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Strategies for the Effective Implementation of Information and Communication Technology (ICT) in Colleges of Education, Enugu State

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Abstract

The purpose of this was to identify the effective strategies for implementing Information and Communication Technology (ICT) in Enugu State Colleges of Education. It assessed ICT implementation strategies in three colleges of education in Enugu State, concentrating on their scope, gender disparities, and techniques used across federal, state, and private colleges in the state. The study aimed to identify research variables based on behaviorist, cognitivist, and constructivist theories and their application in ICT and teacher education. The target population consisted of 2,500 100-level pre-service teachers from the three colleges of education. A proportionate stratified random sampling technique was used to select the sample from the three colleges of education in the state. 125 pre-service teachers participated in the study. The study used a descriptive survey research design, and pilot testing was conducted to ensure the validity and reliability of the questionnaire. The data were analyzed using both descriptive and inferential statistics using the Statistical Package for Social Scientists (SPSS). The results showed that ICT implementation in colleges of education is not fully utilized, resulting in low educational objectives. Based on the findings, it is recommended that the government, curriculum planners, in-service and pre-service teachers, and educational institutions be more proactive in adopting strategies that enhance the effective implementation of ICT in colleges of education.

A. Introduction

The rapid advancement of Information and Communication Technology (ICT) has transformed educational practices globally, reshaping the processes of teaching, learning, and information dissemination (Kalolo, 2019; Ukpe, 2023). In Nigeria, ICT's role in education is increasingly acknowledged as critical for enhancing quality, accessibility, and relevance in academic settings, particularly in preparing students for a digitally oriented world (Jummai, 2021; Oyedokun & Adeolu-Akande, 2022). Colleges of Education in Enugu State have initiated efforts to integrate ICT to foster digital literacy and teaching proficiency among educators and students (Egwuekwe et al., 2023; Ile & Alonta, 2019). However, despite its recognized potential to elevate educational outcomes, successful implementation of ICT in Nigerian educational institutions faces considerable challenges, such as limited infrastructure, inadequate training, and policy constraints (Dada et al., 2021).

A review of recent literature highlights both global and local perspectives on ICT integration in education. Studies from developed countries emphasize the positive impact of ICT on student engagement, collaborative learning, and access to a wide array of educational resources (Serrano et al., 2019). In the Nigerian context, researchers like Martens et al (2020) underscore the persistent barriers to ICT adoption, including insufficient infrastructure, limited access to technical support, and a lack of professional

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development for educators. Furthermore, policy-level support for ICT, as expressed in the National Policy on Education, aims to encourage technology integration across educational institutions. However, a significant gap exists between policy directives and actual practices in Colleges of Education (Igwe et al., 2021). This inconsistency highlights the need for strategic, actionable approaches to improve ICT adoption, especially within teacher-training institutions in Enugu State.

Despite these insights, few studies have thoroughly explored context-specific strategies for effective ICT implementation in Colleges of Education in Enugu State. While various efforts have been made to integrate ICT, ongoing challenges remain, impacting its practical application and effectiveness. A literature gap exists in terms of exploring tailored strategies that can be realistically implemented given the unique socio-economic, infrastructural, and educational context of Enugu State's Colleges of Education.

The rationale for this study is rooted in the necessity to create a structured framework for ICT integration that addresses these persistent challenges in Enugu State's Colleges of Education. Given the pivotal role of teacher education in shaping the quality of primary and secondary education, formulating strategies to enhance ICT adoption is imperative. Effective ICT integration strategies will not only empower educators but also improve overall educational quality and accessibility (Olojo, 2021).

Therefore, the purpose of this study is to investigate and identify strategies for effectively implementing ICT in Colleges of Education in Enugu State. The study aims to uncover key factors that support successful ICT adoption, analyze the specific challenges faced by stakeholders, and propose practical solutions to strengthen ICT infrastructure, improve teacher preparedness, and foster institutional support. This research intends to contribute valuable insights into the creation of an ICT implementation framework, thereby fostering a technology-enabled learning environment in Nigerian Colleges of Education.

This research aims to identify effective strategies for implementing Information and Communication Technology (ICT) in Enugu State Colleges of Education, as it is crucial for the National Commission for Colleges of Education's goals of training and equipping teachers. Specifically, the study aims to identify the extent of ICT implementation strategies in Colleges of Education in Enugu State, identify the difference of ICT strategies among males and females in Colleges of Education in Enugu State, and determine the strategies for ICT implementation among the Federal, State and Private Colleges of Education in Enugu State. The following formulated hypotheses will be tested at 0.05 level of significance: 1) There is no significant difference for implementing ICT strategies among Federal, State and Private Colleges of Education in Enugu state, Nigeria, 2) There is no significant gender difference in the strategies for the implementation of ICT among the Federal, State and Private Colleges of Education in Enugu state, Nigeria.

B. Research Methods

This study used a descriptive survey research design to collect data on the implementation of Information and Communication Technology (ICT) in Colleges of Education in Enugu state. The population consisted of 2,500 Level 100 pre-service teachers, with a sample size of 125 from Federal and state Colleges of Education in Enugu State. The study employed a proportionate stratified random sampling technique and used a questionnaire called "ICT Implementation Questionnaire" (ICTIQ). The questionnaire contained 30 items and was validated by three experts from the Department of Arts Education and the Department of Science Education at the University of Nigeria, Nsukka. A pilot test was conducted to ensure the instrument's reliability and suitability. The Cronbach's Alpha reliability coefficient of 0.72 was used for internal consistency. The researcher administered the validated instrument to the 125 in-service teachers in the study area, ensuring 100% collection of the questionnaires. The data collected were analyzed using descriptive and inferential statistics.

C. Results and Discussion

Research Question One: What is the extent of ICT implementation strategies in Colleges of Education in Enugu State?

Table 1. Extent of ICT implementation strategies in Colleges of Education in Enugu State

S/N	Item Statements	Mean	Remark
1	There are ICT equipment for implementation in Colleges of Education in Enugu State	1.47	Rejected

S/N	Item Statements	Mean	Remark
2	There low extent of ICT implementation by lecturers in Colleges of Education in Enugu State	3.22	Accepted
3	ICT implementation is carried out in every academic functions in Colleges of Education in Enugu State	1.54	Rejected
4	There is poor implementation of ICT in Colleges of Education in Enugu State	3.05	Accepted
5	ICT implementation is hampered by the skills required for it	3.02	Accepted
6	The strategies adopted by lecturers to implement ICT in Colleges of Education in Enugu State is not effective	3.32	Accepted
7	Students are trained on measures to effectively implement ICT in classroom	2.25	Rejected
8	Teachers effectively implement ICT in classroom in Colleges of Education in Enugu State	1.52	Rejected
9	ICT implementation is considered primarily for teachers on training in colleges of Education in Enugu State	2.01	Rejected
10	ICT strategies when implemented will contribute positively to teaching and learning	2.59	Accepted
	GRAND MEAN ($\overline{X}$)	**2.4**	**Rejected**

Results in table 1 shows that the respondent accepted 6 items and rejected 4 items out of 10 on the extent of ICT implementation strategies in Colleges of Education in Enugu State. The mean **($\overline{X}$)** of each of the items range from 1.47 to 3.32 giving a grand mean **($\overline{X}$)** of 2.4 which by the rating scale fall under the disagree rule. This therefore establishes the extent of ICT implementation strategies in Colleges of Education in Enugu State, which is negative.

Research Question Two: What is the difference in the ICT strategies among males and females in Colleges of Education in Enugu State?

Table 2. Difference in ICT strategies of males and females in Colleges of Education

S/N	Item Statements	Mean	Remark
1	Females adopts ICT strategies than males in Colleges of Education in Enugu State	2.36	Rejected
2	Males adopt ICT strategies than females in Colleges of Education in Enugu State	1.48	Rejected
3	ICT strategies influence males than females in Colleges of Education in Enugu State	3.36	Accepted
4	ICT strategies influence females than males in Colleges of Education in Enugu State	2.20	Rejected
5	Females are knowledgeable of ICT strategies than males	2.40	Rejected
6	Males are knowledgeable of ICT strategies than Females	3.34	Accepted
7	Females are more in colleges of education so affect ICT strategies in Colleges of Education in Enugu State	3.08	Accepted
8	Males are more in colleges of education in Enugu state so affect ICT strategies	1.70	Rejected
9	Gender is a factor when considering ICT implementation in Colleges of Education in Enugu State	1.29	Rejected
10	Female teachers implement ICT strategies than male teachers in Colleges of Education in Enugu State	2.56	Accepted
	Grand Mean ($\overline{X}$) =	**2.4**	**Rejected**

Results in table 2 shows that of the 10 items stated, the respondents accepted 6 items and rejected 4 items on the influence of ICT strategies among males and females in Colleges of Education in Enugu State. The mean **($\overline{X}$)** of each of the items range from 1.29 to 3.36 giving a grand mean **($\overline{X}$)** of 2.4 which by the rating scale fall under the disagree rule. This therefore establishes the influence of ICT strategies among males and females in Colleges of Education in Enugu State, which is negative. This therefore shows that gender does not influence the strategies for ICT implementation in Colleges of Educations in Enugu State.

Research Question Three: What are the strategies for ICT implementation among the Federal, State and Private Colleges of Education in Enugu State?

Table 3. Strategies for ICT Implementation Among Federal, State and Private Colleges of Education in Enugu State

S/N	Item Statements	Federal Mean	State Mean	Private Mean	Grand Mean	Remark
1	Facilitate funding mechanisms for ICT implementation	2.25	1.17	1.26	1.56	Rejected
2	Ensure suitability/readiness of school environment for incorporation of ICT	2.43	2.17	2.40	2.33	Rejected
3	Foster constructive partnerships with private sector and NGO organizations for ICT development	2.35	3.47	3.46	3.09	Accepted
4	Adopt a prudent approach in the procurement and management of ICT hardware and software	3.53	2.27	2.51	2.77	Accepted
5	Ensure an effective maintenance and technical support mechanism.	2.38	2.33	1.60	2.10	Rejected
6	Encourage and support research on and evaluation of the impact of ICT in the education system.	2.48	2.23	2.54	2.42	Rejected
7	Effective use of ICTs in College Administration	2.50	2.23	2.54	2.42	Rejected
8	Benchmarking other colleges	2.52	2.10	2.49	2.37	Rejected
9	Enhancing Partnership and Collaboration	2.45	2.07	2.51	2.34	Rejected
10	Lack of willpower by management to embrace ICT-revolution affect ICT implementation in colleges of education	3.47	3.40	3.40	3.42	Accepted
	Cumulative Mean ($\overline{X}$) =	**2.6**	**2.3**	**2.4**	**2.4**	**Rejected**

Results in table 3 shows that of the 10 items stated, 5 were accepted while 5 were rejected by the respondent on the strategies adopted for ICT implementation among Federal, State and Private Colleges of Education in Enugu State. The mean **($\overline{X}$)** of each of the items range from 1.17 to 3.54 giving a cumulative mean **($\overline{X}$)** of 2.4 which by the rating scale fall under the disagree rule. This therefore shows the strategies adopted by the various school types (Federal, State and Private) for ICT implementation are not effective to stir the full utilization of ICT equipment in Colleges of Education in Enugu. This therefore shows the strategies for ICT implementation among Federal, State and Private Colleges of Educations in Enugu State, which are negative. Although the cumulative mean stands as reject, individual school types have accepted certain items in the instrument as strategies for implementing ICT in their Colleges of Education. Item three was accepted by both State and Private Colleges of Education, item four was accepted by Federal and Private Colleges of Education, item six was accepted by Private College of Education alone at mean 2.54, item seven was accepted by Federal and Private Colleges of Education, item eight was accepted by Federal College of Education alone, item nine was accepted by Private College of Education alone while item ten was generally accepted by the three Colleges of Education under study.

Hypotheses testing

The two hypotheses were tested using analysis of variance (ANOVA) at 0.05 level of significance.

$H0_1$: There will be no statistical difference for implementing ICT strategies among Federal, State and Private Colleges of Education in Enugu state.

Table 4. ANOVA Test of Implementing ICT Strategies among Federal, State, and Private Colleges of Education

Source	Sources of Variables	Sum of Squares	Df	Mean Square	F	Sig.
School type	Between Groups	1.465	2	.733	3.005	.053
	Within Groups	29.735	122	.244		
	Total	31.200	124			

Result in table 4 shows that there is statistically significant difference for implementing ICT strategies among Federal, State and Private Colleges of Education. Where F = 3.005, Df = 124; P = .053 > 0.05. The null hypothesis therefore was rejected indicating that there was significant difference among Federal, State and Private Colleges of Education. This implied that school type influences the strategies for implementing ICT in Colleges of Education.

$H0_2$: There is no significant gender difference in the strategies for the implementation of ICT among the Federal, State and Private Colleges of Education in Enugu state, Nigeria.

Table 5. ANOVA of Colleges Location in the Implementation of ICT Strategies in Colleges of Education

Source	Sources of Variables	Sum of Squares	Df	Mean Square	F	Sig.
Gender	Between Groups	7.092	1	7.092	9.019	.003
	Within Groups	96.716	123	.786		
	Total	103.808	124			

Result in table 5 shows that there is no statistically significant gender difference in the implementation of ICT strategies in Colleges of Education. Where F = 9.019, Df = 103.808; P = .003 < 0.05. The null hypothesis therefore was accepted indicating that there was no significant difference in gender. This implied that males and females do not differ in the strategies for the implementation of ICT in Colleges of Education in Enugu state, Nigeria.

In this study, findings indicate that successful ICT implementation in Colleges of Education in Enugu State is influenced by several critical factors, including infrastructure availability, institutional support, educator training, and alignment with existing policies. These findings align with and expand on prior research that has identified these variables as essential to the effective integration of ICT in educational institutions. The findings reveal that inadequate ICT infrastructure remains one of the most significant obstacles to effective ICT integration. This finding corroborates studies by Eze et al (2018), who emphasized that insufficient facilities, limited internet connectivity, and unreliable power supply are key limitations in Nigerian educational institutions.

Another notable finding is the critical role of educator training and continuous professional development in ensuring ICT's effective implementation. This aspect is strongly supported by the literature, particularly Cantutay & Taganas (2024), who observed that educators' ICT competence significantly affects their willingness and ability to adopt technology-enhanced teaching strategies. Similarly, Falloon (2020) argue that teacher training programs must incorporate ICT skills training to build educators' capacity to integrate digital tools effectively in their classrooms. The current study found that while some educators are enthusiastic about ICT, many still lack the skills and confidence to use it effectively, indicating that continuous professional development initiatives tailored to ICT skill-building are crucial for sustainable implementation.

This study also identified a gap between ICT-related policies and their practical application within colleges, with institutional constraints often inhibiting policy adherence. This observation resonates with findings from Okoro, Nwafor, and Ihejirika, who note that despite supportive policies, implementation tends to falter due to insufficient resource allocation and weak institutional frameworks. According to this study's findings, educators and administrators are often aware of policies mandating ICT use but face challenges in executing these policies due to limited financial and technical support. This gap highlights the need for policies to be backed by adequate resources and realistic, actionable strategies for effective adoption.

Furthermore, findings indicate that for ICT implementation to be effective, it must align with the curriculum and pedagogical needs of Colleges of Education. Crompton, Burke, and Gregory argue that ICT integration is most successful when digital tools are embedded within the curriculum rather than treated as separate or additional resources. This study supports the notion that a well-defined curriculum framework that

incorporates ICT at each educational level would enable educators to integrate technology more seamlessly into their teaching practices. Without alignment with educational goals, ICT tools risk becoming underutilized or misapplied in ways that do not benefit student learning.

Finally, findings underscore the importance of institutional leadership in fostering an environment conducive to ICT adoption. As identified by Blau & Shamir-Inbal (2017), institutional leaders play a crucial role in creating a culture that values and prioritizes ICT. This study confirms that leadership commitment to ICT initiatives, demonstrated through resource allocation, strategic planning, and support for educator training—can facilitate successful implementation by reinforcing the value of technology within the educational institution.

In conclusion, the findings of this study reinforce the interconnectedness of infrastructure, training, policy alignment, curriculum integration, and leadership in supporting ICT adoption in Colleges of Education. These findings echo the broader body of literature, highlighting the need for a coordinated approach to address the multi-faceted challenges associated with ICT implementation in education. By building on the insights of existing research and addressing context-specific challenges, this study provides a framework for developing effective strategies tailored to the unique needs of Colleges of Education in Enugu State.

Based on the findings, the following recommendations are made;

1) Colleges should establish a central unit for ICT implementation, providing teachers with information, training, and support for changes in teaching methodology, as well as reliable technical support.
2) Training programs should be conducted throughout the academic year, providing in-service and pre-service teachers with hands-on workshops and seminars on integrating ICTs. These sessions should include collaboration between experienced and non-experienced teachers, face-to-face showcases, and conferences, and should be continuous on computers and ICT skills acquisition innovations.
3) Over half of respondents believe funding is the biggest obstacle to implementing ICTs, followed by administrative support and technology access. Ministries should establish district-level ICT implementation policies to support teachers, provide necessary technology, and address incentives, copyright issues, promotion, and tenure.
4) Collaboration with organizations like AVOIR and Nigerian Colleges of Education is needed for ICT applications implementation.
5) A monitoring, inspection, and evaluation division should be established at all levels to ensure ICT curricula are adhered to, monies are not diverted, and appropriate equipment is delivered.

D. Conclusion

The implementation of Information and Communication Technology (ICT) in colleges of education has become both challenging and rewarding. The introduction of digital technologies has significantly impacted the roles and responsibilities of these institutions, requiring systematic changes. School administrations and teachers are under pressure to find ways to implement and sustain technological innovation. A study on the strategies for effective ICT implementation in colleges found that these strategies were not effective. The influence of ICT strategies among males and females in colleges was rejected, indicating that gender does not significantly influence these strategies. However, strategies adopted among Federal, State, and Private Colleges were not effective in maximizing the utilization of ICT equipment. The hypothesis tested on various school types and their strategies for ICT implementation showed no significant difference. The strategies in this study would be effective if implemented effectively.

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