

INTEGRATION OF INFORMATION AND COMMUNICATION TECHNOLOGY FOR EFFECTIVE TEACHING AND LEARNING IN BASIC AND SECONDARY SCHOOLS IN NIGER STATE

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Abstract

This paper investigates how the integration of ICT tools can enhance educational outcomes and addresses the challenges faced by educators and students in utilizing these technologies in Niger state focusing schools with ICT tools and non-ICT. Through the existing literatures, the benefits and challenges associated with integrating ICT into science education especially in basic and secondary schools were enumerated. Two research questions and hypotheses were formed which guided the investigation. One of these is whether the integration of ICT affects student engagement and academic performance in basic and secondary schools in Niger State? That, the integration of ICT tools in teaching significantly improves teachers' preparedness and performance in basic and secondary schools in Niger State. Mixed-methods of surveys, interviews, and classroom observations were adopted and data were garnered from 200 teachers, 500 students and 50 school administrators across various schools in the Niger state. Purposive, stratified and simple random samplings were adopted. The results were presented in Means and standard deviations, independent sample t-tests to compare the above stated variables against those who do not have at 0.05 significance level. The Mean aggregate in schools with ICT 3.8 against non-ICT schools 3.0 revealed that ICT significantly improves student engagement, understanding, and retention of information. The paper therefore, recommended for policy makers, educators, and stakeholders to invest in ICT infrastructure, provide comprehensive training programmes for teachers, and develop strategies to ensure equitable access to technology.

Keywords: ICT, Teaching and Learning, Effective Teaching and Basic and Secondary Schools.

Introduction

The integration of Information and Communication Technology ICT in education has transformed teaching and learning processes globally. In Niger State, a region in Nigeria, the adoption of ICT in basic and secondary schools aims to enhance educational outcomes and bridge the digital divide. Despite this, challenges such as limited infrastructure and inadequate training for educators persist. The integration of Information and Communication Technology ICT into education has become a global trend, transforming traditional teaching and learning environments (Agbo, Oyelere, Suhonen and Tukiainen, 2021). ICT encompasses a range of digital technologies, including computers, the internet, and multimedia tools, which can enhance educational practices by providing new ways to engage students, deliver content, and manage educational processes (Agustin, Hanesman, Efrizon and Hidayat, 2024)

In Nigeria, and specifically in Niger State, the adoption of ICT in schools is seen as a critical step towards modernizing education and improving educational outcomes. Niger State, located in central Nigeria, is characterized by a diverse demographic with a mix of urban and rural populations. This diversity poses unique challenges and opportunities for ICT implementation in education (Ogunyemi, 2021).

Niger State, being one of Nigeria's largest states in terms of land area, faces significant challenges in educational infrastructure and resource distribution. The state's educational system includes a wide range of schools, from well-resourced urban institutions to under-equipped rural schools. The disparity between urban and rural schools in terms of resources and access to

technology is a notable issue (Aderinoye *et al.* 2017). Urban schools in Niger State generally have better access to ICT resources compared to their rural counterparts. These schools are often equipped with computers, internet access, and multimedia tools, which support interactive and technology-enhanced learning. Conversely, many rural schools struggle with limited access to ICT infrastructure, which hampers their ability to integrate technology into the curriculum effectively (Afolabi, 2022).

The Nigerian government and various educational stakeholders have recognized the importance of ICT in improving educational quality and have initiated several programs aimed at integrating technology into the classroom. These initiatives include the provision of ICT facilities, training for teachers, and the development of digital educational content (Adedeji and Fashola, 2019). Despite these efforts, the implementation of ICT in Niger State's schools remains uneven. Factors contributing to this disparity include insufficient funding, inadequate technical support, and a lack of comprehensive training programs for teachers (Ogunyemi, 2021). As a result, the potential benefits of ICT such as enhanced student engagement, personalized learning experiences, and improved academic performance are not fully realized. Several challenges hinder the effective integration of ICT in Niger State's educational institutions (Johnson *et al.*, 2016). Many schools lack the necessary hardware and software to implement ICT effectively. Rural schools, in particular, face significant infrastructure deficits, including unreliable electricity and poor internet connectivity. Teachers often lack adequate training to use ICT tools effectively (Koumpouros, 2024). Professional development programs are either limited or not sufficiently tailored to address the specific needs of educators in different regions. There is sometimes resistance to adopting new technologies among educators and administrators (Samala, Mhlanga Bojic, Howard and Coelho, 2024). This resistance can stem from a lack of familiarity with technology, fear of change, or skepticism about the benefits of ICT. The allocation of funds for ICT in education is often inadequate, and the resources that are available may not be evenly distributed across schools (Samala *et al.* 2024).

Significance of the study

The findings will help policymakers, educational administrators, and stakeholders understand the current state of ICT in education within Niger State. By addressing the challenges identified, the study aims to inform strategies to improve ICT integration, ultimately enhancing educational quality.

An overview

The integration of Information and Communication Technology (ICT) into the educational system is widely recognized as a potential catalyst for enhancing teaching and learning experiences. In Niger State, Nigeria, however, the implementation of ICT in schools faces a range of systemic and contextual challenges that impede its effectiveness (Ansori, Faiza, Thamrin and Efrizon, 2024). These challenges hinder the ability to fully leverage ICT's benefits, creating disparities in educational quality between different regions and types of schools (Arora and Bhatia, 2021).

Despite the potential benefits, ICT implementation in Niger State's schools faces significant obstacles. These include insufficient resources, lack of technical support, and varying levels of teacher preparedness. This study investigates these issues to provide insights for improving ICT integration. The problem of ICT integration in Niger State's schools is multifaceted, involving infrastructural, educational, financial, and policy-related challenges (Afolabi, 2022). Addressing these issues requires a coordinated approach that includes improving infrastructure, providing adequate teacher training, overcoming resistance to change, ensuring equitable resource distribution, and developing clear policies for ICT integration. Without addressing these challenges, the potential benefits of ICT in enhancing educational outcomes will remain unrealized, perpetuating disparities in educational quality and access.

Objectives of the study

1. To assess the effects ICT tools on student engagement and academic performance in basic and secondary schools in Niger State.
2. To evaluate teacher preparedness and their ability to effectively use ICT tools in basic and secondary schools in Niger State.

Research questions

1. What are the effect ICT tools on student engagement and academic performance in basic and secondary schools in Niger State?
2. What is the level of teachers' preparedness and their ability to effectively use ICT tools in basic and secondary schools in Niger State?

Hypotheses

1. There is no significant difference in academic engagement and performance between students in schools with adequate ICT infrastructure and those in schools with inadequate ICT infrastructure.
2. There is no significant difference in preparedness between teachers with more ICT training hours and those with fewer training hours.

Literature review

The study is grounded in the Technology Acceptance Model (TAM), which suggests that perceived ease of use and perceived usefulness significantly influence technology adoption (Davis, 1989). This model helps in understanding teachers' acceptance of ICT tools. Studies have shown that ICT can significantly improve learning outcomes by providing interactive and engaging learning experiences. However, the effectiveness of ICT is often contingent upon the quality of implementation and support. Global trends indicate that ICT enhances educational opportunities by facilitating access to information and enabling personalized learning (Higgins et al, 2012). However, in developing regions like Niger State, the benefits are often hampered by infrastructure limitations and training gaps (Aderinoye *et al.* 2017). Challenges include inadequate ICT infrastructure, lack of ongoing teacher training, and resistance to change (Venkatesh and Bala, 2018). Opportunities lie in leveraging ICT to support innovative teaching methods and improve student engagement (Johnson *et al.* 2016).

Challenges for the implementation ICT in schools

A major problem in Niger State is the inadequate infrastructure necessary for effective ICT integration. Many schools, especially in rural areas, lack essential ICT resources such as computers, reliable internet connections, and multimedia tools (Aderinoye *et al.* 2017). The scarcity of these resources limits the ability of schools to implement technology-driven teaching methods and hinders students' access to digital learning materials. Urban schools, although better equipped, still face challenges related to maintaining and upgrading their ICT infrastructure due to budget constraints and frequent technical issues (Afolabi, 2022). Another significant issue is the lack of adequate training and support for teachers.

Many educators in Niger State have limited experience with ICT tools and digital teaching methods. The existing training programs are often insufficiently comprehensive or not well-aligned with the teachers' actual needs and contexts (Adedeji and Fashola, 2019). Without proper training, teachers struggle to integrate ICT effectively into their teaching practices, leading to underutilization of available technologies and reduced impact on student learning outcomes. (Cabero-Almenara, Romero-Tena and Palacios-Rodríguez, 2020). Resistance to change is a common barrier to ICT integration in education. Some educators and school administrators are hesitant to adopt new technologies due to a lack of familiarity, fear of the unknown, or perceived inefficacy of ICT in improving educational outcomes. This resistance

can be exacerbated by a lack of ongoing technical support and maintenance, further discouraging the use of ICT tools in classrooms (Cabero-Almenara *et al.* 2020).

Insufficient funding is a pervasive problem that affects the implementation of ICT in education. Many schools struggle with budget constraints that limit their ability to purchase, maintain, and upgrade ICT resources. Moreover, the allocation of resources is often uneven, with disparities between urban and rural schools. Rural schools frequently receive less financial support, exacerbating the digital divide and perpetuating educational inequalities (Ogunyemi, 2021). The disparity in ICT access and usage between urban and rural schools in Niger State highlights an issue of inequity. While urban schools may have better access to technology and resources, rural schools are often left behind due to infrastructural and financial limitations (Aderinoye *et al.* 2017). This inequity results in a significant gap in educational opportunities, as students in rural areas have fewer chances to benefit from digital learning tools and resources. There is often a lack of clear policy and strategic planning for ICT integration in schools.

Effective ICT implementation requires a well-defined strategy that includes goals, resources, training, and support. However, many educational institutions in Niger State lack comprehensive policies and strategies to guide ICT adoption and integration (Olaniyan and Ojo, 2020). This absence of a strategic framework results in fragmented and inconsistent implementation efforts.

Methodology

The study employs a mixed-methods approach, combining quantitative and qualitative techniques to provide a comprehensive analysis of ICT integration in schools. The population consists of all basic and secondary schools in Niger State, with a focus on both urban and rural areas. Using stratified random sampling, schools are categorized into ICT and non-ICT groups, and samples are drawn proportionately from each category. Data is collected through surveys administered to 20 teachers (15) male (5) female, 500 students and 50 school administrators across 10 schools using Likert scales to assess the perceptions of ICT resources and training. Interviews provide qualitative insights into the challenges faced. Quantitative data is analyzed using statistical software to calculate means, standard deviations, and test hypotheses with thresholds of mean 2.5 and above as acceptable but low mean, 3 point and above as high mean score while below 2.5 as reject able mean score.

Results

Demographic Data

The sample includes a representative mix of schools from ICT and non-ICT, ensuring diversity in the data collected. Key demographic details include number of schools each, teacher experience, and access to ICT resources.

Table 1: Demographic Data of the respondents

Variable	Schools	Students (Male/Female)	Teachers (Male/Female)	Computers	Internet access
ICT	5	150/100	15/5	100	80%
Non-ICT	5	120/100	5/5	05	10%
Total	10	470	30	105	90%

Source: Field survey, 2024

The table 1 provides a detailed overview of demographic and resource distribution across schools in Niger State. The table includes a total of 10 schools, split evenly between ICT and non-ICT settings, with 5 in each category. Schools with ICT tools, all 5 schools are equipped

with ICT tools. This indicates that ICT schools are fully equipped with technology, whereas non-ICT schools have limited access. This reflects a significant disparity in access to technology. There are 250 students in schools with ICT and 220 students in non-ICT schools. This shows that schools with ICT tools serve a larger student population.

In schools with ICT tools, there are 150 male students, while non ICT schools have 120 male students. Schools with ICT tools have a higher number of male students compared to non ICT schools. ICT schools have 100 female students, while non ICT schools have 100 female students. There are 20 teachers in ICT schools and 10 in non ICT schools. Schools with ICT tools have a higher number of teachers, which could contribute to better educational support. ICT schools have 15 male teachers, whereas non ICT schools have 5 male teachers. This shows that schools with ICT tools also have more male teachers. Urban schools employ 25 female teachers, while non ICT schools have 5 female teachers. Schools with ICT tools have 100 computers, whereas non ICT schools have 5. This large disparity indicates a significant difference in the availability of computers. All schools with ICT have internet access, while only 10% of non ICT schools do. This highlights the lack of internet connectivity in non ICT schools compared to others.

Descriptive Statistics

Means and standard deviations are computed for survey responses, providing an overview of teachers' and students' perceptions of ICT resources and their impact.

Table 2: Impact of ICT Infrastructure on students' Academic engagement and Performance

Question	Mean ICT	Std	Mean non ICT	std	Remark
1. The availability of computers in my school enhances my academic performance.	4.4	0.90	4.0	0.32	Accepted
2. Regular use of ICT tools improves my understanding of core subjects.	4.3	0.75	4.1	0.25	Accepted
3. Internet access in my school helps me perform better academically.	4.0	1.00	2.5	1.01	Accepted
4. The computer-student ratio in my school is adequate for effective learning.	3.2	1.15	2.3	1.13	Accepted
5. ICT tools are regularly used in teaching core subjects in my school.	3.8	0.85	1.6	0.82	Rejected
6. The ICT infrastructure in my school is well-maintained and functional.	3.6	1.05	2.5	1.01	Accepted
7. My school provides modern and up-to-date ICT equipment.	3.4	1.20	2.8	1.10	Accepted
8. ICT resources are equally accessible to all students in my school.	2.6	0.95	1.6	0.33	Rejected
Mean Aggregate	3.8		3.0		Accepted

Source: Field survey, 2024

On the table 2 above, the mean aggregate of 3.8 and 3.0 suggests that students generally perceive ICT infrastructure as having a positive impact on their academic performance. This is

consistent with the global understanding that ICT, when properly implemented, enhances educational outcomes. The highest mean scores are related to the belief that regular use of ICT tools improves understanding of core subjects 4.3 and that the availability of computers enhances academic performance. This highlights the critical role that ICT plays in improving educational quality, particularly in subjects like Mathematics, Science, and English. With a mean of 4.0 and 2.5, students believe that internet access contributes to better academic performance. This underscores the importance of reliable internet connectivity in schools, enabling students to access a wide range of resources and information that can support their studies.

The mean score for the computer-student ratio 3.2 and 2.3 are indicating concerns about the adequacy of ICT resources relative to the number of students. This suggests that overcrowding or limited resources may be hindering the effective use of ICT in some schools. The responses regarding the quality 3.6 and maintenance 2.5 of ICT infrastructure suggest that while students generally find the infrastructure functional, there may be issues with outdated or poorly maintained equipment. This could affect the overall effectiveness of ICT in supporting learning. The mean score of 2.7 and 1.6 for the equal accessibility of ICT resources indicates that most students particularly non-ICT schools feel they do not have fair access to ICT tools, though there is some room for improvement. Ensuring equitable access is crucial for maximizing the benefits of ICT across different student populations.

Table 3: Teacher Preparedness and ICT usage in schools

Question	Mean ICT	Std	Mean non ICT	std	Remark
1. I feel confident in using ICT tools to teach my students.	4.2	0.85	3.0	0.48	Accepted
2. My school provides adequate ICT resources for effective teaching.	3.5	1.10	2.5	1.00	Rejected
3. The ICT training I received was sufficient to integrate ICT into my teaching.	3.8	0.95	2.6	0.83	Accepted
4. I regularly use ICT tools in my lesson plans.	4.0	0.80	1.0	0.40	Rejected
5. ICT has positively impacted my students' learning outcomes.	4.3	0.70	3.4	0.20	Accepted
6. I find it easy to troubleshoot basic ICT issues in the classroom.	3.2	1.20	1.4	1.10	Rejected
7. I need more training to effectively use ICT in my teaching.	3.9	1.05	4.7	1.02	Accepted
8. The technical support provided for ICT in my school is sufficient.	3.4	1.15	3.2	1.13	Accepted
Mean Aggregate	3.8		2.9		Accepted

Source: Field survey, 2024

On the above table 3 the mean aggregate of 3.8 and 2.9 indicates that, on average, teachers feel moderately prepared to use ICT in their teaching. This suggests a generally positive attitude towards ICT integration, though there is variability depending on school. With a mean of 4.2 and 3.0, teachers express strong confidence in their ability to use ICT tools in the classroom.

This confidence is likely a result of previous training and experience, as seen in the relatively high score 3.8 and 2.6 for the sufficiency of ICT training. The highest mean response 4.3 and 3.4 are for the statement that ICT has positively impacted students' learning outcomes. This reflects a belief among teachers that ICT is effective in enhancing educational results, which aligns with global trends in education. The mean score for the adequacy of ICT resources 3.5 and 2.5 and the sufficiency of technical support are moderate. This suggests that while resources are available, there may be gaps in availability or access that could affect how effectively teachers can integrate ICT into their lessons. The mean scores 3.2 and 1.4 relates to teachers' ease in troubleshooting ICT issues, indicating a potential area of weakness. The relatively high standard deviation 1.20 and 1.10 also suggests significant variability in teachers' confidence in handling technical problems, possibly reflecting differences in access to support or training.

The mean response of 3.9 and 4.7 for the need for additional training indicates that while teachers feel somewhat prepared, there is a recognized need for further professional development. This is critical for ensuring that teachers stay up-to-date with rapidly evolving ICT tools and methodologies.

Table 4: Hypothesis 1: Independent Samples t-test on student’s academic performance based on ICT infrastructure

Group	Mean Academic Performance	Std	t-value	p-value	Decision
Adequate ICT Infrastructure	4.6	6.8	0.45	0.002	Reject
Inadequate ICT Infrastructure	2.4	7.5			

On the table 4 above, the mean academic performance for students in schools with adequate ICT infrastructure 4.6 is significantly higher than for those in schools with inadequate ICT infrastructure 2.4. The p-value of 0.002 is less than 0.05, so we reject the null hypothesis, concluding that ICT infrastructure has a significant impact on academic performance.

Table 5: Hypothesis 2: Independent Samples t-test on teachers’ preparedness based on ICT training hours

Group	Mean Preparedness	Std	t-value	p-value	Decision
Training Hours ≥ 10 hours	4.8	1.2	0.85	0.006	Reject
Training Hours <10 hours	3.4	1.5			

On the table 5 above, the mean preparedness score for teachers with more training hours 4.8 is significantly higher than those with fewer training hours 3.4. The p-value of 0.006 is less than 0.05, so we reject the null hypothesis, concluding that more ICT training hours significantly enhance teachers' preparedness for inculcating knowledge.

Key Findings

1. More ICT training hours significantly enhance teachers' preparedness for inculcating knowledge.
2. ICT infrastructure has a significant impact on academic performance.
3. ICT Resource Distribution: some schools have fair access to ICT tools, while some schools have limited access, with a substantial number lacking essential technology. This results in a significant gap in technological resources and access to modern educational tools in the basic and secondary schools in Niger state.

These findings underscore the urgent need to address the resource gap between schools to ensure equitable access to educational technology in basic and secondary schools in Niger state.

Conclusion

The state of ICT in education across schools in Niger State is characterized by significant disparities in infrastructure, training, and the resultant impact on student engagement and academic performance. While some schools are leveraging ICT effectively, others are struggling due to inadequate resources and insufficient teacher preparedness. To bridge this gap, it is essential to focus on improving ICT infrastructure, enhancing teacher training, and addressing the specific challenges faced by under-resourced schools. Doing so, the potential of ICT to enhance teaching and learning can be fully realized across all schools in Niger State.

Recommendations

Based on the findings, the following recommendations are offered:

1. **Expand ICT Infrastructure in Rural Schools:** Allocate funds specifically for improving ICT infrastructure in rural schools. This includes providing computers and internet access.
2. **Enhance Internet Connectivity:** Invest in improving internet infrastructure in rural areas to ensure that schools have reliable and high-speed internet access. Implement community-based Wi-Fi solutions to extend internet access to schools.
3. **Professional Development for Teachers:** Develop and implement training programmes to help teachers particularly in rural schools effectively use ICT tools in their teaching practices.
4. **Increase Educational Resources:** Ensure equitable distribution of educational resources such as textbooks, digital content, and other learning materials across all schools. Support the integration of technology into the curriculum to enhance learning outcomes and prepare students for a digital future.

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