers and students generally hold positive attitudes toward the use of ICT in teaching and learning, as reflected in the relatively high mean scores across items. The standard deviation values, which range from 0.58 to 0.76, indicate low to moderate variability, suggesting that respondents' opinions are fairly consistent. Students strongly agreed that ICT makes learning more interesting (M = 4.41, SD = 0.62) and that they prefer technology-supported lessons (M = 4.32, SD = 0.65), indicating both positive perception and shared agreement. Similarly, teachers agreed that ICT enhances learning (M = 4.20, SD = 0.68), although their confidence in using ICT is slightly lower (M = 3.85, SD = 0.76), with a bit more variation in responses. Notably, teachers expressed a strong need for further training (M = 4.60, SD = 0.58), with low variability, showing a clear and consistent demand for professional development in ICT integration.

Table 4

Challenges to ICT Integration (n = 60 Teachers)

Challenges	Frequency (f)	Percentage (%)
Inadequate ICT infrastructure	44	73.3
Irregular electricity supply	41	68.3
Lack of internet connectivity	40	66.7
Insufficient ICT training for teachers	36	60.0
Overloaded curriculum/time constraints	27	45.0

The findings revealed that several structural and capacity-related factors hinder effective ICT integration among teachers. The most frequently reported challenge is inadequate ICT infrastructure, identified by 73.3% of respondents, indicating that many schools lack the necessary digital tools and facilities to support technology-based teaching. Irregular electricity supply (68.3%) and lack of internet connectivity (66.7%) were also reported by a large proportion of teachers, highlighting persistent infrastructural challenges that limit consistent access to ICT resources. These issues are particularly critical in contexts where stable power and connectivity are essential for digital learning. In addition, 60% of teachers indicated that insufficient ICT training is a major barrier, suggesting that even when resources are available, inadequate skills may prevent effective use. Lastly, 45% of respondents noted overloaded curriculum and time constraints, implying that teachers may struggle to incorporate ICT into already demanding teaching schedules.

Hypotheses Testing and Results

Two null hypotheses were formulated and tested to examine the relationship between ICT usage and academic performance, as well as differences in performance based on school location.

Hypothesis one (H_{01}): *There is no significant relationship between ICT usage and students' academic performance.*

Table 5

Pearson Correlation Between ICT Usage and Academic Performance

Variables	r	p-value	Decision
ICT Usage & Academic Performance	0.46	< .01	Significant

To test this hypothesis, a Pearson Product-Moment Correlation was conducted. The analysis revealed a moderate positive relationship between ICT usage and academic performance *(r = .46, p < .01)*, indicating that higher levels of ICT use are associated with better student outcomes. Because the p-value is less than 0.01, the relationship is statistically significant, and the null hypothesis is therefore rejected. This finding noted that ICT plays a meaningful role in enhancing students' learning, likely by making instruction more engaging, interactive, and accessible.

Hypothesis Two (H_{02})*: There is no significant difference in academic performance between urban and rural students.*

Table 6

Independent Samples t-test Showing Difference in Academic Performance by Location

Variable	Group	Mean (M)	SD	t-value	p-value	Decision
Academic Performance	Urban	73.2	8.4	5.42	< .05	Significant
	Rural	66.5	9.3			

Table 6 shows a significant difference in academic performance between urban and rural students *(t(238) = 5.42, p < .001)*. Students in urban schools achieved a higher mean score (M = 73.2, SD = 8.4) than their rural counterparts (M = 66.5, SD = 9.3). This indicates that students' location is linked to academic performance, likely reflecting disparities in access to ICT resources, learning infrastructure, and educational opportunities. The very low p-value (< .001) confirms that this difference is highly statistically significant and unlikely to have occurred by chance.

Policy and Practical Implications

The findings of this study highlight that while ICT has the potential to enhance teaching and learning in secondary schools, its effective integration depends on more than the availability of hardware.

Teachers' moderate confidence and expressed need for further training indicate that targeted professional development is critical. Training should focus not only on ICT operation but also on pedagogical strategies for integrating technology meaningfully into lessons, assessments, and classroom interactions. Curriculum alignment with technology is equally essential. ICT should be embedded in lesson planning and learning activities rather than treated as an add-on, ensuring that digital tools actively support student engagement and learning outcomes. Reliable infrastructure such as electricity, functional internet, and updated devices is another prerequisite for sustainable ICT adoption. Inclusive policies are crucial, particularly to address the urban-rural divide. Rural schools face compounded challenges, such as limited connectivity and resource scarcity. Practical solutions could include solar-powered ICT labs, mobile technology units, and community-based digital literacy programs that extend access to learning beyond the classroom. Engaging local stakeholders can further enhance resource availability and foster a culture of digital learning. Implementing these measures can bridge access gaps, strengthen teacher capacity, and create equitable and effective learning environments across both urban and rural schools in Osun State.

Conclusion

The integration of technology in secondary schools in Osun State presents both significant promise and notable challenges. While teachers and students generally demonstrate positive attitudes toward ICT and recognize its potential benefits, actual usage remains limited and uneven, particularly in rural areas. The study highlights that effective technology integration is constrained by infrastructural deficiencies, unreliable electricity, limited internet access, and inadequate teacher preparedness. Despite these challenges, the findings show a positive relationship between ICT use and student academic performance, suggesting that when technology is appropriately implemented, it can substantially enhance learning outcomes. Government-led initiatives, such as the Opon Imo tablet project, demonstrate the potential of targeted interventions to support ICT adoption. However, sustainable success requires a holistic and systemic approach. Key strategies include strengthening teacher capacity through targeted professional development, improving infrastructure and access to digital tools, ensuring consistent policy implementation, and promoting community engagement to support equitable access. Addressing these factors is critical to bridging the digital divide, fostering inclusive learning

environments, and realizing the full potential of technology-driven education in both urban and rural schools across Osun State.

Recommendations

Based on the findings and conclusions from this study, the following recommendations are proposed to enhance the effective integration of technology in teaching and learning across secondary schools in Osun State:

i. ICT infrastructure should be provided in all schools, with special attention to rural areas.

ii. Teachers should receive regular, hands-on training to build their ICT skills.

iii. Schools should be equipped with stable electricity and reliable internet access.

iv. ICT should be integrated into all subjects across the school curriculum.

v. A system should be established to monitor and evaluate ICT implementation in schools.

vi. The government should partner with private sector organizations and donors to support ICT initiatives.

vii. Marginalized schools and students should be supported with devices, access, and digital learning opportunities.

viii. School leaders should be trained and empowered to drive ICT integration in their schools.

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