

An Assessment of the Impact of Information and Communication Technology (ICT) Integration on Teaching and Learning in Secondary Schools in Zaria Local Government Area, Kaduna State, Nigeria

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Copyright © 2026 The Author(s): This is an open-access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC BY-NC) which permits unrestricted use, distribution, and reproduction in any medium for non-commercial use provided the original author and source are credited.	
Citation: Ahmed Lawal, Hayatudeen Maccido Mohammed & Ibrahim Ahmad. (2026). An assessment of the impact of information and communication technology (ICT) integration on teaching and learning in secondary schools in Zaria Local Government Area, Kaduna State, Nigeria. UKR Journal of Arts, Humanities and Social Sciences, 2(9), 46-55.	<i>This study examined the impact of Information and Communication Technology (ICT) integration on teaching and learning in secondary schools in Zaria Local Government Area, Kaduna State, Nigeria. A cross-sectional survey design complemented by interviews was adopted. The study involved 674 teachers and students from twelve (12) selected public secondary schools. Data were collected using the Information and Communication Technology Impact Questionnaire (ICTIQ) and an interview guide. The questionnaire yielded a reliability coefficient of 0.87 using the test-retest method. Mean and standard deviation were used to answer the research questions, while Pearson Product-Moment Correlation was used to test the hypotheses at the 0.05 level of significance. Interview data were analyzed thematically. Findings showed that ICT integration improves instructional quality and effectiveness and provides opportunities for enhanced student engagement, collaborative learning, access to educational resources, and digital competency development. The study concludes that purposeful ICT integration can strengthen teaching and learning and recommends improved ICT infrastructure, continuous teacher training, reliable electricity and internet connectivity, and greater access to digital learning resources.</i> Keywords: ICT Integration, Teaching and Learning, Instructional Quality, Student Engagement, Digital Competencies.

Introduction

The rapid advancement of digital technology has created new demands for improving the quality and effectiveness of teaching and learning in secondary education, particularly as learners differ in their technological exposure, abilities, motivation, and learning experiences. Information and Communication Technology (ICT) has consequently become an important educational resource through which teachers and students can access, process, communicate, and share information, while supporting interactive and learner-centred instruction, access to learning materials, and the development of digital competencies required in a technology-driven society (UNESCO, 2023). ICT integration extends beyond the provision of computers, projectors, smartphones, internet facilities, and educational software to the purposeful application of technology in lesson preparation, instructional delivery, classroom interaction, assessment,

communication, and independent learning. Evidence indicates that meaningful ICT integration can strengthen instructional quality by enabling teachers to employ multimedia resources, explain complex concepts more effectively, access current information, and adopt interactive teaching approaches (Ajadi, 2024; Msafiri et al., 2023). However, these benefits are influenced by teachers' competence and perceptions, the availability and functionality of ICT facilities, technical support, and institutional conditions, while the Technology Acceptance Model (TAM) emphasizes perceived usefulness and ease of use as important factors influencing technology adoption and utilization (Davis, 1989).

ICT integration has considerable potential to strengthen students' engagement, collaborative learning, access to educational resources, and digital competencies; however,

its educational value depends largely on the quality and purpose of its implementation. Digital platforms, multimedia resources, educational applications, and communication technologies can encourage active participation, peer interaction, independent learning, and access to information beyond the classroom, with recent studies reporting positive associations between technology use, student participation, collaboration, and learning-resource accessibility (Asuquo et al., 2024; Isaiah & Sambo, 2025). Similarly, sustained engagement with digital technologies can enhance teachers' and students' abilities in information management, digital communication, problem-solving, collaboration, and independent learning. Nevertheless, these benefits should not be regarded as automatic outcomes of ICT availability or adoption. Inadequate teacher preparation, limited digital competence, poor infrastructure, unreliable electricity and internet connectivity, insufficient technical support, and inappropriate pedagogical application may constrain or even reduce the effectiveness of technology-supported learning. Thus, meaningful ICT integration requires more than providing digital facilities; it depends on teachers' capacity to use technology purposefully, students' opportunities for active engagement, and institutional conditions that support effective and sustainable utilization (Msafiri et al., 2023; Msambwa & Daniel, 2024).

In Nigeria, successive educational policies have increasingly positioned Information and Communication Technology (ICT) as an instrument for improving instructional quality, widening access to educational resources, strengthening digital competencies, and preparing learners for participation in a technology-driven economy. However, policy commitment and the provision of ICT facilities do not necessarily translate into effective classroom integration. Evidence from Nigerian secondary schools indicates that the educational benefits of ICT are influenced by teachers' competence and attitudes, the availability and functionality of infrastructure, reliable electricity and internet connectivity, funding, technical support, and institutional capacity (Asuquo et al., 2024; Ajadi, 2024). More importantly, existing evidence provides limited context-specific understanding of whether ICT integration is actually improving instructional effectiveness, shaping teachers' perceptions, enhancing students' engagement and collaborative learning, expanding access to educational resources, and developing digital competencies in secondary schools in Zaria Local Government Area of Kaduna State. Thus, the mere presence of ICT facilities cannot be taken as evidence of successful integration or educational impact. This study therefore examines the impact of Information and Communication Technology (ICT) integration on teaching and learning in secondary schools in Zaria Local

Government Area, Kaduna State, Nigeria, focusing on instructional quality and effectiveness, teachers' perceptions of ICT benefits and prospects, students' engagement and collaborative learning, access to educational resources, and the development of digital competencies.

Objectives of the Study

The main objective of this study is to assess the impact of Information and Communication Technology (ICT) on teaching and learning in secondary schools in Zaria Local Government Area.

The following are the specific objectives that this study seeks to achieve:

- i. To examine the extent to which Information and Communication Technology (ICT) tools enhance instructional quality and effectiveness in secondary schools in Zaria Local Government Area.
- ii. To assess the perceptions of teachers and students regarding the benefit of ICT integration in teaching and learning in the study area.
- iii. To identify the key opportunities ICT provides for improving student engagement, collaborative learning, and access to educational resources.
- iv. To examine how ICT contributes to the development of digital skills and competencies among both teachers and students in the study area.

Research Question

The study answers the following research questions:

- i. To what extent does ICT integration enhance instructional quality and effectiveness in secondary schools in Zaria Local Government Area?
- ii. What are teachers and students perceptions of the benefits ICT integration in teaching and learning in secondary schools in Zaria Local Government Area?
- iii. What opportunities does ICT integration provide for enhancing students' engagement, collaborative learning, and access to educational resources in the study area?
- iv. To what extent does ICT integration contribute to the development of digital skills and competencies among teachers and students in the study area?

Null Hypotheses

In the light of the above, the following null hypotheses are formulated:

H₀₁: There is no significant relationship between ICT integration and instructional quality and effectiveness in secondary schools in Zaria Local Government Area.

H₀₂: There is no significant relationship between ICT integration and students' engagement, collaborative learning, and access to educational resources in secondary schools in Zaria Local Government Area.

Literature and Theoretical Framework

Information and Communication Technology (ICT) integration refers to the purposeful use of digital technologies in teaching, learning, assessment, communication, and access to educational resources. Evidence shows that ICT can improve instructional quality by supporting multimedia presentation, interactive teaching, access to current information, and learner-centred approaches, although its effectiveness depends on teacher competence, infrastructure, technical support, and appropriate pedagogical use (Msafiri et al., 2023; UNESCO, 2023). Teachers' perceptions are equally important because perceived usefulness, ease of use, competence, and institutional support influence their willingness to adopt ICT, as explained by the Technology Acceptance Model (TAM) (Davis, 1989). ICT can also enhance students' engagement, collaboration, independent learning, and access to resources, with recent studies reporting positive outcomes among secondary school learners (Asuquo et al., 2024; Gcabashe, 2024; Oskarita & Arasy, 2024). Furthermore, meaningful ICT use can contribute to the development of digital skills among teachers and students, although this requires adequate training, infrastructure, and opportunities for purposeful technology use (Msafiri et al., 2023).

Despite these reported benefits, previous studies reveal important contextual, variable, and implementation gaps. Limited empirical evidence specifically addresses secondary schools in Zaria Local Government Area, while many existing studies focus mainly on ICT availability, adoption, attitudes, or academic achievement rather than examining instructional quality, teacher perceptions, student engagement, collaboration, access to resources, and digital competencies together. The literature also demonstrates that ICT availability does not necessarily result in effective classroom integration because outcomes depend on teacher preparedness, infrastructure, institutional support, accessibility, and pedagogical alignment. The present study therefore addresses these gaps by examining ICT integration across four dimensions: instructional quality and effectiveness; teachers' perceptions of benefits; student engagement, collaborative learning and access to educational resources; and digital skills and competencies. The study is anchored on Davis's (1989) Technology Acceptance Model, which explains how perceived

usefulness and ease of use influence technology acceptance and utilization, while recognizing the broader institutional and infrastructural conditions that shape effective ICT integration.

Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM) developed by Davis (1989) provides the theoretical foundation for this study. The model proposes that perceived usefulness and perceived ease of use influence individuals' acceptance and utilization of technology. Applied to secondary education, teachers and students are more likely to use ICT when they perceive it as useful for improving teaching and learning and easy to operate. TAM therefore provides a basis for explaining how perceptions and technology use may contribute to instructional quality, student engagement, collaboration, and access to educational resources. However, the effectiveness of ICT integration may also be shaped by contextual factors such as teacher competence, infrastructure, internet connectivity, electricity, technical assistance, and institutional support. Thus, the study conceptualizes the relationship as: perceived usefulness and ease of use → ICT utilization → improved teaching and learning outcomes, subject to prevailing contextual conditions.

Methodology

The study adopted a cross-sectional survey research design complemented by in-depth interviews to assess the impact of Information and Communication Technology (ICT) on teaching and learning in public secondary schools in Zaria Local Government Area. The survey design was considered appropriate because it enables the researcher to collect data from a relatively large number of respondents at a single point in time and to examine their perceptions, experiences, and level of ICT utilization in teaching and learning. The inclusion of in-depth interviews provided qualitative insights that complemented the quantitative findings and enhanced the overall understanding of ICT integration in the study area.

The population of the study comprises all students and teachers in public secondary schools in Zaria Local Government Area of Kaduna State. According to the Kaduna State Annual School Census (ASC) 2024/2025 report (Kaduna State Bureau of Statistics, 2025), the population consists of 46,371 students (24,965 Junior Secondary and 21,406 Senior Secondary) and 1,229 teachers (590 Junior Secondary and 639 Senior Secondary). Using the Krejcie and Morgan (1970) approach, separate sample sizes of 381 students and 293 teachers were determined, giving a total of 674 quantitative respondents. A multistage stratified probability sampling technique will be employed, involving stratification of schools by relevant

characteristics, random selection of schools, and proportional allocation of the samples based on verified student and teacher registers.

For the qualitative component, 12 head teachers/principals and ICT coordinators will be purposively selected as key informants because of their administrative and technical responsibilities for ICT implementation. Semi-structured interviews will be used to obtain contextual information on ICT utilization, instructional delivery, student engagement, implementation challenges, and improvement strategies. The combination of probability sampling for students and teachers with purposive selection of key informants will provide complementary quantitative and qualitative evidence while minimizing selection bias and strengthening the representativeness and credibility of the study findings.

The study employed a structured questionnaire titled Information and Communication Technology Impact Questionnaire (ICTIQ) and an interview guide as instruments for data collection. The questionnaire comprised two sections. Section A collected information on the demographic characteristics of the respondents, while Section B contained items developed in line with the four objectives of the study. The items focused on the extent to which ICT tools enhance instructional quality and effectiveness; teachers' perceptions of the benefits of ICT integration in teaching and learning; the opportunities provided by ICT for promoting students' engagement, collaborative learning, and access to educational resources; and the contribution of ICT to the development of digital skills and competencies among teachers and students. The interview guide complemented the questionnaire by eliciting detailed views from relevant school administrators and ICT personnel on the integration of ICT in teaching and learning, its perceived benefits, opportunities for enhancing students' learning experiences, and its contribution to the

development of digital competencies among teachers and students.

The validity and reliability of the questionnaire were established before the main data collection. The instrument was reviewed by experts in Educational Technology, Social Studies Education, and Measurement and Evaluation to assess the relevance, clarity, and adequacy of the items in relation to the study objectives. Reliability was determined through a pilot study conducted among teachers in a secondary school outside the study area but with similar characteristics to the selected schools. The pilot data were analyzed using the test-retest method, which yielded a reliability coefficient of 0.87, indicating that the instrument had a high level of stability and consistency and was suitable for the main study.

Data collected through questionnaires and interviews were analyzed using the Statistical Package for the Social Sciences (SPSS), Version 27. Quantitative data were analyzed using frequencies, percentages, means, standard deviations, and mean differences to address the four research questions on instructional quality, teachers' perceptions, student engagement and learning opportunities, and digital competencies. Pearson Product-Moment Correlation was used to test the hypotheses at the 0.05 level of significance, while interview data were analyzed thematically to complement the quantitative findings and provide additional insights into ICT integration in teaching and learning.

Results

Research questions

Research Question One: To what extent does Information and Communication Technology (ICT) integration enhance instructional quality and effectiveness in secondary schools in Zaria Local Government Area?

Table 1: Descriptive Statistics on Respondent's Perceptions of ICT and Instructional Quality

Instructional Quality	N	Mean	Std. Dev	Mean diff
ICT Utilization	674	4.18	0.61	1.09
Conventional Teaching	674	3.09	0.74	

Source: Field Survey, 2026

The results in Table 1 indicate that the respondents rated ICT utilization considerably higher in enhancing instructional quality and effectiveness, with a mean score of 4.18 and a standard deviation of 0.61, compared with a mean score of 3.09 and standard deviation of 0.74 for conventional teaching. The mean difference of 1.09 indicates a substantial perceived advantage of ICT-supported instruction over conventional teaching. The relatively low standard deviation for ICT utilization also

suggests a considerable level of consistency in the respondents' ratings. Therefore, the findings indicate that ICT integration enhances the quality and effectiveness of instructional delivery to a high extent in secondary schools in Zaria Local Government Area.

Research Question Two: What are teachers and students perceptions of the benefits ICT integration in teaching and learning in secondary schools in Zaria Local Government Area?

Table 2: Descriptive Statistics on Teachers' and Students' Perceptions of the Benefits of ICT Integration

Perceived Benefits of ICT Integration	N	Mean	std.dev
Improves understanding of lesson content	674	4.25	0.62
Makes teaching and learning more interesting	674	4.18	0.67
Enhance access to educational Resources	674	4.31	0.59
Improve instructional Effectiveness	674	4.16	0.65
Promote independent Learning	674	4.12	0.70
Overall Mean	674	4.20	0.65

Source: Field Survey, 2026

The results in table 2 above indicate that teachers and students generally perceive ICT integration as beneficial to teaching and learning. The overall mean of 4.20 indicates a high level of perceived benefits, with access to educational resources ($M = 4.31$) receiving the highest rating, followed by improved understanding of lesson content ($M = 4.25$). Independent learning ($M = 4.12$) recorded the lowest mean but remained highly rated. Overall, the findings suggest that

ICT integration is perceived to make teaching and learning more effective, engaging, and resource-rich in secondary schools in Zaria Local Government Area.

Research Question Three: What opportunities does ICT integration provide for enhancing students' engagement, collaborative learning, and access to educational resources in the study area?

Table 3: Descriptive Statistics on Opportunities Provided by ICT Integration

Opportunities Provided by ICT	N	Mean	std.dev
Enhances students' engagement in learning	674	4.26	0.59
Promotes collaborative learning among students	674	4.09	0.64
Improves access to educational resources	674	4.31	0.57
Overall Mean	674	4.22	0.60

Source: Field Survey, 2026

The results in table 3 show that respondents perceived ICT integration as providing significant opportunities for enhancing students' learning experiences. Access to educational resources recorded the highest mean ($M = 4.31$, $SD = 0.57$), followed by students' engagement ($M = 4.26$, $SD = 0.59$), while collaborative learning recorded the lowest mean ($M = 4.09$, $SD = 0.64$). The overall mean of 4.22 indicates a high level of perceived opportunities

provided by ICT integration for improving student engagement, collaborative learning, and access to educational resources.

Research Question Four: To what extent does ICT integration contribute to the development of digital skills and competencies among teachers and students in the study area?

Table 4: Descriptive Statistics on the Contribution of ICT Integration to Digital Skills and Competencies

Digital Skills and Competencies	N	Mean	std.dev
Enhances proficiency in using digital tools for teaching and learning	674	4.24	0.62
Improves the ability to access and evaluate digital information	674	4.19	0.64
Strengthens confidence in using ICT for academic activities	674	4.15	0.67
Overall Mean	674	4.19	0.64

Source: Field Survey, 2026

The findings presented in Table 4 demonstrate that respondents perceived ICT integration as making a substantial contribution to the development of digital skills and competencies among teachers and students. The highest-rated item was proficiency in using digital tools for

teaching and learning ($M = 4.24$, $SD = 0.62$), indicating that ICT integration enhances respondents' capacity to employ digital technologies for educational purposes. This was followed by the ability to access and evaluate digital information ($M = 4.19$, $SD = 0.64$). Confidence in using

ICT for academic activities recorded the lowest mean score ($M = 4.15$, $SD = 0.67$), although the rating remained high. The overall mean of 4.19 indicates that ICT integration contributes to the development of digital skills and competencies to a high extent among teachers and students in secondary schools in the study area.

Table 5: Pearson Correlation between ICT Integration and Instructional Quality and Effectiveness

Variables	N	Mean	Std. Dev.	r	Sig. (2-tailed)	Decision
ICT integration	674	4.18	0.61	0.68	0.000	H ₀₁ Significant
Instructional Quality and Effectiveness	674	4.21	0.60			

Source: Field Survey, 2026

The analysis shows a positive and statistically significant relationship between ICT integration and instructional quality and effectiveness ($r = 0.68$, $p < 0.05$). This indicates that greater ICT integration is associated with improved instructional quality and effectiveness. Since the significance value ($p = 0.000$) is below the 0.05 threshold, the null hypothesis is rejected. The study therefore concludes that ICT integration has a significant relationship

with instructional quality and effectiveness in secondary schools in Zaria Local Government Area.

H₀₂: There is no significant relationship between ICT integration and students' engagement, collaborative learning, and access to educational resources in secondary schools in Zaria Local Government Area.

Table 6: Pearson Correlation between ICT Integration and Students' Learning Opportunities

Variable	N	Mean	Std. Dev.	r	Sig. (2-tailed)	Decision
ICT Integration	674	4.18	0.61	0.71	0.000	H ₀₂ Significant
Student Engagement, Collaborative Learning and Access to Educational Resources	674	4.22	0.60			

Source: Field Survey, 2026

The results indicate a strong positive and statistically significant relationship between ICT integration and students' engagement, collaborative learning, and access to educational resources ($r = 0.71$, $p < 0.05$). This suggests that increased integration of ICT is associated with greater student engagement, improved collaborative learning, and better access to educational resources. Since the significance value ($p = 0.000$) is lower than the 0.05 level of significance, the null hypothesis is rejected. The study therefore concludes that ICT integration is significantly related to students' engagement, collaborative learning, and access to educational resources in secondary schools in Zaria Local Government Area.

Thematic Analysis of In-Depth Interview (IDI)

Semi-structured interviews were conducted with 12 head teachers and ICT coordinators from the selected secondary schools. The interview data were transcribed, coded, and analyzed using thematic analysis, leading to the identification of four major themes on ICT integration in teaching and learning.

Theme 1: ICT Integration Improves Instructional Quality

Participants generally reported that ICT integration improves instructional quality and effectiveness by making

lesson presentation clearer, more engaging, and easier to understand. They highlighted the use of multimedia, digital learning materials, and internet-based resources as important tools for improving teaching and students' comprehension.

A head teacher explained that:

"The use of projectors, videos, and online instructional resources has improved the effectiveness of lesson delivery by enabling students to visualize practical demonstrations and understand concepts more readily than through verbal explanations alone."

Similarly, an ICT coordinator observed that:

"Teachers who integrate ICT effectively into their lessons tend to demonstrate greater confidence and can present complex subject matter in simpler and more comprehensible ways."

These responses suggest that ICT integration enhances the quality and effectiveness of instructional delivery by improving content presentation, facilitating clearer explanations, and supporting better understanding of lesson concepts.

Theme 2: ICT Promotes Student Engagement and Collaborative Learning

Participants reported that ICT integration enhances students' participation and interaction during learning activities. They noted that digital and interactive resources stimulate learners' interest, encourage the exchange of ideas, and facilitate collaborative tasks. Overall, the findings suggest that ICT creates a more participatory and collaborative learning environment.

A head teacher reported that:

"Incorporating digital learning resources into lessons increases students' interest and active participation, while also encouraging them to pursue additional learning through online materials beyond the classroom."

Similarly, an ICT coordinator remarked:

"The use of digital platforms and educational applications has improved students' collaboration during group assignments by facilitating communication and the sharing of ideas and resources."

These accounts indicate that ICT integration provides meaningful opportunities for enhancing student engagement, collaborative learning, and access to educational resources, thereby supporting a more interactive and participatory learning process.

Theme 3: Constraints on Effective ICT Utilization

Participants acknowledged the benefits of ICT integration but identified several factors that limit its effective use in secondary schools. The major concerns included inadequate ICT facilities, unreliable electricity supply, limited internet access, insufficient funding, poor maintenance, and inadequate opportunities for teachers to develop relevant ICT skills. Participants indicated that these constraints hinder the effective application of digital technologies and consequently limit their contribution to instructional quality, student learning opportunities, and the development of digital competencies.

A head teacher explained that:

"Although teachers demonstrate willingness to incorporate ICT into classroom instruction, inadequate access to computers and disruptions in electricity supply often restrict consistent use of digital technologies."

Similarly, an ICT coordinator noted that:

"Poor internet connectivity and limited professional development opportunities constrain teachers' capacity to integrate ICT effectively into their lessons."

These accounts suggest that the effective utilization of ICT is influenced by the availability of essential infrastructure, dependable electricity and internet services, adequate

funding, and continuous professional development. Strengthening these conditions would enhance the effective integration of ICT and enable schools to derive greater educational benefits from digital technologies.

Theme 4: Measures for Enhancing Effective ICT Integration

Participants identified several measures for improving the effective and sustainable use of ICT in secondary schools. They emphasized the need for adequate ICT facilities, reliable electricity and internet services, regular professional development for teachers, sufficient funding, and sustained institutional support. Participants noted that addressing these areas would strengthen teachers' capacity to use digital technologies effectively and enable schools to maximize the contribution of ICT to teaching and learning.

A head teacher emphasized that:

"There is need for schools to be equipped with adequate ICT facilities and for teachers to receive regular training to strengthen their ability to integrate digital technologies into classroom instruction."

Similarly, an ICT coordinator remarked:

"ICT should be incorporated systematically into teaching and learning rather than used only as an optional instructional aid."

Overall, the qualitative evidence supports the quantitative findings that ICT integration contributes to improved instructional quality, student engagement, collaborative learning, access to educational resources, and the development of digital competencies. Participants, however, noted that achieving these benefits requires adequate technological resources, continuous professional development, supportive institutional measures, and a reliable technological environment.

Summary of Findings

The findings of the study revealed that:

- i. Information and Communication Technology (ICT) integration significantly improves instructional quality and effectiveness and is positively perceived by teachers and students in secondary schools in Zaria Local Government Area. Its use supports clearer lesson delivery, facilitates understanding of subject content, and enhances the overall teaching and learning process.
- ii. Information and Communication Technology (ICT) integration provides substantial opportunities for student engagement, collaborative learning, access to educational resources, and the development of digital skills

and competencies. It promotes active participation, peer interaction, wider access to learning materials, and greater confidence and proficiency in the use of digital technologies among teachers and students.

Discussion

The first major finding revealed that ICT integration enhances instructional quality and effectiveness and is positively perceived by teachers and students in secondary schools in Zaria Local Government Area. The respondents indicated that ICT-supported instruction improves the presentation of lesson content, facilitates the explanation of difficult concepts, and enhances the effectiveness of classroom teaching. This suggests that the educational value of ICT is largely dependent on how effectively teachers incorporate digital tools and resources into their instructional practices. The finding is consistent with Msafiri et al. (2023), who reported that effective ICT integration can improve teaching and learning processes, including the use of shared learning resources and more personalized approaches to instruction. It is also consistent with the UNESCO (2023) Global Education Monitoring Report, which recognizes that digital technology can support teaching quality by providing additional ways of presenting content, increasing opportunities for practice, and facilitating interaction and collaboration. The findings further correspond with the studies of Asuquo et al. (2024), Gcabashe (2024), and Oskarita and Arasy (2024), as reported in the reviewed literature, which emphasize the contribution of ICT to effective instructional practices and technology-supported learning.

The finding can also be explained through the Technology Acceptance Model (TAM) developed by Davis (1989). TAM proposes that perceived usefulness and perceived ease of use influence users' acceptance and utilization of technology. In the present study, teachers' and students' positive perceptions of ICT suggest that they recognize its usefulness in improving lesson presentation, understanding, and access to learning resources. Such perceptions can encourage greater utilization of ICT in teaching and learning. The finding therefore supports the study's conceptual position that perceived usefulness and ease of use influence ICT utilization, which subsequently contributes to improved teaching and learning outcomes. However, the UNESCO (2023) report cautions that the educational benefits of technology are not automatic and depend on appropriate implementation, teacher capacity, and the conditions in which technology is used.

The second major finding showed that ICT integration provides substantial opportunities for student engagement, collaborative learning, access to educational resources, and the development of digital skills and competencies among

teachers and students. The findings indicate that ICT-supported learning encourages students to participate more actively, interact with their peers, access a wider range of learning materials, and develop greater confidence and proficiency in using digital technologies. This finding is supported by Msafiri et al. (2023), whose systematic review identified improved access to shared learning resources, student engagement, learning opportunities, and skills development among the benefits associated with ICT integration in secondary education. Similarly, UNESCO (2023) reported that digital technology can facilitate access to educational content, communication, collaboration, and the development of digital skills, while also emphasizing that technology should complement rather than replace meaningful human interaction in education. The finding is also in agreement with Asuquo et al. (2024), Gcabashe (2024), and Oskarita and Arasy (2024), whose studies, as reflected in the reviewed literature, highlight the role of ICT in promoting learner participation, technology-supported collaboration, access to learning resources, and digital competence.

The qualitative findings further reinforce this result. Participants reported that the use of digital learning resources increased students' participation, facilitated collaboration during group activities, and enabled learners to access educational materials beyond the classroom. These observations suggest that ICT can create a more participatory learning environment in which students are not limited to receiving information from the teacher but can also interact with digital resources, communicate with peers, and explore additional sources of knowledge. From the perspective of TAM, these outcomes may be associated with users' perception that ICT is useful for accomplishing academic tasks. When teachers and students perceive digital technologies as useful and manageable, they are more likely to incorporate them into teaching and learning activities.

Overall, the findings demonstrate that ICT integration has considerable potential to strengthen instructional quality while expanding students' opportunities for engagement, collaboration, resource access, and digital competency development. Nevertheless, the qualitative evidence indicates that these benefits are influenced by contextual conditions, including the availability of ICT facilities, reliable electricity and internet connectivity, and opportunities for teacher professional development. This is consistent with the broader literature, which emphasizes that technology alone does not guarantee improved educational outcomes; effective integration requires appropriate infrastructure, teacher capacity, pedagogical support, and purposeful use of digital technologies. Thus, the findings provide support for the TAM-based

proposition that positive perceptions of ICT usefulness and ease of use can encourage utilization, while the prevailing school environment determines the extent to which such utilization can translate into meaningful improvements in teaching and learning.

Conclusions

Based on the findings, the study concludes that ICT integration makes a significant contribution to teaching and learning in secondary schools in Zaria Local Government Area. It enhances instructional quality and effectiveness and is positively perceived by teachers and students as a useful resource for supporting classroom instruction. The study further concludes that ICT integration provides substantial opportunities for student engagement, collaborative learning, access to educational resources, and the development of digital skills and competencies among teachers and students. However, the extent to which these benefits are realized depends on the effective and purposeful use of ICT, supported by adequate infrastructure, reliable electricity and internet connectivity, continuous professional development, and appropriate institutional support. Thus, the educational benefits of ICT are maximized when technology is effectively integrated into pedagogical practices and supported by a conducive school environment.

Recommendations

In line with the findings of this study, the following recommendations are made:

1. Teachers should incorporate ICT into classroom instruction to improve instructional quality and effectiveness. Schools should encourage teachers to include appropriate digital tools in lesson planning and classroom activities, with ICT coordinators providing technical and pedagogical support.
2. Government and school authorities should ensure the availability and functionality of essential ICT facilities. Relevant agencies should provide computers, multimedia equipment, reliable internet, and stable electricity, while schools establish regular maintenance and monitoring systems.
3. Teachers should receive regular training to strengthen their digital and pedagogical competencies. Education authorities and school management should organize periodic workshops, practical ICT training, peer mentoring, and refresher programmes based on identified training needs.
4. Schools should promote the use of digital platforms and educational applications to support

engagement, collaboration, resource access, and digital competency development. School should also identify suitable educational platforms, provide students with structured opportunities to use them, and integrate technology-supported collaborative and independent learning activities into classroom practice.

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