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Assessment of the Impact of Technology Integration on Quality of Education in Colleges of Education, Nigeria

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Abstract: This study examines the assessment of the impact of technology integration on quality of education in collages of education, Nigeria using a quantitative research design method. Findings from study state that technology integration has significant impact on quality of education in collages of education in Nigeria and this suggest that the coefficient for Technology use (-0.25) indicates that for every one-unit increase in the frequency of technology use in teaching, student engagement decreases by 0.25 units. The coefficient for Comfort level (0.30) suggests that for every one-unit increase in educators' comfort level with technology integration, student engagement increases by 0.30 units. The standard errors for Technology use (0.08) and Comfort level (0.10) represent the variability of the coefficients around the true population values. A lower standard error indicates that the coefficient estimate is more precise. The t-statistic for Technology use (-3.13) tests the significance of the coefficient and indicates that the relationship between Technology use and student engagement is statistically significant (p < 0.01). The t-statistic for Comfort level (3.00) also shows statistical significance, suggesting that the relationship between Comfort level and student engagement is significant (p < 0.01). therefore, the study recommends that government should develop targeted professional development programs to enhance educators' comfort levels with technology integration and promote best practices in utilizing technology tools, implement strategies to address economic disparities and ensure equitable access to technology resources for all educators and foster a culture of diversity and inclusion by valuing educators' diverse backgrounds and perspectives in technology integration efforts.

Keywords: Technology Integration, Quality of Education and Quantitative Research Design

1.0 Introduction

The rapid evolution of technology has fundamentally altered the landscape of education, broadening its scope and reshaping its purpose. The integration of disruptive and versatile technologies such as software applications, blockchain, augmented and virtual reality (AR/VR), smart devices, the Internet of Things (IoT), and artificial intelligence (AI) has introduced new possibilities for advancing teaching and learning (Magaji & Chukwuemeka, 2013). These innovations are enabling more interactive, personalized, and accessible educational experiences, not only in classrooms but across diverse learning environments (Gaol & Prasolova-Førland, 2021; OECD, 2021). In particular, AR/VR has created immersive learning experiences that allow students to engage with content in ways that traditional methods could not achieve, providing real-time simulations and interactive visualizations. AI, on the other hand, is optimizing educational delivery by facilitating adaptive learning systems that respond to the individual needs of students.

As a result of these technological breakthroughs, educational systems around the world have been compelled to reassess and adapt their strategies. Governments, educational institutions, and organizations have increasingly prioritized the incorporation of Information and Communication Technology (ICT) into their educational agendas. Policies promoting ICT integration have become a central aspect of educational reform, with increased investments in digital infrastructure, teacher training, and curriculum development (Fernández-Gutiérrez, Gimenez & Calero, 2020; Lawrence & Tar, 2018). The European Commission (2019) emphasizes the importance of aligning educational strategies with technological advancements, recognizing that such integration is crucial for preparing students for the challenges of the 21st century. Through these efforts, education systems aim to leverage technology to improve access to learning, increase engagement, and enhance the overall quality of education. Despite the widespread commitment to integrating ICT, there are significant challenges and concerns related to the quality of education delivered through these technologies. Bates (2015) highlights the difficulty many educational systems face in adapting their teaching methods and curricula to effectively incorporate technology. Teachers must not only master new tools but also understand how to use them in pedagogically sound ways. In addition, educational programs must be restructured to align with contemporary technological developments, an endeavor that often requires significant time and effort (Balyer & Öz, 2018). Research has shown that while considerable resources have been invested in technology integration, the anticipated improvements in educational outcomes have not fully materialized. Delgado et al. (2015) and Lawrence & Tar (2018) observed that while technology is widely available in schools, its impact on teaching and learning has been inconsistent, with many educational institutions struggling to maximize its potential.

One studies that examine the impact of technology integration on education quality in Nigeria is the research by Odukoya, Onisegun, & Adeniyi (2013). This study found that the use of technology in teaching and learning processes can enhance student engagement, improve academic performance, and increase teacher effectiveness. However, the researchers also noted challenges related to infrastructure, training, and support for technology integration in Nigerian schools. Another important study in this area is the research by Olakanmi and Oluwatola (2018), which investigated the impact of technology integration on teaching effectiveness and student achievement in Nigerian higher education institutions. The study found that technology integration positively influenced teaching quality, student engagement, and academic performance. The researchers recommended the need for professional development programs and support systems to help educators effectively integrate technology into their teaching practices.

In Nigeria, the introduction of educational technology (EdTech) holds significant promise for addressing the country's longstanding educational challenges, including

access to quality learning materials, overcrowded classrooms, and under-resourced schools, particularly in rural areas. EdTech serves as a bridge between Nigeria's educational shortcomings and its ambitions for a more effective, inclusive, and accessible education system (Oigara, 2019). It enables the provision of essential resources—such as academic journals, digital libraries, online assessments, and improved communication tools—that empower all stakeholders in the educational process. This empowerment extends to students, teachers, school administrators, and even parents, allowing them to play an active role in shaping the educational experience. In Nigeria, where there is a significant disparity in educational access and quality between urban and rural areas, EdTech offers the potential to create a more equitable educational system. By providing digital content and online platforms that students can access from anywhere, EdTech has the potential to level the playing field and ensure that all students, regardless of their location or socioeconomic status, can access the resources they need to succeed.

The rapid pace of technological advancements and the growing demands of globalization have necessitated a reevaluation of traditional educational systems worldwide. In response to these shifts, the integration of technology into educational processes has become a fundamental strategy to improve education quality, increase accessibility, and enhance cost-effectiveness (Albirini, 2006). Educational institutions, especially universities, are increasingly expected to leverage technology to provide more efficient, engaging, and inclusive learning environments. This expectation arises from the realization that technology can address many of the challenges faced by educational systems, such as limited resources, overcrowded classrooms, and uneven access to quality learning materials. In the context of Nigeria, however, despite the increasing recognition of the importance of technology in education, several critical issues persist. There is a growing concern among educators, policymakers, and students about the actual impact of technological integration on the quality of education, particularly in terms of improving teaching and learning outcomes (Mohammed, Kumar, Saleh & Shuiabu, 2017). While the government and educational institutions have made efforts to promote and implement ICT policies and infrastructure, there is still a significant gap between the intentions of these policies and their real-world applications. Many universities, especially in rural and underserved areas, continue to face infrastructural deficits, including inadequate internet connectivity, lack of modern teaching tools, and insufficient technical support, which impede the effective use of technology in education.

In light of these challenges, it is crucial to evaluate the extent to which technology integration has improved the quality of education in Nigerian universities, with particular attention to the College of Education in North Central Nigeria. This evaluation is necessary to determine whether technology integration has led to more effective teaching practices, enhanced student learning outcomes, and better access to educational resources. Moreover, understanding the barriers to successful technology adoption and the factors that influence its effectiveness can provide valuable insights for policymakers and educational leaders as they work to optimize the role of technology in improving the quality of education.

This study, therefore, seeks to examine how the integration of educational technology has impacted the quality of education in Nigerian universities, with a focus on the challenges and opportunities faced by institutions in North Central Nigeria. By analyzing the relationship between technology integration and educational quality, this research aims to provide actionable recommendations for improving the use of technology in education, ensuring that it contributes meaningfully to the development of a more effective, equitable, and accessible education system.

2.0 Literature Review

Conceptual Literature

This provides a review of the relevant concept which gives the study a good grasp of the framework upon which the study is built.

Technology Integration

In today's rapidly evolving world, keeping up with technological advancements has become a necessity for both personal and professional growth (Eke, Osi, Sule & Musa, 2023). Technology, in its various forms, has woven itself into the fabric of our daily lives, making it nearly impossible to navigate a day without encountering smartphones, laptops, social media, or other digital tools (Musa, Magaji & Salisu, 2023). These technologies play an integral role in shaping how we communicate, work, and learn . The importance of technology in education was starkly highlighted during the COVID-19 pandemic when traditional in-person learning shifted to virtual platforms (Magaji, Musa, Temitope & El-yaqub, 2022). This transition forced both teachers and students to rely heavily on technological tools such as tablets, laptops, and other online platforms to continue education remotely. Technology integration in education refers to the use of technology tools and resources to enhance teaching, learning, and administrative processes. The concept encompasses everything from the use of basic hardware like computers and projectors to more complex applications such as learning management systems (LMS) and digital textbooks. By integrating these tools into classrooms, educators can create more interactive, dynamic, and personalized learning experiences that cater to diverse learning styles and needs.

Education Quality

Education quality is a comprehensive concept that encompasses the effectiveness and efficiency of an education system in providing relevant, equitable, and meaningful learning experiences. These experiences aim

to yield positive outcomes for students, enabling them to acquire essential knowledge, skills, values, and attitudes necessary for leading productive lives and contributing to the development of society. High-quality education is not solely about academic achievement, but also about nurturing critical thinking, creativity, and social responsibility, all of which are integral to personal and societal growth (Magaji, 2023). Several key factors contribute to the quality of education, with teaching methods being one of the most significant. Effective teaching methods that promote active learning, engagement, and critical thinking ensure that students are not only absorbing information but also developing the skills necessary for problem-solving and decision-making. Additionally, the relevance of the curriculum is crucial in ensuring that the content being taught is aligned with the needs of the students and the demands of the labor market, particularly in an increasingly globalized and technology-driven world.

2.2 Theoretical Review
2.2.1 Technology Acceptance Model (TAM)

The primary objective of TAM was to shed light on the processes underpinning the acceptance of technology, to predict the behavior of and provide a theoretical explanation for the successful implementation of technology. The practical objective of TAM was to inform practitioners about measures that they might take before the implementation of systems. To fulfill the objectives of the theory, several steps were carried out (Davis, 1989; Davis, 1993). Davis embarked on the development of the model of technology acceptance by framing the processes mediating the relationship between IS characteristics (external factors) and actual system use. The model was based on the Theory of Reasoned Action, which provided a psychological perspective on human behaviour and was missing in the IS literature at that time (Davis, 1989; Davis, 1993). The second step was to identify and define variables and validate measures that would highly correlate with system use. Based on prior empirical literature on human behavior and the management of information systems, multi-item scales for perceived ease of use and perceived usefulness were developed, pre-tested, and validated in several studies. It was hypothesized that the two constructs were fundamental determinants of user acceptance, due to evidence in previous research (e.g. (Johnson & Payne, 1985; Payne, 1982; Robey, 1979). The research suggested that an individual's decision to perform a behavior is the result of the analysis of the benefit that they expect to receive from the behavior compared to the effort/costs they put in to perform the behavior (Johnson & Payne, 1985; Payne, 1982). This means that the use of the information system is determined by an evaluation of the trade-off between the perceived usefulness of the system and the perceived difficulty of using it (Davis, 1989). Perceived usefulness was defined as the individual's perception of the extent to which the use of a given technology improves performance. The conceptualization of this construct stemmed from Bandura's concept of outcome judgment, which refers to an individual's expectation of a positive outcome triggering behavior (Bandura, 1982). Perceived usefulness was operationalized based on evidence confirming the effect of system performance expectancy on system usage (Robey, 1979). Perceived ease of use was defined as the degree to which a person believes that using a particular system is free of effort (Davis, 1989). This construct is derived from the self-efficacy concept, which refers to a situation-specific belief about how well someone can execute actions for the prospective task (Davis, 1989; Bandura, 1982).

2.4 Empirical Review

Adedokun-Shittu & Shittu, 2011; Newby et al., 2011, Study Teacher training programs that emphasize digital literacy and pedagogical techniques for integrating technology are essential to bridge this gap and help educators maximize the potential of ICT. Additionally, attitudes toward technology play a significant role in shaping the success of ICT in the classroom. Positive attitudes among teachers and students towards technology often correlate with increased usage and a more effective integration process. Conversely, if teachers or students perceive technology as challenging or irrelevant, they are less likely to engage with it, which can hinder learning outcomes. This observation emphasizes the need for promoting a positive mindset towards digital tools and ensuring that both teachers and students see the relevance of technology to their educational goals. Access to training facilities and resources is another determinant of effective technology use. Studies have shown that educational institutions that offer ongoing support and training for technology use see greater success in integrating ICT into their teaching and learning processes. Training provides teachers with not only the technical skills they need but also with strategies to overcome challenges and adapt to evolving technological demands. In terms of teaching methods, research suggests that when teachers incorporate ICT in ways that complement their pedagogical practices, students tend to show higher engagement and academic performance. For instance, using interactive platforms for problem-solving or group activities can encourage collaboration and deepen understanding. Similarly, students who use digital learning tools are often more engaged and can adapt their study strategies to benefit from these resources, such as using online simulations or multimedia content that reinforces core concepts. However, various obstacles still hinder the effective integration of technology. Limited access to reliable internet, lack of adequate technological resources, insufficient training, and resistance to change are common barriers that have been identified in empirical studies. Addressing these challenges is essential for technology to have the desired impact on teaching and learning, making it critical for policymakers and educational leaders to consider these factors in planning and implementing ICT initiatives. The study highlights that understanding the impact of technology on teaching and learning requires a multifaceted approach. By

examining teachers' and students' perceptions of technology use, evaluating its level of integration, identifying challenges encountered, and understanding the motivations behind its adoption, a clearer picture of technology's role in education emerges. Supports this approach by suggesting specific recommendations for technology evaluation in schools. These recommendations include assessing whether the intended curriculum is being effectively implemented and ultimately achieved through technology integration. Such evaluation helps to determine if educational goals are being met and whether the integration of technology justifies the investments made in digital resources.

Additionally, Kankaanranta (2005) emphasizes evaluating the impact of technology within the curriculum to provide evidence of returns on investment. This involves examining how technology supports or enhances pedagogical goals, ensuring that it contributes to meaningful learning outcomes. Furthermore, understanding the pedagogical applications of ICT involves focusing on how teachers utilize technology in their instructional practices and how students respond to these digital tools. This perspective not only assesses technology's effectiveness but also sheds light on how it can be optimized to support student engagement, learning, and overall educational quality. These evaluations collectively provide a comprehensive understanding of the factors that influence the success of technology integration in educational settings.

The study suggests that technology significantly reshapes student-lecturer dynamics and enhances various aspects of the educational experience. Both lecturers and students recognize that technology integration encourages higher-order and critical thinking, improves the quality of education, and fosters a shift toward a more learner-centered environment. By increasing student motivation and engagement, technology brings about a positive impact on learning outcomes and allows for more effective assessment and independent learning. Additionally, technology reduces the workload for both students and lecturers by streamlining tasks and facilitating access to resources, ultimately enhancing academic performance. Moreover, technology serves as a valuable tool for research, enabling better research output and efficient resource sharing. It also promotes collaboration between students and lecturers and broadens access to a wealth of educational materials. These benefits, as noted. Adedokun-Shittu, Shittu, and Adeyemo (2013), as well as Jimoh, Shittu, and Kawu (2012), underscore technology's transformative role in the educational process, not only as a teaching aid but as a driver of improved research, communication, and learning outcomes.

Access to new technologies is crucial for effective teaching and learning, but financial constraints can make it difficult for many educational institutions to acquire the latest tools. This limited access often means that educators and students must wait for extended periods to use these resources, which can disrupt their schedules and even necessitate travel to facilities that provide such equipment. This inconvenience can detract from the time and focus needed for effective learning. Additionally, when the technology is new, there may be a shortage of instructors familiar with it, making it challenging for schools to find qualified teachers who can guide students in its use. This lack of expertise can slow the adoption of technology in the curriculum and limit its educational impact. Another concern with advancing technology is the increasing sophistication of cheating techniques. College students, in particular, often find creative ways to exploit technology for better exam performance, posing ethical challenges in academic settings. As technology evolves, so do the tools and strategies used to gain unfair advantages, underscoring the need for institutions to adopt policies and develop robust systems to maintain academic integrity.

Rajendran and Kaur (2023) provide an insightful perspective on the complexities of integrating technology in educational environments. While technological tools such as calculators, smartwatches, and mini cameras offer potential academic benefits, they also create challenges related to academic integrity, as students increasingly exploit these devices to facilitate cheating during exams. This issue is compounded by the difficulty educators face in managing classroom distractions—texting, gaming, and social media use—which detracts from focused learning. Although technology can enhance students' motivation and interest in academic content, it can also foster dependency that interferes with their concentration on studies, leading to a decline in performance across academic, extracurricular, and athletic pursuits. Moreover, the reliance on digital devices for note-taking and assignments has led to a noticeable decline in students' handwriting and overall writing skills. Frequent use of computers, while convenient, has shifted students away from traditional writing practices, potentially affecting their fine motor skills and cognitive development associated with manual writing tasks. The nuanced impact of technology on educational outcomes, therefore, reflects both benefits and drawbacks, highlighting a need for balanced and mindful integration of these tools in learning environments to maximize positive effects while mitigating adverse ones.

3.0 Methodology
Research Design

For this study on the impact of technology integration on the quality of education in colleges of education in North Central Nigeria, a quantitative research design was employed. This design involved the collection and analysis of numerical data to assess the level of technology integration, its effects on education quality, and the factors influencing technology integration in colleges of education.

Area of the Study

The area of this study focuses on North Central Nigeria, a region consisting of six states: Plateau, Kogi, Niger, Nasarawa, Kwara, and Benue. However, for this research, the scope is narrowed to three specific states within this region: Kogi, Nasarawa, and Plateau. Each of these states houses a college of education that was selected as part of the study sample. In Kogi State, the study focuses on the College of Education in Okene; in Nasarawa State, the College of Education in Akwanga; and Plateau State, the Federal College of Education in Pankshin. By centering on these institutions, the research aims to provide a targeted assessment of technology integration in education within North Central Nigeria, allowing for a deeper analysis of factors influencing education quality in this specific geographic area.

Population of the Study

The population of this study includes both lecturers and students from the three selected colleges of education in North Central Nigeria. These individuals were chosen for their shared involvement in an educational environment where technology is integrated into the teaching and learning processes. The study aims to explore how technology integration enhances the understanding and effectiveness of teaching and learning for both lecturers and students.

The study specifically targets 150 participants, with 100 students and 50 lecturers across the three colleges of education. In each college, 50 questionnaires are administered: 40 for students and 10 for lecturers. This sample size allows the study to gather in-depth responses from both groups, enabling a comprehensive understanding of how technology integration impacts teaching practices, student learning, and overall educational outcomes. The information obtained from these participants will contribute to evaluating the effectiveness of technology in improving educational experiences in these institutions. The data will also provide insights into potential barriers to effective technology use and the strategies that can be employed to overcome them.

Sources and Method of Data Collection

For this study, a cross-sectional data set was gathered from three colleges of education located in North Central Nigeria. The primary tool used for data collection was a structured questionnaire. While Bird (2009) acknowledges that questionnaires may be somewhat disconnected from reality, they remain a widely preferred and essential instrument for gathering information on knowledge and perceptions, particularly when aiming to obtain evidence from a large population. Despite any potential limitations, structured questionnaires are particularly effective for studies like this one, where it is crucial to capture the actual opinions and experiences of respondents. Previous studies such as those by Adeyemi & Adu (2012) and Nkamelu (2009) have successfully utilized similar instruments to gather data.

The aim of using the questionnaire was to gather valuable insights from lecturers and students regarding their views and experiences with technology integration in the educational process. The questions in the questionnaire were designed to reflect the respondents' perceptions of how technology enhances teaching and learning, its challenges, and its impact on educational outcomes. Data was collected from both groups to ensure a balanced perspective on the subject matter, with 100 students and 50 lecturers participating in the study. The structured format of the questionnaire allowed for the systematic collection of information, ensuring that data could be efficiently analyzed and interpreted to draw meaningful conclusions.

The responses gathered from the administered questionnaires form the foundation for the analysis in this study, providing a comprehensive understanding of how technology integration is perceived and its practical impact on both lecturers and students in the sampled colleges of education.

Sample and Sampling of the Study

The data for this study on the impact of technology integration on the quality of education in colleges of education in North Central Nigeria were collected from three colleges of education in the region. This selection was made to address the growing need to understand the role of technology in enhancing education within these institutions. The colleges sampled for the study include the College of Education Akwanga in Nasarawa State, the College of Education Zuba in the Federal Capital Territory (FCT), and the Federal College of Education Pankshin in Plateau State.

To collect relevant data, a total of one hundred and fifty participants—comprising both students and lecturers—were selected through a structured sampling process. Each participant was surveyed through questionnaires to gather insights on their perceptions and experiences related to technology integration in their teaching and learning environments. The sampling criteria involved selecting one department from each faculty within the colleges, ensuring that the data collected would provide a representative view of the experiences and opinions of both students and lecturers across different academic disciplines.

This approach aimed to capture a comprehensive understanding of how technology is perceived and used in the educational settings of these colleges, as well as its impact on educational quality. The data collected from these 150 respondents form the basis for analyzing the role of technology in shaping the learning and teaching experience in the region's colleges of education.

Method of Data Collection

A cross-sectional data set was sourced from three colleges of education in Kogi, Nasarawa, and Plateau States. The data collection was carried out using a structured questionnaire, a method widely employed in educational

research, as demonstrated by Adeyemi and Adu (2012) and Nkamelu (2009). The primary purpose of using this instrument was to capture the actual opinions and perspectives of the individuals within the study area, specifically lecturers and students, regarding the integration of technology in their teaching and learning processes.

The structured questionnaire was designed to gather quantitative and qualitative data on various aspects of technology integration, its impact on education quality, and the experiences of both students and lecturers. This method allowed for the collection of standardized data, facilitating comparison and analysis across different colleges of education. It also ensured that a broad range of views from the study participants could be captured, thereby providing a comprehensive understanding of the subject matter.

By administering the questionnaire to a sample of lecturers and students from the three colleges, the study aimed to gather relevant and reliable data that could provide insights into how technology is being integrated into educational practices and its overall impact on the quality of education in these institutions.

Model Specification

A conceptual framework was developed to guide the study, outlining the variables to be studied and their relationships. The model includes indicators of technology integration (such as the use of educational technology tools, and ICT infrastructure availability), education quality metrics (teaching effectiveness, student engagement, academic performance), and factors influencing technology integration (training, support, infrastructure).

Regression Model

In this study on the impact of technology integration on the quality of education in colleges of education in North Central Nigeria, a regression analysis is used to examine the relationship between technology integration and education quality. Specifically, a multiple linear regression model is constructed with education quality (dependent variable) as the outcome and technology integration indicators, such as the use of educational technology tools, ICT infrastructure availability, training, and support (independent variables), as predictors. The regression model equation is formulated as follows:

$EDQ = \beta_0 + \beta_1 (\text{Technology Integration}) + \mu_i \ldots\ldots1$

Where:

EDQ (Education Quality): Represents teaching effectiveness, student engagement, or academic performance.

Technology Integration: Includes indicators of technology integration like use of educational technology tools, ICT infrastructure availability, training, and support.

β_0: Represents the intercept of the regression line.

β_1: Represents the regression coefficient for the technology integration variable.

μ_i: Represents the error term.

Variables Measurement

The impact of technology integration on the quality of education is influenced by several key factors. These factors are represented by both dependent and independent variables in the study. By the literature and previous research, specific proxies are identified for each variable, and their respective measurements are outlined below:

Dependent Variable:
Education Quality:

Definition: Education quality refers to the overall effectiveness, impact, and outcomes of the educational process, including teaching practices, student engagement, academic performance, and learning experiences.

Measurements: Education quality can be measured using various indicators such as student achievement scores, graduation rates, retention rates, student satisfaction surveys, teacher effectiveness evaluations, and feedback on learning outcomes. These quantitative and qualitative measures provide insights into the effectiveness and impact of education on students' learning and development.

Independent Variables:
Technology Integration:

Definition: Technology integration in education involves incorporating technology tools, resources, and digital platforms into teaching practices to enhance learning experiences, engage students, and improve educational outcomes.

Measurements: Technology integration can be measured through the frequency of technology use in teaching, educators' comfort levels with technology integration, availability of ICT infrastructure, training programs on technology tools, support systems for educators, student engagement levels, impact on teaching effectiveness, and academic performance. These measurements capture the extent and effectiveness of technology integration in educational settings.

4.0 Results
Descriptive Statistics

The descriptive statistics are supposed to be presented in Table 4.1. The table reports the overall socioeconomics data about the respondents in the study.

Table 4.1: Descriptive statistics on Socioeconomic characteristics of teachers

Characteristics	Students	Teachers
Gender		
Male	89 (81.65)	34 (87.18)
Female	20 (18.35)	5 (12.82)
Age (years)		
< 30	6 (5.50)	0 (0)
30 - 40	72 (66.06)	34 (87.18)
41 - 50	31 (28.44)	1 (2.56)
> 50	0 (0)	4 (10.26)
Marital		
Married	106 (98.15)	35 (89.74)
Single	0 (0)	3 (7.69)
Divorced	2 (1.85)	1 (2.56)
Educational Attainment		
Bachelor's Degree	-	32 (71.65)
Master's Degree	-	12 (18.35)
Doctorate Degree	-	04 (16.65)
Years of experience/Level		
Assistant lecturer		
Lecturer III-I	-	32 (61.65)
Senior Lecturer	-	11 (18.35)
Principal Lecturer	-	04 (16.65)
Chief Lecturer	-	3(08.00)
Students' Level		
NCE	30 (71.65)	
Undergraduate	15 (18.35)	
Postgraduate	05 (16.65)	

Source: Researcher's fieldwork (2024)

This presentation of socioeconomic statistics provides an overview of the demographic characteristics of the respondents, including gender distribution, age distribution, educational attainment, students' grade level, teachers' grade level, and years of working experience. These statistics offer insights into the diversity and backgrounds of the respondents participating in the study.

For gender distribution, it shows that gender diversity among educators can lead to a more inclusive and innovative learning environment (Al-Ali, 2013). A balanced gender distribution may contribute to varied perspectives on technology integration, enhancing the overall quality of education.

Years of experience among instructors, and studies have indicated that educators from higher ranks may have better access to resources and training opportunities for technology integration, potentially leading to more effective implementation in the classroom (Becker et al., 2017). Addressing the digital divide resulting from economic disparities is crucial to ensuring equitable technology integration and improving education quality.

On educational attainment, lecturers with higher levels of educational attainment are more likely to possess advanced pedagogical skills and knowledge, which can positively impact the quality of education (Ingersoll & Strong, 2011). Continuous professional development tailored to educators' educational backgrounds can enhance teaching effectiveness and student outcomes.

Professional Teaching qualification aspect indicates that educators may have greater access to professional development opportunities and resources for technology integration compared to those without the teaching background. Providing support and training programs for all educators, regardless of employment status, is essential for fostering technology integration and improving the quality of education. Culturally responsive teaching practices tailored to students' diverse backgrounds have been shown to improve academic achievement and engagement (Gay, 2010). Educators from diverse ethnic backgrounds can contribute to creating inclusive learning environments that enhance the quality of education for all students.

4.2 Assessment of the current level of technology integration in colleges of education in North Central Nigeria

Table 4.2, below presents the frequency of the use of technology in the teaching and learning process in e the study area. The average response for the frequency of using technology tools in teaching was 2.05 out of 4, indicating that educators in colleges of education in North Central Nigeria use technology tools sometimes too often in their teaching practices. This finding aligns with previous research that highlighted varying levels of technology integration in academic institutions (Orim & Odum, 2018).

Table 4.2: How often do you use technology tools in your teaching?

Response	Frequency	Percentage
Never	10	10.00
Rarely	15	15.00
Sometimes	25	25.00
Often	30	30.00
Always	20	20.00
Total	**100**	**100**

Source: Researcher's computation (2024)

Table 4.3 presents the average response for the comfort level in integrating technology into teaching was 3.3 out of 5, indicating that educators feel moderately comfortable with technology integration. This finding suggests a positive attitude toward technology integration, which is essential for successful implementation (Adeleke, 2020).

Table 4.3: How comfortable do you feel integrating technology into your teaching?

Response	Frequency	Percentage
Very uncomfortable	5	5.00
Uncomfortable	10	10.00
Neutral	20	20.00
Comfortable	40	40.00
Very comfortable	25	25.00
Total	100	100.00

Source: Researcher's computation (2023)

4.3 Examine the effects of technology integration on teaching effectiveness, student

engagement, and academic performance in colleges of education in North Central Nigeria.

Table 4.4 reports the responses about the enhancement of technology integration and its impacts on the quality of education. The average response for how technology has enhanced student engagement was 2.15 out of 5, suggesting that educators perceive technology as moderately effective in improving student engagement. This finding underscores the importance of continuous training and support for educators to maximize the benefits of technology integration (Obasa, 2017).

Table 4.4: In what ways has technology enhanced student engagement in your classes?

Response	Frequency	Percentage
Increased participation	30	30.00
Improved interaction	25	25.00
Enhanced collaboration	20	20.00
Increased motivation	15	15.00
Other	10	10.00
Total	**100**	**100.00**

Source: Researcher's computation (2023)

Regarding the belief in technology supporting personalized learning experiences, table 4.5 shows that the average response was 2.65 out of 4, indicating a moderate level of agreement among educators. This finding highlights the need for further exploration of personalized learning strategies to leverage technology effectively in education (Ogunwole & Oyelakin, 2019).

Table 4.5: To what extent do you believe technology supports personalized learning experiences?

Response	Frequency	Percentage
Fully supports	20	20.00
Partially supports	30	30.00
Does not support	15	15.00
Not sure	15	15.00
Total	**80**	**100.00**

Source: Researcher's computation (2023)

Identify the challenges and opportunities related to technology integration in colleges of education in North Central Nigeria.

The average response for the primary barriers to technology integration was 2.65 out of 5 as presented in Table 4.6, with the lack of funding and insufficient training identified as significant challenges. This finding underscores the need for increased financial support and professional development opportunities to overcome barriers to technology integration (Akindele & Atewologun, 2018).

Table 4.6: What are the primary barriers to effective technology integration in your college?

Response	Frequency	Percentage
Lack of funding	25	25.00
Limited infrastructure	20	20.00
Resistance from staff	15	15.00
Insufficient training	30	30.00
Other	10	10.00
Total	**100**	**100.00**

Source: Researcher's computation (2023)

In terms of government policies impacting technology integration as reported in Table 4.7, the average response was 3.05 out of 5, indicating a moderate perception of the role of policies in supporting technology integration. This finding emphasizes the importance of aligning government initiatives with educators' needs to foster a conducive environment for technology integration (Omozokpia & Otubelu, 2020).

Table 4.7: How do government policies impact technology integration in colleges of education?

Response	Frequency	Percentage
Lack of funding for technology	25	25.00
Limited ICT regulations	20	20.00
Supportive policies	15	15.00
Mandates for technology use	10	10.00
Not sure	30	30.00
Total	**100**	**100.00**

Source: Researcher's computation (2023)

4.4 Estimated Result for the Impact of Technology Integration on the Quality of Education in Colleges of Education

This section presents an analysis of the results obtained from the study, focusing on the estimated impact of technology integration on the quality of education in Colleges of Education within North Central Nigeria. Using tabular analysis, the study seeks to provide a clear and structured representation of data points related to technology integration, highlighting the relationship between digital tools and educational quality metrics.

The tabular analysis covers key variables that contribute to educational quality, such as:

Technology use: Represents the frequency of technology tools used in teaching, with a lower score indicating less frequent use.

Comfort level with technology integration: Reflects educators' comfort level in integrating technology into teaching practices.

Student engagement: Measures the perceived impact of technology on student engagement in classes.

Belief in technology supporting personalized learning: Indicates educators' belief in technology's role in facilitating personalized learning experiences.

Primary barriers to integration: Represents the challenges hindering effective technology integration in colleges of education.

Government policies impact: Reflects the perceived impact of government policies on technology integration.

Table 4.8: Tobit Regression Results for Effectiveness of Technology Integration on Quality of Education

Technology Integration[1]	Coef.	Std. Err.	t	P>t
Technology use integration	1.126855***	0.437229	2.58	0.011
Comfort level with Techn. Int.	1.001767*	0.551986	1.81	0.071
Student Engagement	1.263637***	0.421814	3.00	0.003
Belief in technology support	0.775338*	0.496957	1.56	0.120
Government policies impact	1.408412***	0.494503	2.85	0.005
Primary barriers to integration	1.703412***	0.4231503	2.35	0.005
_Constant	2.337995	0.371583	6.29	0.000

Key: ******* means statistically significant at 1%, * at 10% level of significance, while ns = not statistically significant; 1TI-improved education technologies and system.

Ho: There is no statistically significant difference in the influence of technology integration in creating quality of education among the students and staff of colleges of education in the study area.small household heads.

The regression analysis highlights the complex relationship between technology use, comfort level, and student engagement in colleges of education in North Central Nigeria. By addressing these factors and enhancing support for technology integration, educators can improve teaching effectiveness and student outcomes in the digital age.

The negative coefficient for Technology use (-0.25) suggests that as the frequency of technology use in teaching increases, student engagement decreases. This unexpected result may indicate potential issues with how technology is being integrated or utilized in classrooms (Orim & Odum, 2018).

The positive coefficient for Comfort level (0.30) indicates that a higher comfort level with technology integration is associated with increased student engagement. Educators who are more comfortable with technology may be more likely to utilize it effectively in their teaching practices, leading to better student engagement (Adeleke, 2020).

The intercept (1.75) represents the baseline level of student engagement when both Technology use and Comfort level are zero.

The error term captures the unexplained variance in student engagement not accounted for by the independent variables.

The coefficient for Technology use (-0.25) indicates that for every one-unit increase in the frequency of technology use in teaching, student engagement decreases by 0.25 units. The coefficient for Comfort level (0.30) suggests that for every one-unit increase in educators' comfort level with technology integration, student engagement increases by 0.30 units. The standard errors for Technology use (0.08) and Comfort level (0.10) represent the variability of the coefficients around the true population values. A lower standard error indicates that the coefficient estimate is more precise. The t-statistic for Technology use (-3.13) tests the significance of the coefficient and indicates that the relationship between

Technology use and student engagement is statistically significant (p < 0.01). The t-statistic for Comfort level (3.00) also shows statistical significance, suggesting that the relationship between Comfort level and student engagement is significant (p < 0.01). The negative coefficient for Technology use suggests that educators may need additional support or training to effectively integrate technology into their teaching practices. Addressing barriers to technology use, such as lack of resources or resistance from staff, could help improve student engagement levels.

The positive coefficient for Comfort level highlights the importance of educators' attitudes and comfort level with technology in enhancing student engagement. Providing ongoing professional development and support can empower educators to leverage technology effectively in their classrooms.

The coefficients, standard errors, and t-statistics provide valuable insights into the relationships between technology use, comfort level, and student engagement in colleges of education in North Central Nigeria. By understanding these factors and their significance, educators, and policymakers can work towards promoting effective technology integration and enhancing learning outcomes.

The negative coefficient for Technology use indicates that there is a negative relationship between the frequency of technology use in teaching and student engagement. This unexpected finding may suggest that simply using technology more frequently does not guarantee improved student engagement. Educators need to explore how they are integrating technology to ensure it enhances student learning experiences effectively.

The positive coefficient for Comfort level implies that educators who feel more comfortable with technology integration tend to have higher levels of student engagement in their classes. This underscores the importance of providing educators with adequate training and support to build their confidence and skills in utilizing technology for pedagogical purposes.

The t-statistics for both Technology use and Comfort level are significant (p < 0.01), indicating that the relationships between these variables and student engagement are unlikely to have occurred by random chance. This

strengthens the validity of the regression model and suggests that the observed associations are robust.

The t-statistics being significant also imply that the coefficients for Technology use and Comfort level are estimated with a high level of confidence and are reliable indicators of the relationships with student engagement.

The findings from the regression analysis underscore the need for tailored professional development programs that focus on not just increasing the frequency of technology use but also enhancing educators' comfort levels and pedagogical strategies when integrating technology into their teaching.

Policymakers should take into account the impact of educator attitudes and support systems on technology integration in colleges of education. Policies should prioritize providing resources, training opportunities, and incentives to encourage educators to embrace technology effectively in their instructional practices.

5.0 Conclusion and Recommendation

The study concludes that educators' comfort levels with technology and socioeconomic factors play vital roles in technology integration efforts and education quality in colleges of education. Responsive teaching practices and inclusive policy frameworks are essential in promoting equitable and effective technology integration practices in educational settings. The findings underscore the need for tailored professional development programs that focus on enhancing educators' comfort levels with technology, leveraging their diverse backgrounds to improve technology integration, and addressing economic disparities to promote equitable access to technology tools and resources. Culturally responsive teaching practices, ongoing support for educators from diverse backgrounds, and inclusive policy frameworks can facilitate effective technology integration and enhance the quality of education in colleges of education in North Central Nigeria.

   i.   Develop targeted professional development programs to enhance educators' comfort levels with technology integration and promote best practices in utilizing technology tools (Ertmer et al., 2012).
   ii. Implement strategies to address economic disparities and ensure equitable access to technology resources for all educators (Becker et al., 2017).
   iii. Foster a culture of diversity and inclusion by valuing educators' diverse backgrounds and perspectives in technology integration efforts (Al-Ali, 2013).
   iv. Establish supportive policy frameworks that prioritize equitable access to technology and culturally responsive teaching practices to enhance education quality and promote student success.
   v.   Develop targeted professional development initiatives to enhance educators' comfort levels

with technology integration and promote best practices for utilizing technology tools in teaching.
   vi. Implement strategies to address economic disparities by providing equal access to technology resources and training opportunities for educators across different income levels.
   vii. Foster a culture of diversity and inclusion by valuing educators' diverse backgrounds, experiences, and perspectives in technology integration efforts.

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