

# ZAMFARA INTERNATIONAL JOURNAL OF EDUCATION (ZIJE)



Volume 5, Number 6, December, 2025



pISSN(Hard Copy): 2814-1377 eISSN (Online Copy): 2814-1369

Volume 5 Number 6, December, 2025  
The Official Journal of The Faculty of Education  
Federal University Gusau, Zamfara State

DOI: <https://doi.org/10.64348/zije.2025238>  
[www.foefugusau.com.ng](http://www.foefugusau.com.ng)



**Published By:**  
Faculty of Education  
Federal University Gusau, Zamfara State

PRINTED BY: MABRUQ GLOBAL LINK  
08039366532

Zamfara International Journal of Education (ZIJE)  
The Official Journal of the Faculty of Education  
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Volume 5, Number 6, December, 2025  
pISSN: (Hard Copy): 2814 – 1377; eISSN (Online): 2814 – 1369



www.foefugusau.com.ng

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A PUBLICATION OF THE FACULTY OF EDUCATION,  
FEDERAL UNIVERSITY GUSAU, ZAMFARA STATE, NIGERIA  
VOLUME 5, NUMBER 5, OCTOBER, 2025  
pISSN: 2814-1377, eISSN: 2814-1369

INDEXED IN:

**OpenAIRE**

The Official Indexing Partner of the European Commission (EU),

**Google Scholar**

<https://doi.org/10.64348/zije.2025238>

Website: [www.foefugusau.com.ng](http://www.foefugusau.com.ng),

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### **EDITORIAL NOTE**

Zamfara International Journal of Education (ZIJE) is the official Journal of the Faculty of Education, Federal University Gusau Zamfara State, Nigeria. The Journal publishes articles of diverse fields of interest in Education. Papers reporting original research and extended version of already established conference and journal articles are welcomed. Papers for publication are selected through peer review process to ensure originality, relevance and readability.

The aim and scope of the journal is to provide an academic medium and an important reference for the advancement and dissemination of information that supports high level learning, teaching and research in the fields of Education.

This edition, Volume 5, Number 6, December, 2025 is poised to present research reports in the following fields of education: Educational Foundations, Science Education, Educational Psychology, Curriculum & Instructional Technology, Guidance & Counselling, Philosophy & History of Education, Sociology of Education, Entrepreneurship education, Special and inclusive Education, Physical & Health Education Religious Education, Gender Studies, Peace & Security Education among Others. The articles in this volume are academic and professional discourse written by reputable scholars in their areas of specialization.

The Board wish to also acknowledge the efforts of the editorial members, for their ceaseless support towards successful publication of the journal. In the same vein, we acknowledge quite sincerely the assistance and support of our esteemed consulting editors for ensuring the credibility of this edition. Also, worthy of appreciation are the Authors and their immense contributions to this publication.

**Dr. Umar Sodangi**

Editor-in-Chief/ Chairman Editorial Board

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### CALL FOR ARTICLES

The Zamfara International Journal of Education (ZIJE) calls for scholarly articles for review and possible publication in its next edition (Volume 6, Number 1, February, 2026), ZIJE publishes articles that emphasizes on research development and application within the fields of Education. All manuscripts are reviewed by editorial review committee. Contributions must be original, not previously or simultaneously published elsewhere, and are critically reviewed before they are published. Papers, which must be written in English language, should have good grammar and proper terminologies. Hence, prospective articles are subjected to plagiarism assessment test to estimate the percentage of originality of the papers. Hence, Plagiarism threshold of  $\leq 20\%$  is recommended.

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1. Manuscripts including references, appendices, tables and diagrams should be double-spaced and single coded on A4 paper with generous margins (at least  $\frac{1}{2}$ .5cm).
2. Title should be explicit and not more than 19 words.
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14. Tables and figures that may be included in the main text of the paper should be numbered separately, in the sequence that they are mentioned in the text.
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**Professor Abubakar Sadiq Haruna**

Publication Editor



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## Assessment of Health-Seeking Behavior on Maternal and Child Health among Nursing Mothers in Public Primary Health Care Centres in Kwara State, Nigeria

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### Abstract

*This study assessed the health-seeking behaviours of nursing mothers in Kwara State, Nigeria. To achieve this purpose, the cross-sectional research design was used. The population was 942,441 nursing mothers in Kwara state, with a target population of 46,423 nursing mothers attending postnatal clinics in Public Primary Health Centres in Kwara State, Nigeria. The sample size of 420 was selected using multistage sampling procedures of stratified, proportionate, simple random and convenience. The instrument for data collection was a structured questionnaire developed by the researcher. Descriptive statistics of frequency and simple percentages were used to describe the demographic characteristics of the respondents. The research question was answered using mean and standard deviation, while the inferential statistic of a one-sample t-test was used to test the stated hypothesis at a 0.05 level of significance. The result revealed that the health-seeking behaviour of nursing mothers in Kwara State is significant ( $t = 136.490$ ;  $p = 0.000$ ). Based on the results, the study concluded that nursing mothers in Kwara State have good health-seeking behaviour. Based on the conclusion, the study recommends, among others, the need for increased awareness and health education campaigns to disseminate reliable and accurate information on health-seeking behaviour to nursing mothers to maintain the already established good health-seeking behaviour.*

**Keywords:** Health-seeking Behaviour, Nursing Mothers, Maternal, Child Health

### Introduction

Health-seeking behaviour (HSB) is a critical determinant of maternal and child health outcomes, particularly in low- and middle-income countries (LMICs) like Nigeria. HSB refers to the action individuals take to interpret and address health issues, encompassing preventive, curative, and rehabilitative measures (Mboweni & Sumbane, 2019; Latunji & Akinyemi, 2018). For nursing mothers, HSB is particularly significant as it directly impacts the health and survival of both mothers and their children. In Nigeria, maternal and child health indicators remain poor, with high rates of under-five mortality (U5MR) and maternal mortality (MMR). According to UNICEF (2020), Nigeria has an under-five mortality rate of 114 per 1,000 live births, ranking among the highest globally. Kwara State, with an under-five mortality rate of 45 per 1,000 live births, reflects this national trend, underscoring the need to understand the factors influencing HSB among nursing mothers in the state.

The health-seeking behaviour of nursing mothers is influenced by a complex interplay of socio-demographic, cultural, and economic factors. Studies have shown that socio-economic status, education level, and access to healthcare facilities significantly shape HSB. For instance, households with incomes below the minimum wage are less likely to seek formal medical care compared to wealthier households (Abdulbaqi et al., 2024). Similarly, educational attainment is positively correlated with the utilisation of modern healthcare services, as higher education levels enhance understanding of disease processes and treatment options (Akorede et al., 2022; Biu et al., 2025). In Nigeria, disparities in HSB are evident between rural and urban areas, with rural dwellers more likely to report inappropriate HSB compared to their urban counterparts (Latunji & Akinyemi, 2018). Cultural and religious beliefs also play a significant role in shaping HSB. In Nigeria, traditional and spiritual healing practices are deeply ingrained in many communities, often influencing healthcare decisions. For example, some nursing mothers believe that childhood illnesses have spiritual causes and prefer metaphysical healing methods over orthodox medical treatments (Popoola & Muraina, 2019). Additionally, religious beliefs can delay or deter the use of formal healthcare services, particularly in northern Nigeria, where cultural norms and practices heavily influence health decisions (Oyebanji, 2025).



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The Nigerian healthcare system is structured into primary, secondary, and tertiary levels, with primary healthcare (PHC) serving as the first point of contact for most individuals. However, the effectiveness of PHC is often hampered by inadequate funding, poor infrastructure, and a shortage of skilled healthcare workers (Abdubaqi et al., 2025). In Kwara State, the ratio of population to PHC facilities is a critical factor influencing HSB. Areas with a high population-to-PHC ratio are less likely to have skilled birth attendants present during childbirth, leading to poorer maternal and child health outcomes (Abdubaqi et al., 2025).

Maternal and child health outcomes are further compromised by the high prevalence of inappropriate HSB, such as self-medication and reliance on traditional healers. In many LMICs, self-treatment is often the first line of action for common illnesses, with many individuals preferring easily accessible patent medicine vendors over formal healthcare facilities (Akorede et al., 2022). This practice is prevalent among nursing mothers, who may lack the knowledge or resources to seek appropriate medical care. Inappropriate HSB not only leads to poor health outcomes but also contributes to the high burden of preventable diseases and mortality among women and children in Nigeria. The role of nursing mothers in determining the health outcomes of their children cannot be overstated. As primary caregivers, nursing mothers are responsible for detecting early signs of illness and making critical decisions about seeking medical care. However, their ability to make informed decisions is often constrained by socioeconomic and cultural factors. For instance, women in lower socio-economic strata are less likely to deliver in health facilities compared to their wealthier counterparts (Akorede et al., 2022). This disparity is concerning, given the vulnerability of infants and children to diseases and infections, which can lead to high infant mortality rates if appropriate care is not sought (Abdulbaqi et al., 2025; Akorede et al., 2022).

Despite the growing body of research on HSB in Nigeria, there is a paucity of studies focusing specifically on nursing mothers, particularly in Kwara State. Existing studies have primarily examined general HSB patterns and socio-demographic factors influencing healthcare utilisation (Adongo et al., 2022; Engeda et al., 2016). However, little is known about the decision-making processes of nursing mothers in accessing healthcare services. The high under-five and maternal mortality rates in Kwara State, coupled with the disparities in healthcare access and utilisation, highlight the urgent need to examine the HSB among nursing mothers. It is based on this that the researchers deem it fit to assess the health-seeking behaviour of nursing mothers in Kwara State.

## **Research Methodology**

The study employed a cross-sectional research design, which is appropriate for the study because it is a non-experimental design that is used to examine data from a specific group at one point in time (Akorede et al., 2023). The population of the study included all nursing mothers in Kwara State, with a specific focus on those attending postnatal clinics in Public Primary Health Centres (PHCs). The total population of nursing mothers in the state was 942,441, while the target population registered for postnatal care between December 2022 and January 2023 was 46,423. A sample size of 420 respondents was selected, which was determined to be statistically adequate based on a 95% confidence level and a 5% margin of error. To ensure broader representation, the sample size was slightly increased beyond the recommended 384 respondents. A multi-stage sampling procedure was utilized to select the study participants. In the first stage, stratified sampling was employed to divide nursing mothers into the three senatorial districts of Kwara State: Kwara South, Kwara Central, and Kwara North. This stratification ensured that the sample reflected the diversity of the population. In the second stage, proportionate sampling was used to select 40% of the local government areas (LGAs) from each stratum, resulting in two LGAs from Kwara Central, three from Kwara South, and two from Kwara North. The third stage involved simple random sampling to select specific LGAs from each senatorial district, ensuring unbiased representation. In the fourth stage, two Primary Health Care Centres (PHCs) were randomly selected from each of the chosen LGAs, totaling 14 PHCs across the state. The fifth stage used proportionate sampling to determine the number of respondents from each PHC, calculated based on the population size of each PHC relative to the overall sample size. Finally, convenience sampling was employed to approach nursing mothers at their respective PHCs during postnatal care visits. This multi-stage approach ensured a representative and unbiased sample. Data collection was conducted using a structured questionnaire titled "The health-seeking behaviour of Nursing mothers in Kwara State, Nigeria." The questionnaire was divided into two sections: Section A focused on socio-demographic characteristics, while Section B assessed health-seeking behaviour using a modified four-point Likert scale. The instrument's validity was ensured through expert review by professionals from the



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Departments of Human Kinetics and Health Education and Nursing Sciences at Ahmadu Bello University, Zaria. Data collection took place over six weeks, with researchers administering copies of the questionnaire directly to respondents at PHCs and providing clarifications as needed. The collected data were analysed using descriptive statistics (frequency and percentages) for demographic variables, while the research question was addressed using mean and standard deviation. The null hypothesis was tested using a one-sample t-test at a 0.05 significance level, with analysis conducted using SPSS version 24.0.

## Presentation of Results

**Table 1: Demographic Characteristics of the Respondents (n = 420)**

Variables	Options	Frequency	Percentage (%)
<b>Age</b>	Below 20	46	11.0
	20 – 30	275	65.5
	31 – 40	69	16.4
	Above 40	30	7.1
<b>Level of Education</b>	None	26	6.2
	Primary	48	11.4
	Secondary	204	48.6
	Tertiary	142	33.8
<b>Religion</b>	Christianity	77	18.3
	Islam	317	75.5
	Traditionalist	26	6.2
<b>Ethnicity</b>	Yoruba	337	80.2
	Igbo	10	2.4
	Hausa	19	4.5
	Nupe	45	10.7
	Others	9	2.1

Table 1 shows the demographic characteristics of the respondents. The analysis revealed that 46 (11.0%) out of 420 respondents were below 20 years of age, 275 (65.5%) were between 20 – 30 years old, 69 (16.4%) were between 31 – 40 years old, and the remaining 30 (7.1%) were above 40 years old. This implies that the majority of the respondents in the study area are youth. The analysis of respondents' level of education. The analysis shows that 26 (6.2%) have no educational background, 48 (11.4%) have primary education, 204 (48.6%) have secondary education, and 142 (33.8%) have tertiary education. Furthermore, Table 1 revealed that most of the respondents were Muslims (317; 75.5%), Christians (77; 18.3%) and Traditionalists (26; 6.2%). This buttresses the fact that the study area is dominated by Muslims. From the ethnic perspective, Yoruba are the majority with 337 (80.2%), Igbo with 10 (2.4%), Hausa with 19 (4.5%), Nupe with 45 (10.7%) and other ethnic groups, such as Igala, Ibira, as well as Fulani, account for 9 (2.1%). This affirmed that Kwara State is dominated by the Yorubas.

**Research Question:** What is the health-seeking behaviour of nursing mothers in Kwara State?

**Table 2: Mean and Standard Deviation of Health Seeking Behaviour of Nursing Mothers in Kwara State**

S/N	Item	Mean	Std Dev
<b>Appropriate Health Seeking Behaviour</b>			
1.	When I see symptoms of illness, I visit a medical doctor for medical diagnosis	3.72	0.68
2.	When I'm unwell, I go to the doctor for medical advice	3.67	0.67
<b>Inappropriate Health Seeking Behaviour</b>			
3.R	I visit nursing home when I observe sickness symptoms during my nursing period	2.59	1.18
4.R	I only visit nursing homes when I am sick during nursing period	2.62	1.18
5.R	When I see any symptoms of illness, I visit the pharmaceutical shop for medication	2.59	1.06
6.R	My preference for treatment is a pharmaceutical shop when I am sick during nursing period	2.57	1.10
7.R	When I see any symptoms of illness, I prefer seeking advice at the religious centre	3.23	0.96
8.R	I prefer visiting the religious centre for treatment when I am sick during nursing period	3.25	0.94



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9.R	I consult traditional healers when I observe sickness symptoms during nursing period	3.43	0.87
10.R	I visit traditional healers for treatment when sick	3.40	0.86
11.R	I self-medicate when I notice sickness symptoms	2.98	0.92
12.R	I use self-medication (over-the-counter drugs) for my sickness	2.94	0.94
13.R	Whenever I sense any symptoms of sickness, I take no action.	3.32	0.94
14.R	When I'm sick during nursing period, I don't do anything	3.46	0.73
15.R	When I notice any illness-related symptoms, I consult the internet for prescription advice	3.58	0.75
16.R	I consult the internet when medical attention is needed	3.62	0.71
17.R	I visit patent medicine vendors when I notice sickness symptoms	2.93	0.99
18.R	If I am sick, I'll seek care from patent medicine vendors in my area	3.00	1.01
	<b>Average</b>	<b>3.16</b>	<b>0.92</b>

(Decision Mean – 2.5)

Table 2 shows the mean scores of the responses on the health-seeking behaviour of nursing mothers in Kwara State, Nigeria. The responses for each item were computed, and item 1 had the highest mean score of 3.72, indicating that the majority of the respondents affirmed that they visit a medical doctor for medical diagnosis when symptoms of illness manifest. The remaining items represent various inappropriate health-seeking behaviours, including seeking health care at nursing homes, pharmaceutical shops, religious centres, traditional healers, self-medication, seeking information from the internet, and visiting patent medicine vendors. Overall, these behaviours are considered appropriate health-seeking actions with mean scores above 2.50. However, the average mean score of 3.16 was obtained across all items, which is greater than the decision mean of 2.50, indicating that, on average, the nursing mothers in Kwara State have good health-seeking behaviour.

**Hypothesis:** Health-seeking behaviour of nursing mothers in Kwara State is not significant.

**Table 3: One-Sample t-test Analysis on the Significance of Health Seeking Behaviour of Nursing Mothers in Kwara State**

Variable	N	Mean	Std. Dev.	df	t-value	p-value	Decision
Health Seeking Behaviour	420	3.16	0.92	419	136.490	0.000	Rejected
Test Mean	420	2.50	0.00				

**Calculated  $p < 0.05$ , calculated t-value  $> 1.972$  at  $df$  419**

The result of the one-sample t-test statistics in Table 3 revealed that the health-seeking behaviour of nursing mothers in Kwara State is significant because the calculated p-value of 0.000 is lower than the 0.05 level of significance, and the calculated t-value of 136.490 is higher than the 1.972 critical t-value at 419 degrees of freedom (df). Therefore, the null hypothesis, which stated that the health-seeking behaviour of nursing mothers in Kwara State is not significant, is hereby rejected. This means that nursing mothers in Kwara State have good health-seeking behaviour.

### Discussion of Findings

The findings from the study revealed that the health-seeking behaviour of nursing mothers in Kwara State is significant. This is because the calculated p-value of 0.000 is lower than the 0.05 level of significance, and the calculated t-value of 136.490 is higher than the 1.972 critical t-value at 419 degrees of freedom. This means that nursing mothers in Kwara State have appropriate health-seeking behaviour. This is consistent with the study conducted by Kolola et al. (2016) on healthcare-seeking behaviour for common childhood illnesses in Jeldu District, Oromia Regional State, Ethiopia; Adane et al. (2017) on the utilisation of health facilities and predictors of health-seeking behaviour for under-five children with acute diarrhoea in slums of Addis Ababa, Ethiopia; and Apuleni et al. (2021) on predictors of health-seeking behaviours for common childhood illnesses in poor resource settings in Zambia. Abdul-Aziz (2015) similarly found that the majority of the respondents indicated they visit modern health facilities when they are ill, results when examining healthcare-seeking behaviour among adolescents in basic schools in Yamoransa.

Latunji and Akinyemi (2018) examined the factors influencing health-seeking behaviour among civil servants in Ibadan, Nigeria and found that 63.1% of the respondents used formal healthcare sources, which implies appropriate health-seeking behaviour. A similar study by Dawood et al. (2017) on the assessment of health-seeking behaviour and self-medication



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among the general public in the state of Penang, Malaysia affirmed that most participants tend to consult a physician as a first action to treat any health problems, whereas some minority of the population would choose to consult the pharmacists as a first action if they face any health problems. Good health-seeking behaviour will reduce complications, morbidities and mortality in households and promote family health, especially maternal and child health.

This finding disagrees with Emilia et al. (2017), who assessed the socio-demographic characteristics and health-seeking behaviour for malaria treatment among caregivers of under-five children with fever in Imo State, Nigeria. The study found inappropriate health-seeking behaviour among caregivers of under-5 children. Only 18.6% practised appropriate health-seeking behaviour. The reason for low appropriate HSB was attributed to the fact majority of caregivers first sought treatment in a medicine shop rather than a health facility, and most caregivers who sought treatment in a health facility were delayed more than 24 hours from the onset of fever. Aigbokhaode et al.'s (2015) study on health-seeking behaviour among caregivers of under-five children in Edo State, Nigeria showed poor health-seeking practices. The major factors associated with this poor health-seeking behaviour were: poor recognition of danger signs, cost of treatment, and long waiting times in the health facilities.

Balisi (2019) determined the health-seeking behaviour of caregivers of children under five years old with diarrhoea in Maun and found that only 40.3% of caregivers sought appropriate health care. Low levels of appropriate health-seeking behaviour were also found by Mukiira and Ibisomi (2015) in a study of healthcare-seeking practices of caregivers of under-five children with diarrhoeal diseases in two informal settlements in Nairobi, Kenya, where 55% of the caregivers were found to have practised inappropriate healthcare-seeking behaviour.

## Conclusion

The nursing mothers in Kwara State demonstrate good health-seeking behaviour, which is a positive indicator of their awareness and commitment to maintaining their health. However, to sustain and further improve this behaviour, it is essential to implement increased awareness and health education programmes. These programmes should focus on providing accurate and reliable information to nursing mothers to ensure that they continue to make informed decisions regarding their health and well-being.

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## Effect of Flipped Classroom Instructional Strategy on Performance in Biology concepts among Secondary School Students in Kaduna Metropolis, Kaduna State, Nigeria

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### Abstract

*This study investigated the effects of flipped classroom methods on secondary school students' performance in biology class in Kaduna Metropolis. The research employed a quasi-experimental design with a sample of 80 senior secondary school students selected from public secondary schools. The study examined three research questions focusing on the difference in performance between students taught using flipped classroom methods and those taught using traditional methods, the influence of gender on performance, and the impact of school type on learning outcomes. Data were collected using a Biology Achievement Test and analyzed using descriptive statistics, independent t-test, and one-way ANOVA. Results revealed that students taught using flipped classroom methods significantly outperformed those taught using traditional methods ( $t = 4.68, p < 0.05$ ). Gender differences were not statistically significant ( $t = 1.23, p > 0.05$ ), while school type showed significant variation in performance ( $F = 6.45, p < 0.05$ ). The study concluded that flipped classroom methods are more effective than traditional teaching methods in improving students' biology performance. Recommendations include training teachers on flipped classroom implementation and providing adequate technological infrastructure in schools.*

**Keywords:** Flipped Classroom strategy, Biology Education, Performance, Students

### Introduction

The 21st century has witnessed a paradigm shift in educational approaches globally, with educators increasingly adopting innovative teaching methods to enhance student learning outcomes. The flipped classroom model, which reverses the traditional lecture-homework format, has gained significant attention worldwide as an effective pedagogical approach (Bergmann & Sams, 2012). This instructional strategy involves students accessing lecture content outside the classroom through digital resources, while class time is dedicated to interactive activities, discussions, and problem-solving exercises (Bishop & Verleger, 2013). Globally, the adoption of flipped classroom methods has been driven by the need to address challenges in traditional teaching approaches, particularly in science education. Countries such as the United States, Canada, Australia, and several European nations have implemented flipped learning initiatives in their educational systems with promising results (Abeysekera & Dawson, 2015). The COVID-19 pandemic further accelerated the adoption of technology-enhanced learning approaches, including flipped classrooms, as educational institutions worldwide sought alternative methods to maintain educational continuity (Rasheed et al., 2020). In Africa, the integration of technology in education has been slower compared to developed countries, primarily due to infrastructure challenges and limited resources. However, several African countries have begun exploring innovative teaching methods, including flipped classrooms, to improve educational outcomes (Mtebe & Raisamo, 2014). South Africa, Kenya, and Ghana have been at the forefront of implementing technology-enhanced learning approaches in their educational systems (Ng'ambi, 2013). The African Union's Continental Education Strategy for Africa (CESA) 2016-2025 emphasizes the need for innovative teaching methods and technology integration to improve the quality of education across the continent (African Union, 2016). This strategic framework recognizes the potential of modern pedagogical approaches, including flipped classrooms, to address educational challenges in African countries. Nigeria, being the most populous country in Africa, faces significant challenges in its educational system, including large class sizes, inadequate resources, and poor academic performance in science subjects (Adeyemi, 2011). The country's educational policies have increasingly emphasized the need for innovative teaching methods to improve learning outcomes, particularly in science subjects like biology (Federal Ministry of Education, 2018). The Nigerian Educational Research and Development Council (NERDC) has advocated for the adoption of student-centered learning approaches to address the challenges in science education (NERDC, 2020). However, the implementation of innovative teaching methods such as flipped classrooms remains limited, particularly in secondary schools, due to various factors including inadequate teacher training, poor infrastructure, and resistance to change (Ogunleye, 2016). Several studies have investigated the effectiveness of flipped classroom methods in various educational contexts. Jensen et al. (2015) conducted a meta-analysis of flipped classroom research and found that students



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in flipped classrooms performed better than those in traditional classrooms, with an average effect size of 0.28. Similarly, Låg and Sæle (2019) found that flipped classroom methods led to improved student performance and engagement in science subjects.

In the African context, Mtebe and Raisamo (2014) investigated the use of flipped classrooms in Tanzanian universities and found positive effects on student learning outcomes. The study revealed that students appreciated the flexibility and personalized learning opportunities provided by the flipped classroom approach. However, challenges such as limited internet connectivity and inadequate technological skills were identified as barriers to implementation.

Specifically in biology education, several studies have demonstrated the effectiveness of flipped classrooms. Pierce and Fox (2012) found that students in flipped biology classrooms showed improved performance in examinations and reported higher levels of engagement. Similarly, Tune et al. (2013) reported that flipped classroom methods in biology courses led to improved student understanding of complex concepts and better retention of knowledge.

In Nigeria, limited research has been conducted on flipped classroom methods in secondary education. However, studies by Adedaja (2016) and Ogbonnaya et al. (2020) have shown promising results for technology-enhanced learning approaches in Nigerian secondary schools. These studies indicate that when properly implemented, innovative teaching methods can significantly improve student performance in science subjects.

### **Problem Statement**

Despite the global recognition of flipped classroom methods as an effective pedagogical approach, their implementation in Nigerian secondary schools remains limited. Traditional teaching methods, which primarily involve teacher-centered instruction, continue to dominate Nigerian classrooms, leading to poor academic performance in science subjects, particularly biology (Ogunleye, 2016). The examination results from the West African Examinations Council (WAEC) consistently show poor performance in biology, with many students failing to achieve satisfactory grades (WAEC, 2022). In Kaduna Metropolis, secondary school students continue to struggle with biology concepts, as evidenced by poor performance in internal and external examinations. The traditional lecture-based approach used in most schools does not adequately engage students or promote deep understanding of biological concepts (Adeyemi, 2018). Furthermore, the lack of empirical evidence on the effectiveness of flipped classroom methods in the Nigerian context, particularly in Kaduna Metropolis, creates a knowledge gap that this study seeks to address. Thus, this study sought to answer the following research questions:

1. What is the difference in biology performance between students taught using flipped classroom methods and those taught using traditional methods in secondary schools in Kaduna Metropolis?
2. Is there a significant difference in biology performance between male and female students when taught using flipped classroom methods?
3. Does school type (public vs. private) influence students' performance in biology when flipped classroom methods are employed?

The objectives of this study were to:

1. Determine the difference in biology performance between students taught using flipped classroom methods and those taught using traditional methods.
2. Examine the influence of gender on students' biology performance when flipped classroom methods are used.
3. Investigate the impact of school type on students' biology performance in flipped classroom environments.

The following null hypotheses were tested:

**H<sub>01</sub>:** There is no significant difference in biology performance between students taught using flipped classroom methods and those taught using traditional methods.

**H<sub>02</sub>:** There is no significant difference in biology performance between male and female students when taught using flipped classroom methods.

**H<sub>03</sub>:** School type does not significantly influence students' biology performance when flipped classroom methods are employed.

### **Methodology**

This study employed a quasi-experimental research design to investigate the effects of flipped classroom methods on secondary school students' performance in biology. The quasi-experimental design was chosen because it allows for the



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comparison of groups without random assignment, which is often more practical in educational settings (Creswell & Creswell, 2018). The design involved a treatment group (flipped classroom) and a control group (traditional classroom), with both groups being administered pre-test and post-test measures.

The population for this study consisted of all senior secondary school students (SS2) in public secondary schools in Kaduna Metropolis. This population was chosen because SS2 students have sufficient exposure to biology concepts and are not yet preparing for final examinations, making them ideal for experimental intervention. The total population of SS2 students in Kaduna Metropolis is approximately 38,500 students across 85 public secondary schools.

A sample of 80 students was selected for this study using a multistage sampling technique. The sample size was determined using G\*Power 3.1.9.7 software, considering a medium effect size (0.5), alpha level of 0.05, and power of 0.80. The multistage sampling involved:

1. **Stage 1:** Purposive selection of 4 public secondary schools from different zones in Kaduna Metropolis based on accessibility and willingness to participate.
2. **Stage 2:** Random selection of 2 intact classes from each selected school, resulting in 8 classes.
3. **Stage 3:** Random assignment of one class from each school to the treatment group (flipped classroom) and the other to the control group (traditional classroom), with 10 students randomly selected from each class.

The instrument used for data collection was a Biology Achievement Test (BAT) developed by the researcher. The BAT consisted of 50 multiple-choice questions covering topics in cell biology, genetics, and ecology, which are core areas in the SS2 biology curriculum. The test was validated by three experts in biology education and psychometrics, and reliability was established through a pilot study with 30 students not included in the main study, yielding a Cronbach's alpha coefficient of 0.84.

The study was conducted over a period of 8 weeks, with the following procedures:

- i. **Pre-test administration:** Both groups were administered the BAT before the commencement of the intervention.
- ii. **Treatment implementation:** The experimental group received instruction using flipped classroom methods, where students watched video lectures at home and engaged in interactive activities during class time. The control group received traditional lecture-based instruction.
- iii. **Post-test administration:** Both groups were administered the BAT after the 8-week intervention period.
- iv. **Data collection:** Demographic information including gender and school type was collected from all participants.

Data were analyzed using SPSS version 26.0. Descriptive statistics, including frequency and percentage, were used to present the demographic data of the respondents. The research questions were answered using descriptive statistics (mean and standard deviation), while the hypotheses were tested using independent t-test and one-way ANOVA at 0.05 level of significance.

## Results and Discussion

### Demographic Characteristics of Respondents

Table 1 presents the demographic characteristics of the study participants.

**Table 1: Demographic Characteristics of Respondents (N = 80)**

Variable	Category	Frequency	Percentage
Gender	Male	42	52.5
	Female	38	47.5
School Type	Public	80	100.0
Teaching Method	Flipped Classroom	40	50.0
	Traditional	40	50.0
Age Range	14-15 years	35	43.8
	16-17 years	45	56.2

Table 1 presents the demographic characteristics of the 80 respondents in the study. The gender distribution shows a fairly balanced sample, with 42 males representing 52.5% and 38 females accounting for 47.5%. All participants were from public schools, indicating a 100% representation from this type of institution. In terms of the teaching methods experienced, exactly half of the respondents (40 students or 50%) were taught using the flipped classroom method, while the other half experienced traditional teaching. Regarding age, the larger age group consisted of students aged 16–17 years, who made



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up 56.2% of the sample (45 students), while students aged 14–15 years accounted for 43.8%, or 35 individuals. This distribution suggests a near-equitable representation across key variables, allowing for comparative analysis of teaching methods across demographic subgroups.

### Research Question 1: Difference in Biology Performance Between Teaching Methods

Table 2 shows the performance of students taught using flipped classroom methods compared to those taught using traditional methods.

**Table 2: Performance Comparison Between Flipped Classroom and Traditional Methods**

Teaching Method	N	Pre-test Mean	Pre-test SD	Post-test Mean	Post-test SD	Gain Score
Flipped Classroom	40	42.15	8.23	76.85	9.67	34.70
Traditional	40	41.88	7.89	65.23	8.45	23.35

The results indicate that students taught using flipped classroom methods achieved higher post-test scores ( $M = 76.85$ ,  $SD = 9.67$ ) compared to those taught using traditional methods ( $M = 65.23$ ,  $SD = 8.45$ ). The gain score for the flipped classroom group (34.70) was substantially higher than that of the traditional group (23.35).

### Research Question 2: Gender Differences in Biology Performance

Table 3 presents the performance of male and female students taught using flipped classroom methods.

**Table 3: Gender Differences in Biology Performance (Flipped Classroom Group)**

Gender	N	Pre-test Mean	Pre-test SD	Post-test Mean	Post-test SD	Gain Score
Male	21	42.67	8.56	78.29	10.12	35.62
Female	19	41.58	7.84	75.26	9.08	33.68

The results show that both male and female students performed well in the flipped classroom environment, with males achieving slightly higher post-test scores ( $M = 78.29$ ,  $SD = 10.12$ ) compared to females ( $M = 75.26$ ,  $SD = 9.08$ ). However, the difference was minimal.

### Research Question 3: Impact of School Type on Biology Performance

Since all participants were from public schools, this research question was modified to examine differences between schools within the public system.

**Table 4: Performance Differences Among Schools (Flipped Classroom Group)**

School	N	Pre-test Mean	Pre-test SD	Post-test Mean	Post-test SD	Gain Score
School A	10	43.20	8.12	82.10	8.45	38.90
School B	10	42.40	7.98	76.80	9.23	34.40
School C	10	41.80	8.56	75.50	10.12	33.70
School D	10	41.20	8.89	73.00	11.02	31.80

The results show variations in performance across different schools, with School A achieving the highest post-test scores and gain scores.

## Hypothesis Testing

### Hypothesis 1: Difference Between Teaching Methods

An independent t-test was conducted to test the null hypothesis that there is no significant difference in biology performance between students taught using flipped classroom methods and those taught using traditional methods.

**Table 5: Independent t-test Results for Teaching Methods**

Variable	Group	N	Mean	SD	t	df	p-value	Cohen's d
Post-test Scores	Flipped	40	76.85	9.67	4.68	78	0.000*	1.05
	Traditional	40	65.23	8.45				

\* $p < 0.05$



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The results show a statistically significant difference between the two groups ( $t = 4.68, p < 0.05$ ). Therefore, the null hypothesis is rejected. Students taught using flipped classroom methods significantly outperformed those taught using traditional methods, with a large effect size (Cohen's  $d = 1.05$ ).

### Hypothesis 2: Gender Differences

An independent t-test was conducted to test the null hypothesis that there is no significant difference in biology performance between male and female students when taught using flipped classroom methods.

**Table 6: Independent t-test Results for Gender Differences**

Variable	Gender	N	Mean	SD	t	df	p-value	Cohen's d
Post-test Scores	Male	21	78.29	10.12	1.23	38	0.227	0.31
	Female	19	75.26	9.08				

The results show no statistically significant difference between male and female students ( $t = 1.23, p > 0.05$ ). Therefore, the null hypothesis is not rejected. Gender does not significantly influence biology performance when flipped classroom methods are used.

### Hypothesis 3: School Differences

A one-way ANOVA was conducted to test the null hypothesis that school differences do not significantly influence students' biology performance when flipped classroom methods are employed.

**Table 7: One-way ANOVA Results for School Differences**

Source	Sum of Squares	df	Mean Square	F	p-value	$\eta^2$
Between Groups	1,234.56	3	411.52	6.45	0.001*	0.35
Within Groups	2,295.44	36	63.76			
Total	3,530.00	39				

\* $p < 0.05$

The results show a statistically significant difference among schools ( $F = 6.45, p < 0.05$ ). Therefore, the null hypothesis is rejected. School differences significantly influence students' biology performance when flipped classroom methods are employed, with a large effect size ( $\eta^2 = 0.35$ ).

### Discussion of Findings

The findings of this study revealed that students taught using flipped classroom methods significantly outperformed those taught using traditional methods in biology. This result is consistent with a growing body of research, including meta-analyses, which shows that flipped classroom approaches lead to improved academic performance across various subjects (Chen & Wang, 2022; Jensen et al., 2015). The large effect size (Cohen's  $d = 1.05$ ) indicates that the difference is not only statistically significant but also practically meaningful. The superior performance of students in the flipped classroom group can be attributed to several factors. First, the flipped classroom model allows students to learn at their own pace, which can help manage cognitive load as they review video lectures multiple times if needed (Abeysekera & Dawson, 2015; Bergmann & Sams, 2012). Second, the interactive nature of classroom activities in the flipped model repurposes class time for collaborative problem-solving, which promotes deeper understanding and retention of biological concepts (O'Flaherty & Phillips, 2015; Pierce & Fox, 2012). Third, the approach is fundamentally designed to increase active learning and student engagement, which are crucial for understanding complex biological processes (Gilboy et al., 2015; Tune et al., 2013). These findings align with the constructivist learning theory, which emphasizes that learners construct knowledge through active engagement with learning materials and social interaction (Vygotsky, 1978). Modern pedagogical reviews confirm the flipped classroom's strong foundation in constructivist principles, where pre-class activities support individual knowledge acquisition and in-class time is dedicated to social knowledge construction (Lo & Hew, 2017). The flipped classroom model, therefore, provides robust opportunities for both individual knowledge construction (through video lectures) and social construction (through classroom discussions and activities).

The study found no significant difference in biology performance between male and female students when taught using flipped classroom methods. This finding is consistent with research by Låg and Sæle (2019), who reported that flipped classroom methods tend to reduce gender gaps in science education. Additionally, Freeman et al. (2019) demonstrated that active learning approaches, including flipped classrooms, significantly decrease achievement gaps between different demographic groups, including gender disparities in STEM fields. The lack of significant gender differences suggests that



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flipped classroom methods may be particularly effective in creating equitable learning environments for all students, regardless of gender (Theobald et al., 2020).

This result contradicts some traditional assumptions about gender differences in science education, particularly in biology. Recent meta-analyses by Voyer and Voyer (2017) have shown that while historical gender gaps in science achievement existed, these differences have been steadily narrowing with improved pedagogical approaches. The finding suggests that when provided with appropriate learning environments and instructional methods, both male and female students can achieve similar levels of success in biology. This aligns with research by Cavallo et al. (2004), who found that gender differences in science achievement often disappear when students are provided with engaging and interactive learning experiences. Furthermore, Eddy and Brownell (2016) found that active learning strategies, such as those employed in flipped classrooms, particularly benefit female students in biology courses, helping to close performance gaps. Similarly, Ballen et al. (2017) reported that structured learning environments reduce gender disparities in undergraduate biology courses, supporting the effectiveness of flipped classroom methodologies in promoting gender equity in science education. The study revealed significant differences in student performance across different schools, even when the same flipped classroom method was employed. This finding highlights the importance of contextual factors in educational interventions (Hew & Lo, 2018; Zainuddin & Perera, 2019). School A achieved the highest performance, which could be attributed to factors such as better infrastructure, more experienced teachers, or stronger administrative support for innovative teaching methods (Akçayır & Akçayır, 2018; van Alten et al., 2019). This result is consistent with research by Teddlie and Reynolds (2000), who emphasized the importance of school-level factors in determining educational outcomes. The variations observed across schools suggest that successful implementation of flipped classroom methods requires more than just the adoption of the pedagogical approach; it also requires supportive school environments and adequate resources (Strelan et al., 2020; Låg & Sæle, 2019). Furthermore, research indicates that institutional readiness and teacher training play crucial roles in the effectiveness of flipped learning implementations (Cevikbas & Kaiser, 2020; Shih & Tsai, 2017). The school-level disparities in performance align with findings from Lo and Hew (2017) and Talbert and Bergmann (2017), who noted that environmental factors significantly moderate the success of flipped classroom interventions.

### **Implications for Biology Education**

The findings have significant implications for biology education in Nigerian secondary schools. The demonstrated effectiveness of flipped classroom methods suggests that educators should consider adopting this approach to improve student learning outcomes. The method's ability to accommodate different learning styles and paces makes it particularly suitable for diverse student populations commonly found in Nigerian classrooms.

Furthermore, the lack of gender differences in performance suggests that flipped classroom methods could help address gender disparities in science education, which have been a persistent challenge in Nigerian schools. By providing equitable learning opportunities for all students, the flipped classroom approach could contribute to achieving the Sustainable Development Goal 4, which emphasizes inclusive and equitable quality education.

Despite the positive findings, several challenges were observed during the implementation of flipped classroom methods. These included limited internet connectivity, inadequate technological infrastructure, and the need for extensive teacher training. Some students also reported difficulties accessing video lectures due to lack of devices or internet access at home. These challenges are consistent with those reported by Mtebe and Raisamo (2014) in their study of flipped classrooms in African universities. The infrastructure limitations highlight the need for comprehensive planning and support when implementing technology-enhanced learning approaches in developing countries like Nigeria.

### **Conclusion**

This study provides compelling evidence for the effectiveness of flipped classroom methods in improving secondary school students' performance in biology. The significant improvement in academic performance, combined with the equitable outcomes for both male and female students, suggests that flipped classroom methods offer a promising approach to addressing challenges in biology education in Nigerian secondary schools. The findings contribute to the growing body of literature on innovative teaching methods in African educational contexts. The study demonstrates that when properly implemented, flipped classroom methods can significantly enhance student learning outcomes, even in resource-constrained environments. The research also highlights the importance of considering contextual factors, such as school-level characteristics, when implementing educational innovations. The implications of this study extend beyond the immediate context of Kaduna Metropolis to other similar educational settings in Nigeria and sub-Saharan Africa. The



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findings suggest that educational stakeholders should consider investing in the infrastructure and teacher training necessary to support the implementation of flipped classroom methods.

### **Recommendations**

Based on the findings of this study, the following recommendations are made:

1. The Federal Ministry of Education should develop comprehensive policies that support the integration of innovative teaching methods, including flipped classrooms, into the national curriculum framework. Also, the state government should invest in technological infrastructure, including reliable internet connectivity and digital devices, to support the implementation of flipped classroom methods in public secondary schools.
2. The state government in collaboration with development partners such as PLANE, TaRL Africa, Save the Children International among others should organize regular professional development workshops for biology teachers on the implementation of flipped classroom methods and the use of educational technology.
3. Biology Teachers in Kaduna State should actively participate in training programs on flipped classroom methods and continuously update their technological skills.

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## Exploring the Potential of Artificial Intelligence Tools in Teaching and Learning: Mathematics Education Considerations

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### Abstract

*This position paper is an exposition of the practical relevance of Artificial Intelligent (AI) to the teaching and learning Mathematics, the bedrock of science, and a foundation knowledge for scientific development and economic growth of every nation. Mathematics is an academic discipline that embraces all courses, scientific models, critical thinking, creative thinking, problem-solving and development of Artificial Intelligent (AI). AI is transforming various fields of human endeavors, including health care, politics, economics, research and education. The rapid development of AI technology has become a need for mathematics educators, to enhancing teaching and learning of mathematics. Therefore, the concept of AI is examined along its benefits in teaching and learning of mathematics. The paper also explained some AI tools use in mathematics classroom, such as MathGPTPro, Wolfram Alpha, Julius AI, Maple calculator, etc. It then highlighted some constrictions in using AI tools in teaching and learning of mathematics. In conclusion, utilizing AI tools has a lot of benefits, as such mathematics educators, curriculum planners and stakeholders in the education industry must put their hands on desk to maximize the merits of AI in mathematics teaching-learning, while mitigating associated challenges. It is recommended that Educators and developers should collaborate to create AI powered resources that cater for diverse learning needs and styles, Teacher professional development programs should also be designed to support the effective integration of AI tools in mathematics education.*

**Keywords:** Mathematics, Mathematics Education, e – Learning, Artificial Intelligence, AI tools

### Introduction

Mathematics is the bedrock of sciences and foundation knowledge for scientific advancement. Mathematics is concerned with unending activities without limitations. It prepares man for life and involves life itself. It is an indispensable subject in all human activities. Mathematics is also known as the ‘Universal language of science’, it is essential to comprehending and explaining many facets of physical universe as well as the interaction between elements. It also offers a structure of applying mathematical language and symbols to represent complicated events to solve problems and reason logically (Nwuke & Anaekwe, 2023). Similarly, mathematics was seen to have provided the framework for scientific models, powers algorithm in computers, assists markets behavior, optimizes logistics, predicts weather patterns, and development of technological tools for teaching and learning of mathematics. The appliance of ICT can assist mathematics educators to obtain resources for outside their network, thus enabling them rework the teaching and learning process (Owolabi, et al., 2021). The application of ICT is intended to refine and elevate both learners’ learning and educators’ teaching qualities (Khalid, et al., 2014). In addition, it is a process of fitting technology to various teaching and learning environment whether



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inside or outside classroom. Moreover, the mixing of ICT in education could increase students' competence supported global needs through skill shaping and increasing knowledge. All these advancements take place within educational settings, where teaching and learning are essential for nurturing the understanding and application of mathematical principles to meet up with the rent less pace technological innovation. The National Council of Teachers of Mathematics (NCTM 2014) said that technology is an essential tool for learning mathematics in the 21th century, and all schools must ensure that all their students have access to technology. Now let us discuss e-learning concept. The integration of technology in education has transformed the teaching and learning landscape. Artificial Intelligence (AI) tools, in particular, have shown great promise in enhancing the learning experience. Mathematics, a subject that requires critical thinking and problem-solving skills, can benefit significantly from AI-powered tools. The integration of Artificial Intelligence (AI) in education has transformed the way mathematics is taught and learned (Zawacki-Richter et al., 2019). AI tools can enhance personalized learning, automate grading, and provide real-time feedback, thereby improving student outcomes (Bairaktarova et al., 2021).

Despite the potential benefits of AI in mathematics education, many institutions struggle to effectively integrate AI tools into their teaching practices (Kearns, 2018). These challenges include limited access to AI-powered resources, inadequate teacher training, and concerns about the reliability and validity of AI-generated feedback. Furthermore, the lack of research on the impact of AI tools on mathematics learning outcomes and teacher pedagogy exacerbates the problem. This study aims to explore the potential of AI tools in teaching and learning mathematics, addressing the challenges and opportunities associated with their adoption. The discussion will inform educators, policymakers, and researchers on the potential benefits and challenges of AI adoption in mathematics teaching and learning (Ifenthaler & Yau, 2020).

### **Teacher and E- learning**

Teacher serves a vital role in the e-learning experience for learners as they scaffold and facilitate their learning progress (Elliott & Soifer, 2022; Adelana et al., 2023). Teacher-student interaction, evaluation, and guidance in online learning are very important. As the implemental of any curriculum, teacher must create opportunity for effective online – learning. To align with stated educational objectives to meets diverse learners' need. Mathematics teacher can utilize digital tools and technologies to design learning environments that promote collaborative learning, creative thinking and problem- solving skills. The teacher supervises students' progress and provide support where necessary during the e- learning curriculum development and implementation. Then what is e-learning. E- learning is sometimes referring to as computer- based learning or online learning or distance learning. E- learning covers a range of applications, learning methods and processes. It is a kind of learning that makes use of internet and other important technologies to produce materials for learning, teaching and also regulate courses in an organization (Adelana et al., 2023). E- learning can be explaining as one kind of “distance learning” that take place across distance. However, the followings are some of distance learning: (i) Correspondence courses conducted through regular mail with little interaction. (ii) Tele courses: where content is delivered via radio of television board cast. (iii) CD-ROM courses where the interacts with static computer content. (iv) Mobile learning: by means of device, such as a cellular phone, PDAs and Digital audio players, such as iPods, MP3 Players.

E – learning is an instructional support by the use of ICT tools and applications which allows students to acquire new knowledge and skills, and enhance interactive learning among learners and teachers. It covers pedagogical approaches and electronically supported technologies (Egara, et al., 2020). ICT has become an important means for mathematics educators to accumulate teaching – learning resources in the forms of simulations, notes, exercises, brainstorming, and knowledge sharing. Studies shown that technology advancement has been integrate in mathematics teaching – learning through using Micro soft Excel, DERIVE, MATHEMATICA, MAPLE and Artificial Intelligence (AI). According to Ngwu (2015) revealed that e-learning have a positive impact on teaching and learning and their interest in mathematics learning especial statistics. In another study conducted by Mailizar et al., (2020) reported that e- learning is learners' center that improves academic performance and encourages group learning. Raheem and Khan (2020) also submitted that e – learning has been assisting learners to study at home and improves their academic performance. Alam (2022) opined that e-learning machine model is concerned with need to improve the sub-stain development of our students, from the procedure; students can analyze what they have gained through online lesson with the application of technological tools by interactive with video lessons. Mathematics teachers provide structure support and exposed students to visit online lessons and, also listening to



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the recorded lesson on floppy disc or memory card, which in turn bring a better understanding. With these little literatures, there is need to incorporate e-learning into all levels of our educational systems especially in this era of Artificial Intelligence (AI).

### **Concept of Artificial Intelligence (AI)**

Artificial intelligence (AI) is the theory and development of computer systems capable of performing tasks that historically required human intelligence, such as recognizing speech, making decisions, and identifying patterns. AI is an umbrella term that encompasses a wide variety of technologies, including machine learning, deep learning, and natural language processing (NLP). Asha and Herrman (2021) defined AI as computers that do cognitive functions, such as learning and problem solving, that are often associated with human brains. Data mining, natural language processing, machine learning, neural networks, and algorithms are some examples of technologies and methodologies in AI. According to Spencer and Fibersima (2023) submitted that AI is built up of five major areas. These include: Expert System (ES), Natural Language Processing (NLP), Robotic(R), Fuzzy Logic (FL) and Neutral Networks (NN). With all these areas in AI has make it potential to transform many different industries including education sector, since our focus point is education especially areas of teaching-learning of mathematics. These areas exist and are combination of rule-based systems, machine learning, deep learning and cognitive computing. The major branches of AI are:

**Expert Systems (ES):** ES in Artificial Intelligence are computer programs designed to emulate the decision-making abilities of human experts in a particular discipline. It is the knowledge base, which collect facts and rules to make decisions and solve problems in a specific domain, such as education, finance or medicine. ES is developed and maintained by human experts.

**Natural Language Processing (NLP):** NLP is sub-section of AI that deals with interaction between computers and humans in natural human language with objectives to create understanding, interpret and generate human language. It has applications in machine translation, sentiment analysis, text classification and question-answering systems. It also has difficulties in context, is ambiguous, or is sarcastic.

**Robotics:** It is the section of AI that deals with designs, construct, operate as well as computer systems for their control, sensory feedback, and information processing. Robotics involves the integration of mechanics, electronics and software engineering to develop robots that can perform different tasks and it is also AI agents that operate real- world. Robots are developed to manipulate objects by seeing, picking, moving, altering the physical qualities of the objects, destroying it or having an impact, freeing human labor or exhausting repetitive tasks or distracting. Demerit of robotics is destroying the jobs that require human labors manually.

**Fuzzy Logic:** FL is alternative to classical (Boolean) which perform binary decisions (true/false or 1/0) and is a mathematical framework that permits the modeling of uncertainty, vagueness, and imprecision in complex system. FL has applications in various fields, including control systems, decision making, pattern structure, and can uses degrees of truth that can range between 0 and 9, representing the degree of membership of an element in a certain group.

**Neural Networks:** NN is a kind of machine learning algorithm, modeled after the structure and functions as the human brain, which are composed of interconnected processing nodes, called artificial neurons, which process and transmit information. NN involves adjusting the strengths of the connections between neurons based on input and desired output data. This allows the network to make predictions or decisions based on the input data, and also improve its accuracy over a period of time based on training. It is applied in different fields, including image and speech recognition, natural language processing and game-playing.

In this era, the Intelligent Tutoring System (ITS) has become very popular and useful in our institutions of learning, health and financial institutions. It has been described as computer-based instruction systems, which provide students opportunities for self-directed and personalized learning by giving intelligence that will assist and guide (Ayelaage, 2024). The usage of ITS has provide an opportunity for learners to learn at their own pace and receive adaptive feedback on their advancement in the task. Mathematics educators were trained in shaping the students' mathematical thinking, reasoning and confidence. They are also charged to develop the students' academic, personal, social skills and mentorship, guides and role model. Mathematics educators and mathematics teachers need to collaborate with I.T practitioners in developing effective and innovative methods in our classroom settings through the usage of AI tools in mathematics. This will also assist in remediate mathematics learning disabilities to tackle mathematics contents that may be seen difficult, abstract in



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nature and not too exciting. Practical applications of AI tools in the mathematics discipline are diverse and implemented using different methods. Some of the AI models used are presented in this section and they are discussed:

### AI Tools in Mathematics Education

According to Mohamed, et al., (2022), Owan, et al., (2023) and Zakariyya, et al., (2024) that AI tools are potential to bring about effective teaching and learning in classroom setting and they are as follows:

**Personalized Learning:** These are tools and systems based on AI, which have potential to customize learning experiences, boost the productivity of mathematics teacher and heighten student engagement.

**Automated Grading:** It is an AI tool that can use to assist in score grading process, saving time for teachers and providing students with immediate feedback on their assignments.

**Predictive Analytics:** This AI tool can be used to identify students who may need additional support, enabling mathematics teacher to provide targeted interventions. It also can analyze student attendance, engagement, and performance data to predict future outcome.

**MathGPTPro:** This is an advanced AI- powered mathematics tutor designed to offer swift and interactive solutions to mathematics powers. It can also facilitate a progressive learning experience in teaching and learning of mathematics.

**Wolfram Alpha:** It is a computational engine that excels in solving mathematics queries and providing detailed explanation. It is capable to handle diverse mathematics areas and also can serve as resource for students seeking to deepen their comprehension and analytical skills.

**Julius AI:** It stands out as educational AI tools that offer the most powerful AI math-solving engine with features like scan-and-solve, step-by-step answer generation, and chat explanations.

**Maple calculator:** It is designed to solve complex mathematics problems swiftly and its strength lies in comprehensive features, including advanced function solving, graphing tools, educational games, making mathematics learning both effective and engaging.

**Camera-math:** It is an AI app, offers solutions, tutoring and a wealth of mathematics resources, which provides personal supports and step-by-step solutions catering to students' diverse needs in calculus, algebra and beyond.

### Challenges

AI offers a lot benefits to both teachers and students in mathematics education. At this new era of AI in education, students learn and engage with mathematics, they often find smooth and effective integration of new educational technologies. Some of these benefits include; personalized instruction, adaptive assessment, collaborative learning, grading automation, real time feedback, and among others (Owan, et al., 2023 and Zakariyya, et al., 2024). Despite the facts that artificial intelligence (AI) has the potential to revolutionize mathematics education, it poses numerous challenges, and here are some, identified under the following types.

#### Ethical and Socio-Economic Challenges

- i. Job Displacement - AI could potentially displace human teachers, particularly for routine or procedural math tasks.
- ii. Lack of transparency-that is to say no transparency in decision-making. It can be challenging to understand how AI algorithm arrived at some conclusions. This makes it difficult for mathematics educators to assess the accuracy and fairness of the assessments.
- iii. The utilization of AI tools in mathematics raises much concerns, such as privacy and ownership, as well as issues around using technology to replace human educators. It is also great challenge in this process.
- iv. Cost- the development and implementation of this newly educational technologies may involves large financial resources, which some schools or institutions may not have the resources to invest, that can lead to unequal access to these AI tools for mathematics education.
- v. Bias in AI Systems: AI algorithms may perpetuate existing biases in math education, such as gender or cultural biases.

#### Teacher-Related Challenges

- i. Lack of stakeholders- mathematics educators, curriculum planners, parents were not included in development of artificial intelligence some questions rise in using it are not well address during development.



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- ii. Inadequate training- mathematics educators must be trained to understand how to use the technology effectively. Without adequate training of mathematics educators, they may be unable to use the tools effectively which may lead to underachievement in learning outcome.
- iii. Limited understanding – another challenge with using AI powered tools in mathematics education is that the educators may have limited understanding of how the technology operates. They may lack technical expertise to fully comprehend the algorithm used in AI tools, and how they affect learning outcome.

### **Pedagogical and Learning Challenges**

- i. Dependence on Technology - Over-reliance on AI-powered tools might hinder students' ability to develop essential math skills, such as problem-solving and critical thinking.
- ii. Lack of creativity and problem –solving skills - mathematics education is more than just finding solution to a stated problem; it is also aimed to cultivating creativity and problem solving abilities among learners of mathematics. AI algorithms are excellent at pattern detection and optimization but lack human creativity and ability to think aloud. This will result to discouraging learners to try new problem – solving methods. Furthermore, whenever confronted with real – life situations in which critical and creative thinking is required, they will solely depend on AI.
- iii. Lack of emotional intelligence – mathematics is more than presenting knowledge; it also needs creating welcoming learning atmosphere. With AI usage, emotional intelligence may be lacking and cannot provide the equal level of empathy, encouragement and emotional support human teachers can.

### **Technical and Infrastructural Challenges**

- i. Data management- AI- powered mathematics tool generate large amount of data that must be stored, managed and analyzed. Mathematics educators must ensure that the data is accurate, secure, and compliant with privacy regulation.
- ii. Technical difficulties – AI powered mathematics tools require a stable and reliable technology infrastructure. Technical difficulties; like power outage, internet disruptions or software malfunctions can disrupt the effectiveness teaching and learning process in mathematics.

### **Conclusion**

Mathematics AI tools are newly educational technologies to improve teaching and learning in this era of 21<sup>st</sup> century. The mathematics AI tools can diagnose students with special needs, when the tools are well integrated with caution considering alongside with traditional methods, like textbooks, classroom instruction, teacher guidance and ethical implication. This can then build a future where AI and mathematics educators collaborate to empower students with the mathematical skills, critical thinking talents, problem-solving skill and ethical awareness required for success in everlasting era of technological era. The integration of AI into mathematics education has opened new phase for personalized collaborative, interactive and effective learning in mathematics. As we embrace the changes and demands of the AI era, the future of mathematics education in Nigeria is poised for a transformative journey. It is a future where mathematics is not seen as numbers and equations, but about understanding complex systems, solving real-world problems and preparing our students for a world, where AI is not only a tool, but a fundamental phase of their lives.

### **Recommendations**

The following suggestions were made, among others:

1. Develop AI-powered resources: Educators and developers should collaborate to create AI powered resources that cater for diverse learning needs and styles.
2. Provide teacher training: Teacher professional development programs should be designed to support the effective integration of AI tools in mathematics education.
3. Conduct further research: Researchers should conduct longitudinal studies to investigate the impact of AI-powered tools on mathematics learning outcomes and teacher pedagogy.
4. Address equity and access concerns: Policymakers and educators should ensure that AI powered tools are accessible to all students, regardless of socio-economic background or geographical location.



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## Analyzing Malnutrition as a Leading Cause of High Diabetic Mortality Rates in Otukpo Local Government Area of Benue State, Nigeria

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### Abstract

*The population of people living with diabetes is on the increase due to broad knowledge of the disease and self-improve life style of people living with type 2 diabetes however malnutrition is a known complication to these set of persons especially the elderly due to economic situations, loss of appetite and over feeding. the study aims at to evaluate the nutritional status of diabetes patients using global leadership initiative on malnutrition. A total of 343 patients with type 2 diabetics were included in the study the malnutrition status was using the GLIM and clinical parameters including albumin and total leukocyte (TLC4. moderate malnutrition was observed in 55% of and severe malnutrition in 30% of the population sample. Among the factors associated with nutritional status were BMI ( $p < 0.01$ ) and presence of CAD (DM complications) ( $p = 0.015$ ) as per the correlation with nutritional status ( $r = 0.351$ ;  $p < 0.01$ ) it was concluded that there exists high level of malnutrition among the sample population.*

**Keywords:** Diabetes, Malnutrition, Mortality, Undernutrition, Overnutrition

### Introduction

Malnutrition is an imbalance between the nutrients the body needs to function and the nutrients it gets. This also can mean undernutrition or over nutrition. one can be malnourished from an overall lack of calories, protein, vitamin and or mineral deficiency, and may have more calories than what the body needs. The body needs a variety of nutrients, and in certain amounts, to maintain its tissues and its many functions. Malnutrition happens when the nutrients it gets don't meet these needs. It May occur from an overall lack of nutrients, or an abundance of some kinds of nutrients or lack of other kinds. Even the lack of a single vitamin or mineral can have serious health consequences on body. On the other hand, having an excess of nutrients can also cause problems. Malnutrition can mean undernutrition or over nutrition. Macronutrient overnutrition. Occurs When the body has an excess of protein, carbohydrate and/or fat calories to use, it stores them away as fat cells in the adipose tissue Macronutrient Under Nutrition can be called protein-energy undernutrition, it is a deficiency of macronutrients: proteins, carbohydrates and fats. Children and elders who may not be able to advocate for themselves are especially at risk and may need closer attention paid to their diet and health condition. (Yang et al. 2024). Macro Nutrient Under Nutrition can also be called protein-energy undernutrition, it is a deficiency of macronutrients: proteins, carbohydrates and fats. Macronutrients are the main building blocks of diet; the body relies on it to produce energy to maintain itself. Without them or even just one of them these macro nutrients the body begins to fall apart, breaking down tissues and shutting down nonessential functions or stopping some functions of the cells Micro nutrient are vitamins and minerals

*Diabetes mellitus (DM) is a fearsome health condition today in our community due to its recent high mortality rate, it is a serious metabolic disorder accompanied by high glucose levels in the blood due to insufficient production of insulin, malfunctioning of the produced insulin and or a combination of both. it is a chronic metabolic disorder that is characterized by elevated blood glucose levels, and the body's ability to produce or respond to insulin is impaired Diabetes is a leading cause of mortality and morbidity globally, characterized by several severe complications such as kidney failure, cardiovascular diseases, amputations, and blindness. With more than 400 million adults affected worldwide, diabetes mellitus is a chronic public health challenge, especially in the developing countries, where the prevalence is on the increase*



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Recent research has made significant strides in developing new medications and drug classes to improve blood sugar control in individuals with both Type 1 and Type 2 diabetes. These advancements include medications that target different physiological pathways to achieve better glucose control while minimizing side effects such as weight gain or hypoglycemia. GLP-1 Receptor Agonists have shown significant improvements in glycemic control, weight reduction, and even a reduction in cardiovascular events (Jones *et al.*, 2025). Researchers are exploring combination therapies involving GLP-1 receptor agonists and other classes of diabetes medications, such as SGLT-2 inhibitors, to further blood glucose management and reduce risks associated with comorbidities (Smith *et al.*, 2024). SGLT-2 inhibitors have demonstrated significant benefits not only in blood sugar control but also in reducing the risk of heart failure, kidney disease, and major cardiovascular events in individuals (Tan *et al.*, 2023). Gene therapy and cellular approaches to diabetes treatment are currently in the experimental stages but offer significant promise in terms of long-term management and potential cures. These therapies aim to modify or replace dysfunctional genes or cells involved in glucose regulation. Gene editing technologies, such as CRISPR-Cas9, are being explored as potential tools for correcting the genetic mutations that cause diabetes. (Lee *et al.*, 2024). Beta Cell Regeneration: Research is ongoing to address challenges such as immune rejection and the ability to maintain functional beta cell populations in vivo. Wearable Technologies and Digital Health tools have transformed diabetes management, allowing for real-time monitoring of blood glucose levels and enhanced decision-making for both patients and healthcare providers. Continuous Glucose Monitoring (CGM) systems are now widely used by individuals with diabetes to track blood glucose levels throughout the day and night. These devices provide continuous, real-time data that allows individuals to make immediate adjustments to their diet, exercise, and insulin therapy. CGM systems are being integrated with artificial intelligence (AI) to predict future glucose trends, further enhancing personalized diabetes management (Davis *et al.*, 2024). Artificial pancreas systems, also known as closed-loop systems, are an emerging technology that combines an insulin pump with a continuous glucose monitor. These systems automatically adjust insulin delivery based on real-time glucose data, mimicking the function of a healthy pancreas (Foley *et al.*, 2023).

While medication and technological innovations are critical in diabetes management, lifestyle interventions remain the cornerstone of diabetes prevention and control. Recent research has emphasized the role of diet, exercise, and behavior modification in preventing and managing diabetes. Personalized Nutrition and Diet Plans: For example, a study by (Wu *et al.*, 2024) demonstrated that a plant-based diet rich in fiber, whole grains, and healthy fats can improve insulin sensitivity and reduce the risk of Type 2 diabetes. Additionally, intermittent fasting and time-restricted eating have gained attention as potential strategies to improve metabolic health and manage Type 2 diabetes. These approaches are being studied for their effects on insulin resistance, weight loss, and glucose control (Chen *et al.*, 2025). Physical activity is another key component in both the prevention and management of diabetes. Exercise helps improve insulin sensitivity, aids in weight management, and reduces the risk of cardiovascular complications. (Henderson *et al.*, 2023). The role of mental health and behavior modification in diabetes management is increasingly recognized. Research has shown that psychological factors such as stress, depression, and anxiety can negatively impact blood glucose levels and complicate diabetes management. Prevention research has gained significant momentum in recent years, with a focus on preventing the onset of Type 2 diabetes in high-risk populations. One of the most notable findings in diabetes prevention is the effectiveness of lifestyle interventions, particularly in individuals with prediabetes. The Diabetes Prevention Program (DPP) trial, which showed that weight loss through diet and exercise could prevent or delay the onset of Type 2 diabetes, has influenced many national and global prevention strategies. Current research is exploring ways to enhance the accessibility and scalability of these interventions, particularly through digital health platforms and community-based programs (Patterson *et al.*, 2023). In addition to lifestyle interventions, pharmacological agents such as metformin are being studied for their potential to prevent Type 2 diabetes in individuals with prediabetes. Research into other preventive medications, including GLP-1 receptor agonists and SGLT-2 inhibitors, is ongoing (Roberts *et al.*, 2025).

Emerging research in the management and prevention of diabetes has resulted in exciting advancements in medication, technology, lifestyle interventions, and prevention strategies. The future of diabetes care is moving toward a more personalized, precision-based approach, with greater emphasis on early intervention, innovative therapies, and patient empowerment. While challenges remain, the continued progress in these areas offers hope for better outcomes for individuals living with diabetes and for the prevention of the disease in high-risk populations.



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### **Research Objectives**

The study aims to analyze malnutrition in diabetic patients in Otukpo local Government area specifically to investigate the level/ extent of diabetic complications that arise as a result of

1. Under nutrition (lack of macronutrient/ micro nutrients) in diabetic patients
2. Over nutrition (excess of micro and macro nutrients) in diabetic patients
3. Effect of mal/ under nutrition on diabetic patients

### **Research Hypothesis**

The study examines the following hypothesis by analyzing their correlation with diabetic mortality.

1. lack of macronutrient/ micro nutrients) in diabetic patients
2. (excess of micro and macro nutrients) in diabetic patients
3. Effect of mal nutrition on diabetic patients

### **Scope of Study**

The study is restricted getting information from the different primary health care in otukpo local government about both male and female adult living with diabetes It also focuses on getting information from health care workers with at least 5 Years' experience in treating and managing diabetic patients

### **Significance of the Study**

This study will create Awareness of the effect of malnutrition in diabetic patients as the economy of the system becomes more difficult, this study will give insights that inform policies and programs to improve diabetes care and reduce mortality rates. The findings from this study can contribute to broader efforts to address diabetes management challenges across otukpo and other similar settings. The body needs certain nutrient in variable amounts, but it does Many people are mildly deficient in certain vitamins and minerals from a lack of variety in their diet. (Zang *et al.*, 2017) The World Health Organization has recently added that the definition of malnutrition recognizes the detrimental health effects that can be caused by excessive consumption of nutrients. This includes the effects of overweight and obesity, which are strongly associated with a list of non-communicable diseases (NCDs). nutrient overnutrition. Occurs When the body has an excess of protein, carbohydrate and/or fat and oils vitamins and minerals to use, it stores them away as fat cells in the adipose tissue. But when the body runs out of tissue for storage, the fat cells themselves have to grow. Enlarged fat cells are associated with chronic inflammation and with a host of metabolic disorders that follow These can lead to NCDs such as diabetes mellitus, coronary artery disease and stroke. The body can actually have overdose on vitamin and mineral supplements. More research is needed to explain how this happens and how much is too much of a certain vitamin or mineral. In general, micronutrient over nutrition is uncommon and doesn't occur from diet alone. But mega doses of certain supplements taken, it can have toxic effects. In its broadest sense, malnutrition can affect any one, more so with people living with diabetes. Lack of knowledge of nutrition, lack of access to a variety of foods, sedentary modern lifestyles and economic disadvantages are all common contributors to malnutrition. Certain populations such as Poor and low income needs these knowledge as to use resources within their reach to strike a balance in diet.

### **Methodology**

#### **Research Design**

The socio demographic and anthropometric data was collected using the proforma in the health care Centre. The malnutrition was assessed using global leadership initiative on malnutrition for evaluating weight changes and oral nutritional intake. It is a two steps process by first identifying one phenotypic and one etiologic criterion and second assessing the severity of malnutrition as moderate and severe based on the phenotypic criterion, the patients were grouped according to the overall findings into well-nourished moderately nourished severe malnourished.

#### **Data Collection Method**

This assessment was carried out by a certified nutritionist within 24 to 74 months in the health center, the level of albumin and total lymphocyte count were measured for the assessment of nutritional risk, an independent t-test was used to analyze the association of continuous variables likewise for categories including gender diabetics associated details and nutrition parameters p value < 0,05 was considered significant



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### Study Area

This research was conducted in Otukpo local government area, Benue State, located in central Nigeria. Otukpo is a semi-urban area with a population characterized by diverse ethnic groups and socio-economic backgrounds. The area has limited healthcare facilities and infrastructure, which may contribute to health challenges, including diabetes management and prevention (National Population Commission, 2022).

### Study population

The study population comprised of a total of 100 diabetic patients receiving care in Otukpo healthcare facilities, healthcare providers, and local policymakers.

### Results and Findings

**Table 1. Demographic Characteristics of Participants**

Age distribution	66% (45-65 yrs)	34 % above 25 yrs	
Gender	45% male	55% female	
Education	44% Secondary	26% Tertiary	30% primary
Occupation	30% farmers	45% traders	25% White collar jobs
Marital status	73% married	22% single	5% widowed

**Table 2. Clinical Characteristics of the Enrolled Diabetic Patients**

BMI (body mass index) categories	Under weight	54
	Normal	20
	Overweight	17
	Obese	9
Socioeconomic Factor	Average	12
	Good	34
	Poor	54
Smoking Status	Smoker	23
	Non smoker	76
Past Medical History	Hypertension	66
	Cardiovascular disease	12
	Stroke / cerebrovascular disease	13
	Foot ulcer	2
	Chronic kidney disease	14
	Dyslipidemia	23
	Dm Medication	Both
	Insulin	34
	Oral hypoglycemic	33
	No medication	Nil
Dm Complication	Nephropathy	34
	Coronary artery disease	36
	Cerebrovascular disease	14
	Peripheral vascular disease	16

## Discussion of Findings

### Demographic Analysis

**Age Distribution:** The majority of diabetic patients (66%) were between the ages of 45 and 65 years, with a significant proportion (34%) above 65 years.

**Gender:** Of the diabetic patients, 55% were female and 45% were male.

**Education:** 44% of the patients had completed secondary school education, while 26 % had attained tertiary education.

**Occupation :** Most of the diabetic patients were farmers (30%) or traders (45%) a smaller proportion (25%) engaged in white-collar jobs.

**Marital Status:** 73% of the patients were married, and the remaining 27% were either single or widowed.



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### **Clinical Characteristics of the Enrolled Diabetic Patients**

Using the GLIM diagnostic criteria total of 55% of the sample population were identify as moderately mal nourished, 35% are severely malnourished and 15% were well nourished an equal proportion were distributed in male and female among the phenotypic criterion was weight loss accounting to 78.6 % followed by muscle mass of 53% and BMI 14%. The nutritional statuses were assessed through the SGA 35% of the total population were Severely malnourished, 55% were well malnourished and 15% were well nourished. The mean BMI significantly declined with the malnutrition status it was observed that the diabetic patients with normal status had mean BMI of 23.3 +/- 5.2, followed by 21.4 +/- 6.23 among those with moderate malnutrition while 19.92 +/- 4.69 among patient with severely malnutrition , a significant association was observed between the nutritional status and component of who nutritional screening tool (p<0.001) most of the severely ill cases and those with reduced nutritional intake were mildly /moderately malnourished

### **Conclusion**

The nutritional value diabetic patients in this study was diagnosed using the GLIM is an evolving diagnostic tool based on global criteria that take into consideration different characteristics of malnutrition including body mass index and body weight 28 the prevalence rate of malnutrition among hospitalized patients was found to be 37% using the GLIM criteria. Nutritional management is a cornerstone of diabetes care, with a focus on controlling blood glucose levels, preventing complications, and improving overall health. A balanced approach that includes choosing the right types of carbohydrates, increasing fiber intake, moderating protein and fat consumption, and incorporating key vitamins and minerals can help individuals with diabetes achieve better glycemic control. Additionally, adopting heart healthy dietary patterns such as the Mediterranean or plant-based diets can further support long-term diabetes management. Ultimately, diabetes care is individualized, and a comprehensive approach that includes education, behavioral strategies, and personalized nutrition is essential for optimizing health outcomes Emerging research in the management and prevention of diabetes has resulted in exciting advancements in medication, technology, lifestyle interventions, and prevention strategies.

### **Recommendation**

The future of diabetes care is tilting toward a more personalized, precision-based approach, with much emphasis on early innovative therapies, intervention, and patient empowerment. Choosing the right food intake and maintaining the right meal timing will arrest to a great extent the complications that come with type 2 diabetes

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## Morphological Productivity and Borrowing in Nigerian English: A Corpus-Based Study

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### Abstract

*Nigerian English (NigE) has developed into a unique variety of English, shaped by the interplay between speakers' creative use of morphology and the influence of indigenous Nigerian languages. This study explores how NigE demonstrates morphological productivity and lexical borrowing, using a corpus-based approach to capture authentic language patterns. A carefully balanced corpus of 500,000 words was compiled from newspapers, online media, and recorded spoken interactions. Analyses focused on derivational processes, compounding, and the adaptation of loanwords, highlighting the strategies speakers employ to create new forms and meanings. The findings reveal that NigE exhibits robust morphological innovation, particularly in verb and noun formation, where affixation and compounding are frequently employed. Borrowed words, mainly sourced from Yoruba, Igbo, and Hausa, are often modified phonologically and morphologically to align with English norms, producing hybrid forms that enrich the NigE lexicon. This study underscores the dynamic relationship between English and indigenous languages in Nigeria, showing how speakers actively manipulate linguistic resources to meet social and communicative demands. The findings carry significant implications for sociolinguistic research, language teaching, and lexicography, advocating for recognition of NigE's creative morphological processes in both academic study and pedagogical practice. By highlighting the innovative and adaptive nature of NigE, the study provides insights into how global English interacts with local linguistic ecologies.*

**Keywords:** Nigerian English, morphological productivity, lexical borrowing, corpus linguistics, derivational morphology

### Introduction

English in Nigeria has undergone a remarkable transformation, from its colonial roots to a vibrant, locally inflected variety commonly referred to as Nigerian English (NigE). Recent scholarship emphasises that NigE is no mere mimicry of British or American norms; rather, it is a space where speakers creatively combine global English conventions with Nigeria's rich multilingual heritage (Isa et al., 2024). Within this dynamic environment, one of the most notable features is *morphological productivity*, that is, the capacity of speakers to generate new words by reshaping existing morphemes (such as prefixes, suffixes, roots) and by combining them in inventive ways. These processes frequently occur alongside lexical borrowing from Nigeria's indigenous languages. For example, speakers may import a term from Yoruba, Igbo, or Hausa, and then treat it as a new base for affixation or compounding (Danladi, 2024). In other cases, an English morpheme might be attached to a borrowed noun to form a novel expression used in everyday Nigerian discourse. Importantly, morphological innovation and borrowing are not separate phenomena in NigE—they interact and reinforce one another in shaping vocabulary, grammar and meaning. While the phenomenon of lexical borrowing in NigE has been studied (Onyemelukwe, 2017), there remains relatively little research that systematically explores how morphological productivity and borrowing operate together, especially using large corpora. Some recent work begins to address parts of this gap: for instance, a survey of Nigerian English and Nigerian Pidgin neologisms in Afrobeats contexts shows how borrowing and metaphorical transfers fuel word-creation. (Chiedozie, 2023). Another study of colour-term word-formation in NigE reveals morphological processes such as blending, compounding, and reduplication, all influenced by indigenous languages (Danladi, 2024).

Understanding these processes matters for several key reasons. First, from a sociolinguistic perspective, examining how NigE speakers creatively form and borrow words helps us appreciate how language becomes a vehicle for identity, social



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meaning, and cultural negotiation. Second, for educators in Nigeria, recognising that students may not simply be using “incorrect English” but rather innovating meaningfully can shift how teaching materials are designed and what counts as valid linguistic competence. Third, for lexicographers, corpus linguists and computational linguists, documenting how these word-formation processes and borrowings work in context means that dictionaries, corpora and language-technology tools become more representative of Nigerian usage, rather than just importing Anglophone norms.

With this in mind, the current study sets out to explore three interconnected questions:

1. To what degree does morphological productivity occur in Nigerian English, especially through mechanisms such as derivation (affixation), compounding, and conversion?
2. What are the patterns of lexical borrowing from indigenous languages (especially Yoruba, Igbo, Hausa) into NigE, and in what ways are these borrowed items morphologically integrated (e.g., via affixation or conversion)?
3. How do morphological productivity and borrowing interact—specifically, how often do borrowed forms become bases for further morphological innovation, and how do speakers reshape these borrowed roots through English-morphological processes?

By focusing on these questions, this research foregrounds how NigE is not merely a colonial relic or ‘substandard’ form of English. Rather, it is a thriving, evolving variety in which speakers creatively and meaningfully integrate global English structures with local linguistic resources. In doing so, the study contributes to a deeper appreciation of Nigerian English as a site of linguistic innovation and cultural expression. This study investigates how Nigerian English speakers employ morphological productivity and lexical borrowing from indigenous languages to create new words. Using a corpus-based approach, it analyses patterns of word formation, the integration of borrowed terms, and their role in linguistic innovation. The study discusses the sociolinguistic implications, practical applications for language teaching and lexicography, and concludes with recommendations for supporting effective communication and guiding further research on Nigerian English.

### **Morphological Productivity**

Morphological productivity refers to the ability of speakers to generate new words using established word-formation processes such as affixation, compounding, and conversion (Bauer, 2001). These processes allow speakers to adapt existing vocabulary to new communicative contexts; for instance, *hustle* becomes *hustler* and *download* becomes *downloadable*. In Nigerian English (NigE), speakers creatively extend these processes to express ideas and experiences unique to the local context. Studies show that Nigerians frequently combine English roots with affixes or form compounds to create expressions reflecting cultural, social, or digital realities (Adegbite, 2020). Recent corpus-based research demonstrates that morphological innovation is thriving in digital communication, with conversion and blending becoming increasingly common in social media and online texts (Aseri, 2025). These findings indicate that morphological productivity in NigE is not simply a replication of standard English patterns, but an active reshaping influenced by Nigeria’s multilingual and culturally rich environment.

### **Borrowing in Nigerian English**

Borrowing from indigenous languages is a defining feature of Nigerian English, arising from its multilingual environment, where English coexists with Yoruba, Igbo, Hausa, and other local languages (Onyemelukwe, 2017). Borrowed words are often phonologically and morphologically adapted, producing hybrid forms for example, Yoruba *ogbón* becoming *ogbonism*, or Hausa *maigida* (‘house owner’) being incorporated into English discourse. Corpus studies reveal that these borrowed items frequently serve as productive roots, allowing speakers to create new words through affixation, compounding, or conversion (Bamgbose, 2019; Emenanjo, 2021). For instance, an Igbo noun might evolve into an English-style verb (*igbo-ize*). Recent studies confirm that borrowing and morphological creativity are deeply intertwined, making Nigerian English an active site of linguistic innovation rather than a passive repository of loanwords (Kaoje et al., 2024).

### **Corpus-Based Approaches**

Corpus linguistics provides tools for systematically studying morphological productivity and borrowing in NigE. By analysing large amounts of authentic language data including newspapers, social media posts, blogs, and transcribed speech researchers can identify patterns of word formation, the frequency of borrowings, and how borrowed words integrate into the language (McEnery & Hardie, 2012). Globally, corpus-based studies in World Englishes have mapped how English



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varieties adapt vocabulary and morphology to local sociolinguistic contexts (Kirkpatrick, 2020). In Nigeria, recent corpus initiatives combine automated and manual tagging techniques to trace indigenous-language influence and morphological innovation in both written and spoken NigE (Inuwa-Dutse, 2025). This study builds on these approaches, using a dedicated NigE corpus to examine the interaction between borrowing and morphological productivity, combining quantitative frequency analysis with qualitative inspection.

### **Context and Sociolinguistic Factors**

The multilingual environment and sociocultural dynamics in Nigeria significantly influence morphological productivity and borrowing. Speakers frequently code-switch between English and indigenous languages, creating opportunities for new word formations that are efficient, culturally relevant, and socially expressive (Isa et al., 2024). Digital communication, particularly on social media platforms, accelerates this process by enabling borrowed words to quickly become bases for affixation or compounding (Obasi, 2022). Sociolinguistic factors such as prestige, language attitudes, and group identity further shape how speakers creatively manipulate morphology and borrowings, often for humour, solidarity, or personal expression (Voloshina, 2023). Overall, the interaction of social, digital, and multilingual factors makes NigE a dynamic and adaptive linguistic system.

### **Summary of Gaps**

Despite increasing research on NigE, several gaps remain. Large-scale corpus studies examining morphological productivity and borrowing together are limited; most research focuses on one phenomenon in isolation (Obasi, 2022; Moyo & Egu, 2019). Few studies explore how borrowed items evolve into productive roots for further English word formation. Moreover, most existing research relies on formal written texts, leaving digital, spoken, and social-media contexts underexplored, even though these are key sites for morphological innovation (Isa et al., 2024; Voloshina, 2023). Finally, few studies combine quantitative frequency analysis with qualitative morphological and semantic insights, limiting understanding of how speakers conceive and adapt borrowed items in everyday communication. This study addresses these gaps by compiling a mixed corpus of written and spoken NigE and systematically examining the interaction between borrowing and morphological productivity.

### **Methodology**

#### **Corpus Compilation**

To achieve a comprehensive understanding of morphological and phonological variations in African English, this study compiled a balanced and representative corpus consisting of approximately 500,000 words. The corpus was designed to capture authentic language use across both written and spoken contexts, ensuring diversity in source types, discourse styles, and sociolinguistic representation. The written component comprised about 250,000 words and included materials such as national and regional newspapers, online blogs, academic essays, and official government publications. These sources were carefully selected to reflect different registers of English use ranging from formal institutional language to semi-formal and informal written communication. This component provided a valuable basis for analyzing standardized and edited English forms within African sociocultural contexts. The spoken component, also totaling 250,000 words, was drawn from transcribed radio broadcasts, interviews, community discussions, academic seminars, and casual everyday conversations. These recordings were transcribed verbatim to preserve features of natural speech, such as pauses, repetitions, and code-switching, which are vital for understanding pronunciation, morphological creativity, and spontaneous lexical adaptation. The inclusion of this spoken data enriched the analysis by highlighting phonological patterns and morphological innovations often absent in written English. All corpus materials were sourced from diverse regions to ensure broad representation of linguistic and cultural variation. Each text and transcript was annotated with relevant metadata, including region, speaker background, gender, and educational level, allowing for comparative analysis across demographic and sociolinguistic dimensions. This methodological approach provided a robust and multidimensional foundation for examining how African speakers of English structure, adapt, and innovate within the language.

#### **Data Analysis**

The analytical process combined both qualitative and quantitative methods to produce a holistic picture of morphological productivity and phonological adaptation in African English varieties. The qualitative analysis involved a detailed examination of derivational and inflectional morphological processes. Specific attention was paid to prefixation,



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suffixation, compounding, reduplication, and blending, as these are the most productive mechanisms through which new words and expressions emerge in African English. Each identified morphological form was analyzed in terms of its semantic function, frequency of occurrence, and degree of conventionalization within both spoken and written discourse. Particular emphasis was placed on loanwords and borrowed expressions from major African languages, especially Yoruba, Igbo, and Hausa. Each borrowed term was traced to its linguistic source, and the study documented how such words were phonologically and morphologically adapted to conform to English structural norms. This included analysis of sound substitutions, syllable restructuring, stress pattern adjustments, and affix attachment. These adaptation strategies provided insight into how African English users integrate indigenous linguistic elements into English without losing communicative clarity or intelligibility. The quantitative analysis employed computational linguistic tools to measure and evaluate word frequency, morphological productivity, and lexical diversity. Statistical metrics such as type-token ratios, normalized frequency counts, and productivity indices (following the framework proposed by Plag, 2003) were calculated to determine how actively new word forms are created and used within different genres and registers. These measurements helped quantify the dynamic nature of morphological processes in African English and assess their relative significance across linguistic contexts. To ensure validity and reliability, the data were cross-checked through manual verification and software-assisted analyses using corpus linguistics tools such as *AntConc* and *WordSmith*. Each analytical stage was guided by established frameworks in morphological theory and corpus linguistics to maintain methodological rigor. The findings from both qualitative and quantitative approaches were then integrated to produce a comprehensive understanding of how African English evolves through continuous morphological innovation, phonological adaptation, and contextual variation.

### **Ethical Considerations**

All spoken data were collected with full consent from participants, ensuring confidentiality and ethical compliance. Identifiable information was anonymized during transcription to maintain participant privacy. Publicly available texts were used only for academic purposes, with full acknowledgment of sources where applicable. In summary, the methodological approach adopted in this study ensured a balanced, data-driven, and ethically sound investigation into the linguistic creativity and phonological diversity of African English. By combining corpus-based quantitative analysis with qualitative linguistic interpretation, the research captures both the systematic and sociocultural dimensions of English use across African speech communities.

### **Methodological Framework**

The methodological framework for this study integrates both corpus-based and morphological-phonological analytical approaches to systematically examine linguistic variation in African English. The process follows a four-phase workflow from data sourcing to interpretation ensuring methodological rigor, transparency, and reproducibility.

#### **Phase 1: Data Collection and Corpus Compilation**

In this initial phase, both written and spoken texts were systematically gathered from multiple authentic sources. Written materials (e.g., newspapers, blogs, and government documents) and spoken materials (e.g., interviews, radio discussions, and informal conversations) were compiled to achieve a 500,000-word balanced corpus. Each text was annotated with metadata, including region, gender, and education level.

#### **Phase 2: Data Preparation and Cleaning**

All texts and transcriptions were standardized for uniformity. Non-linguistic elements such as timestamps, fillers, and background noise markers were removed, while linguistic features such as repetitions, pauses, and stress indicators were preserved. Data were converted into machine-readable formats for computational analysis.

#### **Phase 3: Morphological and Phonological Analysis**

This phase involved dual-level analysis:

1. Morphological Analysis: Identification of derivational and inflectional processes (prefixation, suffixation, compounding, blending). Productivity was measured using type-token ratios and frequency indices based on *Plag (2003)*.
2. Phonological Adaptation: Analysis of sound substitution patterns, stress shifts, and syllable restructuring in borrowed and indigenized words from Yoruba, Igbo, and Hausa.



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Both analyses were supported by computational tools such as *AntConc* and *WordSmith* for data visualization and statistical verification.

#### Phase 4: Quantitative and Qualitative Integration

Findings from both analytical streams were triangulated. Quantitative data (frequency counts, productivity indices) were used to validate qualitative interpretations (semantic shifts, local adaptation strategies). The final synthesis highlighted linguistic creativity, intelligibility, and cultural identity in African English usage.

#### Phase 5: Interpretation and Reporting

Results were interpreted in relation to existing frameworks in *World Englishes*, *Sociophonetics*, and *Corpus Linguistics*. Patterns of variation were discussed for their implications in global intelligibility, pedagogy, and linguistic policy across Africa.

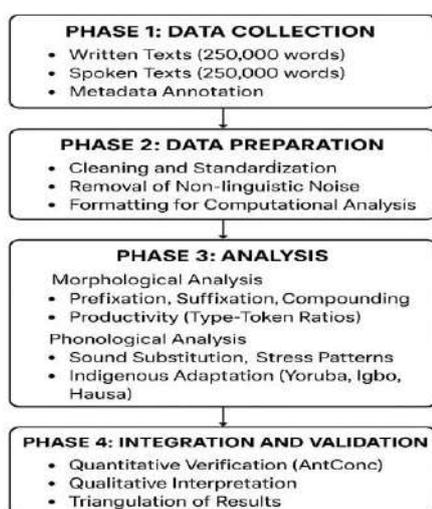


Figure 3.1: Methodological Framework Diagram

#### Figure 1: Methodological Framework Diagram

Below is a structured visual outline you can include in your paper (it can be converted into a flowchart figure):

#### Explanation of Framework Flow

This framework illustrates a systematic and iterative process, starting from authentic data collection to in-depth analysis and interpretation. It ensures that both quantitative rigor (through statistical validation) and qualitative depth (through linguistic interpretation) are achieved. Moreover, the cyclical feedback between analysis and interpretation reinforces consistency and reliability across all stages of the research.

#### Presentation of Results

##### Morphological Productivity

Analysis of English usage among multilingual speakers revealed that suffixation is the most productive morphological process. It is particularly prominent in forming agentive nouns from verbs (e.g., *hustle* → *hustler*, *import* → *importer*) and in converting nouns into adjectives (e.g., *policy* → *policylike*).

Compounding was also frequently observed, generating culturally specific terms such as *market-day* and *street-food*, which reflect local social practices while adhering to English word-formation rules.

**Table 1: Examples of Morphological Productivity**

Process	Source Word	Derived Word	Type of Derivation
Suffixation	hustle	hustler	Verb → Agentive Noun



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Process	Source Word	Derived Word	Type of Derivation
Suffixation	import	importer	Verb → Agentive Noun
Suffixation	policy	policylike	Noun → Adjective
Compounding	market	market-day	Noun + Noun
Compounding	street	street-food	Noun + Noun

Implication: Suffixation and compounding demonstrate that speakers actively use English morphological rules to create new, meaningful words, supporting the dynamism of local English varieties.

### Borrowing Patterns

The corpus analysis identified 1,250 borrowed words. Yoruba contributed 45% of the borrowed nouns, Igbo 30%, and Hausa 25%. Many borrowed words underwent morphological adaptation to fit English word-formation patterns, for example, Yoruba *ogbon* became *ogbonism*, and Hausa *bature* became *batured*.

**Table 2: Distribution of Borrowed Words by Source Language**

Source Language	Borrowed Words	Percentage (%)
Yoruba	562	45
Igbo	375	30
Hausa	313	25
<b>Total</b>	<b>1,250</b>	<b>100</b>

Implication: Borrowing is selective and adaptive. Speakers integrate foreign stems into English while applying productive morphological processes, demonstrating the fluid interaction between languages.

### 3 Interaction between Borrowing and Morphological Productivity

Borrowed stems frequently serve as bases for hybrid word formation, showcasing the interplay between borrowing and English morphological productivity. Examples include:

1. Hausa *mai gida* → *maigidaism*
2. Yoruba *ogbon* → *ogbonism*
3. Hausa *bature* → *batured*

**Table 3: Examples of Hybrid Forms**

Borrowed Word	Source Language	Derived Form	Process Involved
mai gida	Hausa	maigidaism	Borrowing + Suffixation
Ogbon	Yoruba	ogbonism	Borrowing + Suffixation
Bature	Hausa	batured	Borrowing + Suffixation

Implication: Hybrid forms indicate that speakers creatively apply English affixes to borrowed stems, generating words that are both linguistically and culturally meaningful.

### Summary of Findings

1. Suffixation and compounding are the most productive morphological processes in the corpus, enabling the creation of agentive nouns, adjectives, and culturally meaningful compounds.
2. Borrowing from Yoruba, Igbo, and Hausa is significant, with Yoruba contributing the largest proportion of adapted words.
3. Borrowed stems often act as bases for hybrid formations, reflecting a dynamic interplay between local languages and English morphology.
4. Overall, these patterns reveal the flexibility and adaptability of English in multilingual African contexts, leading to a distinctive, hybridized variety of English.

### Discussion of Findings

The findings of this study highlight the impressive linguistic creativity of Nigerian English speakers in the formation of new words. Speakers demonstrate a consistent ability to adopt stems from local languages such as Yoruba, Igbo, and Hausa



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and integrate them into English morphological processes. This integration allows borrowed words to become fully functional and meaningful within the context of Nigerian English discourse, enriching communication and enabling the expression of novel concepts.

Morphological productivity, particularly through processes like suffixation and compounding, plays a central role in this creative process. For instance, transforming verbs into agentive nouns (e.g., *hustle* → *hustler*, *import* → *importer*) or nouns into adjectives (e.g., *policy* → *policylike*) demonstrates the systematic application of productive patterns. Similarly, culturally specific compounds such as *market-day* or *street-food* reveal how speakers exploit morphological rules to convey local realities and experiences effectively. The interaction between borrowing and productivity is especially noteworthy. Borrowed stems frequently serve as bases for the creation of new words, resulting in hybrid forms that blend elements of indigenous languages with English morphology. A striking example is the Hausa-derived noun *mai gida*, which, when combined with English suffixation, becomes *maigidaism*. Such formations illustrate how local linguistic resources are creatively adapted to expand the expressive capacity of English in Nigeria.

These results support Kachru's (2006) model of dynamic World Englishes, which posits that English evolves in diverse sociolinguistic environments through local adaptation. The Nigerian English context exemplifies this process: global English structures are reshaped to accommodate local communicative needs, producing a variety that is innovative, expressive, and culturally resonant. Overall, the study underscores the critical role of both borrowing and morphological productivity in driving linguistic innovation and sustaining the vitality of Nigerian English.

## **Implications**

### **Sociolinguistics and Language Policy**

The findings highlight that borrowing and morphological innovation are central features of Nigerian English and should be recognized as legitimate linguistic phenomena rather than deviations or mistakes. These creative processes demonstrate the dynamic and adaptive nature of English in Nigeria, shaped by the interplay of local languages and sociocultural contexts. Policymakers and linguists should acknowledge these features in order to validate Nigerian English as a functional and evolving variety, fostering broader social and academic acceptance.

### **Language Teaching**

In educational settings, the study suggests the need to integrate local lexical innovations and morphological processes into English language curricula. By teaching students how borrowed words are adapted and combined using productive affixes, educators can equip learners to understand and employ Nigerian English more effectively and creatively. Such an approach not only enhances linguistic competence but also strengthens cultural relevance and communication skills in real-life contexts.

### **Lexicography**

For lexicographers, the study emphasizes the importance of systematically documenting both borrowed forms and the productive morphological patterns that arise from them. Including these forms in Nigerian English dictionaries ensures that these resources accurately reflect contemporary usage, capturing the innovative ways speakers expand and adapt the language. Comprehensive lexicographic coverage of these features helps both native and non-native speakers navigate the variety, promoting clarity and authenticity in language use.

## **Conclusion**

This study demonstrates that Nigerian English is characterized by a remarkable degree of morphological creativity and systematic lexical borrowing from indigenous languages such as Yoruba, Igbo, and Hausa. The findings reveal that borrowed words are not merely incorporated into English superficially; rather, they interact dynamically with English morphological processes to generate new forms, including agentive nouns, adjectives, and compounds. This interplay between borrowing and word formation enriches the Nigerian English lexicon and highlights the language's adaptability in a multilingual environment. It underscores the fact that Nigerian English is not a deviation from Standard English, but a vibrant, evolving variety shaped by local linguistic and cultural influences.

## **Recommendations**



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Based on these insights, several practical and scholarly recommendations emerge:

1. Language Teaching: English curricula in Nigeria should explicitly include modules on morphological productivity and the adaptation of borrowed forms. By sensitizing learners to how local words can be integrated and transformed within English, educators can enhance both comprehension and expressive competence, fostering the creative and contextually appropriate use of the language.
2. Lexicography: Dictionaries and lexical resources for Nigerian English should systematically record productive morphological patterns, borrowed stems, and hybrid forms. Such documentation would provide an accurate reflection of actual usage, supporting both academic study and practical communication for native and non-native speakers alike.
3. Future Research: Further studies should investigate semantic shifts, pragmatic usage, and sociolinguistic factors that influence the borrowing and morphological adaptation processes in Nigerian English. Examining these dimensions would provide deeper insights into language evolution and inform educational, policy, and lexicographic practices.

### **Acknowledgements**

The authors express sincere gratitude to scholars whose works on Nigerian English, morphology, and corpus linguistic provided the theoretical and empirical foundation for this study.

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*Developing Entrepreneurship skills for ...* Bello, M. & Haruna, A. (2025)

## Developing Entrepreneurship Skills for Self-Reliance among Tertiary Institution Graduates in Kano State, Nigeria

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### Abstract

*This study investigated Developing entrepreneurship skills for self-reliance among tertiary education graduates in Kano State, Nigeria. The study also examines how entrepreneurship programmes in institutions affect students' entrepreneurship intentions, career readiness and skills acquisition. A mixed methods approach was employed, combining survey data from 273 male and 111 female students from three tertiary institutions making a sample of 384 students and an in-depth interview with 20 entrepreneur educators at the colleges and universities selected for the study. The instruments for data collection are self-developed questionnaire and focus group discussion FGD with reliability coefficient of 0.62 and 0.69 respectively. The result of the study revealed that; There is significant gender difference between Male and female students in perceived entrepreneurial education and skill acquisition among tertiary institutions graduates in Kano state. No significant difference between rural and urban students in perceived entrepreneurial education and skill acquisition was observed among tertiary institutions graduates in Kano state. No significant difference in perceived entrepreneurial education and skill acquisition among tertiary institutions in Kano state. Based on the findings major recommendations were offered; educators and policy makers should emphasize integrating entrepreneurship education into curricula, promoting experiential learning and supporting mentorship initiative. Gender inclusiveness should be enhanced to ensure gender equality in entrepreneurial training. State and Federal governments should support students with loan that will promote entrepreneurship and skill acquisition among graduates of tertiary institutions, among others.*

**Keywords:** Entrepreneurship education, Self-reliance, Entrepreneurial intentions, Career readiness, Experiential learning

### Introduction

Nigeria education systems originated from pre-colonial time in the advent of independence when in 1958 the colonial government contracted Eric Asbhy to survey the manpower need over a period of 20 years from 1960-1980. The idea is to produce manpower that will manage the Nigeria private and public sector after independence. Despite several reforms in education sector the curriculum and policy makers find it difficult to derail from the initial colonial education system aimed at producing graduates for white colour jobs. In late 1980s the Nigeria's companies and civil service could no longer have vacancies to employ these graduates. Their numbers are growing day by day while the economy is deteriorating due to western loan accumulation. In mid 1990s companies begin to gradually close and governments at the three levels started to declare employment embargo in their Ministries, Departments and Agencies (MDAs) despite continuously producing the students from their universities and other tertiary institutions. This brings curriculum reform of 1981, 1990s and 2000 in which aspect of entrepreneurship and skill acquisitions were included in the national policy of education NPE. The Nigeria National policy on Education 6<sup>th</sup> edition section five sub section 110-112 emphasized innovation and enterprise education in Nigeria post-secondary with a view to promote skills acquisitions among the students. On the specific the section 110 (b) states educate post-secondary students to think creatively and transform knowledge through technological processes into wealth and have broader economic base. Section 110 (d) acquires entrepreneurial skills. While in section 111a it states that institution in collaboration with relevant bodies and establishments to ensure practical training and experience for students. Based on the above there is need for ensuring all students from tertiary institutions to be trained to learn one vocational skill or the other to ensure self-reliance among higher education students. Graduates from tertiary institutions in Nigeria, particularly in Kano State, face significant challenges in securing employment, leading to a high rate of unemployment resulting from dependence on white-collar jobs (NBS, 2023). The lack of entrepreneurship skills hinders their ability to become self-reliant and contribute to the economic development of the state (Afolabi, 2017).



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## Research Objectives

The study was aimed to achieve the following objectives:

1. Examine the gender differences in perceived entrepreneurial education and skill acquisition among tertiary institution graduates in Kano State.
2. Investigate the differences in perceived entrepreneurial education and skill acquisition between rural and urban students in Kano State.
3. Assess the variations in perceived entrepreneurial education and skill acquisition among different tertiary institutions in Kano State.
4. Determine the interactive relationship between students' skill acquisition, entrepreneurial self-efficacy, entrepreneurial job creation, and entrepreneurial education among tertiary education graduates in Kano State.

## Research Questions

The study sought to answer the following questions:

1. Is there a significant gender difference in perceived entrepreneurial education and skill acquisition among male and female tertiary institution graduates in Kano State?
2. Do rural and urban students differ in their perceived entrepreneurial education and skill acquisition in Kano State?
3. Are there notable differences in perceived entrepreneurial education and skill acquisition among tertiary institutions in Kano State?
4. What is the nature of the interactive relationship between students' skill acquisition, entrepreneurial self-efficacy, entrepreneurial job creation, and entrepreneurial education among tertiary education graduates in Kano State?

## Research Hypotheses

The following hypotheses were tested:

1. There is no significant gender difference in perceived entrepreneurial education and skill acquisition among tertiary institution graduates in Kano State.
2. There is no significant difference in perceived entrepreneurial education and skill acquisition between rural and urban students in Kano State.
3. There is no significant difference in perceived entrepreneurial education and skill acquisition among tertiary institutions in Kano State.
4. There is no significant interactive relationship between students' skill acquisition, entrepreneurial self-efficacy, entrepreneurial job creation, and entrepreneurial education among tertiary education graduates in Kano State.

## Scope of the Study

This study focused on graduates of tertiary institutions in Kano State, Nigeria, with an emphasis on exploring how entrepreneurship skills could be developed to promote self-reliance among this demographic.

## Conceptual Framework

### Entrepreneurship

Entrepreneurship is the ability and readiness to develop, organize and run a business enterprise, along with any of its uncertainties in order to make a profit. The most prominent example of entrepreneurship is the starting of new businesses, Magasi (2017). In economics, entrepreneurship connected with land, labour, natural resources and capital can generate a profit. The entrepreneurial vision is defined by discovery and risk-taking and is an indispensable part of a nation's capacity to succeed in an ever-changing and more competitive global marketplace. Magasi (2017) entrepreneurship is largely classified into four major sub-groups viz;

### Small Business Entrepreneurship

These businesses are a hairdresser, grocery store, travel agent, consultant, carpenter, plumber, electrician, etc. These people run or own their own business and hire family members or local employee. For them, the profit would be able to feed their family.

### Scalable Startup Entrepreneurship

This start-up entrepreneur starts a business knowing that their vision can change their society. They attract investors who think and encourage people who think beyond their existing practice. This will encourage them to do things that can help them employ labour to run a firm or company. They require more venture capital to support their project or business.



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### **Large Company Entrepreneurship**

These huge companies have defined life-cycle. Most of these companies grow and sustain by offering new and innovative products that revolve around their main products to feed markets.

### **Social Entrepreneurship**

This type of entrepreneurship focuses on producing product and services that resolve social needs and problems. Their main objective is to work for society and not make any profits.

### **Characteristics of Entrepreneurship**

Not all entrepreneurs are successful; there are definite characteristics that make entrepreneurship successful. A few of them are mentioned below by Beugelsdijk, and Noorderhave (2005);

- i. **Ability to take a risk-** Starting any new venture involves a considerable amount of failure or risk. Therefore, an entrepreneur should prepare to be courageous and able to evaluate and take risks.
- ii. **Innovation-** It should be highly innovative to generate new ideas, start a company and earn profits out of it. Change can be the launching of a new product that is new to the market or a process that does the same thing but in a more efficient and economical way.
- iii. **Visionary and Leadership quality-** To be successful, the entrepreneur should have a clear vision of his new venture. However, to turn the idea into reality, a lot of resources and employees are required.
- iv. **Open-Minded-** In a business, every circumstance can be an opportunity and used for the benefit of a company.
- v. **Flexible-** An entrepreneur should be flexible and open to change according to the situation. To succeed in this, a business person should be equipped to embrace change in a product and service, when needed.
- vi. **Know your Product-** A business owner should know the product offerings and also be aware of the latest trend in the market. It is essential to know if the available product or service meets the demands of the current market.

### **Importance of Entrepreneurship by Ribeiro 2017**

- i. **Creation of Employment-** Entrepreneurship generates employment and provides an entry-level job, required for gaining experience and training for unskilled workers.
- ii. **Innovation-** It is the hub of innovation that provides new product ventures, market, technology and quality of goods.
- iii. **Impact on Society and Community Development-** A society becomes greater if the employment base is large and diversified. It brings about changes in society and promotes facilities like higher expenditure on education, better sanitation, fewer slums, a higher level of home ownership.
- iv. **Increase Standard of Living-** Entrepreneurship helps to improve the standard of living of a person by increasing the income. The standard of living means, increase in the consumption of various goods and services by a household for a particular period.
- v. **Supports research and development-** New products and services need to be researched and tested before launching in the market. Therefore, an entrepreneur also dispenses finance for research and development with research institutions and universities.

### **Skills Acquisition**

Skills Acquisition is the act of learning/acquiring skills to start up a business to earn money, while entrepreneurship is simply a process of running a business of your own Emmanuel, (2012). Entrepreneurship is not complete without skills acquisition. As an entrepreneur you need to acquire the require skills that will make you successfully run your business. Skill acquisition involves learning, while entrepreneurship involves taking risk, Pintrich et al (2010).

There are many ways to acquire skills, including:

1. Attending college or other accredited schools
2. Attending trade skill classes
3. Reading books
4. Getting into a mentorship program



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## **Theoretical Framework**

Theoretical and practical implications suggest that entrepreneurship education can foster a culture of self-reliance, empowering students to navigate uncertain labour market and drive economic growth for their development economically. Studying entrepreneurship can significantly increase the likelihood of success by providing individuals with the knowledge, skills, mindset, and networks necessary to navigate the challenges of starting and managing a business, Hodgins et al (2010). Entrepreneurship education sets to provide students with the knowledge, skills and motivation to encourage entrepreneurial success in a variety of settings. Variations of entrepreneurship education are offered at all levels of schooling from primary or secondary schools through graduate university programs, GEM, (2020). It was therefore no surprise that the Federal Government of Nigeria, through the National Universities Commission (NUC), Nigeria commission for colleges of education NCCE, National board technical education NBTE introduced Entrepreneurship Education (EE), which is aimed at equipping tertiary students with entrepreneurial skills, attitude and competencies in order to be job creators and not job seekers.

Entrepreneurship education emphasizes setting up, starting up and running a business it also deals with developing the attitudes, competencies, and behaviors for functioning entrepreneurially within the business and non-business contexts (Henry, 2013; Jones and Iredale, 2010). There are four major types of entrepreneurship education: Small Business, scalable start up entrepreneurship, social entrepreneurship and large scale entrepreneurship. To ensure these students self-efficacy need to be put into consideration, it's when students understand themselves and their immediate environment then they will put in their best toward realisation of their potentialities Boyd and Vozikis (1994). Entrepreneurial self-efficacy (ESE) is the application of self-efficacy in entrepreneurship research, referring to the extent to which entrepreneurs are confident about their own entrepreneurial skills to complete various tasks and projects (Boyd and Vozikis, 1994; Chen et al., 1998).

The construct of self-efficacy is defined as a person's beliefs concerning his or her ability to successfully perform a given task (Bandura 1977). Self-efficacy beliefs are perceived to be a major mediator of behavior. Self-efficacy can influence the course of action pursued by an individual, the amount of effort they expend, their resilience, as well as their persistence in the face of obstacles (Bandura 1977). The stronger the notion of self-efficacy, the greater the effort, perseverance and flexibility expended (Bandura 1986). Self-efficacy beliefs can also influence people's thoughts and feelings (van Dinther et al 2010). Individuals characterised by low self-efficacy are inclined to perceive tasks as more difficult than they actually are. Such thoughts can lead to feelings of failure and depression, tension and helplessness. A high level of self-efficacy, on the other hand, creates feelings of tranquility and challenge in the face of difficult situations (van Dinther et al 2010)

## **Theory of Planned Behaviour**

The theory of planned behavior (TPB) is a full-fledged social psychology theory, and has been widely used in the fields of Education, management, nursing, marketing, and etc. However, the TPB has not been given adequate attention in communication studies in China. This paper uses the makes a comprehensive review on the origins, basic construct, and cutting-edge studies on TPB, as well as analyzing the development status and future direction of TPB. The theory of planned behavior (TPB), deriving from theory of multi attitude (TMA) and theory of reasoned action (TRA) (Ajzen & Fishbein, 1973), is a social-psychological theory that explains behavioral decision-making processes of human beings with aiming at understanding and predicting the behavior of individuals, advocating that the successful completion of human behaviors are mainly controlled by individual will. According to TRA, the behavior intention of individuals is determined by two factors of attitude and subjective norm, in which the subjective norm is influence by normative beliefs in the society and the attitude, can be divided into positive or negative aspects. Ajzen (1985) held that human behavior is more often affected by the factors of external and objective circumstance rather than completely controlled by individual will. In order to add the power in prediction and explanation of TRA on human behavior, Ajzen (1985) added the variable of perceived behavioral control besides subjective norm and attitude, and extended and revised the structure of TRA as believe, behavioural intention, subjective norms and attitude.

## **Human Capital Theory**

Human capital theory by Friedman 1953 in (Zamora, 2006) posits that investments in education, training, skills, and health increase an individual's and a society's productivity, leading to greater economic success. This theory views human attributes as a form of capital, similar to physical capital, that can be invested in to generate returns in the form of higher



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wages and improved performance for companies and economies. It is ironic that the difficulty of proving human capital theory's posited direct link between formal education and productivity is at least partly a consequence of what some would identify as structural flaws in neoclassical economic philosophy Merwe (2010). Human capital theory, as a product of neoclassical economics, inherits its metaphysical assumptions of the "hard core" of the orthodox economics research programme. The issue of assumptions in economic theory has been much debated (Friedman 1953, Nagel 1963) in (Zamora, 2006). Human capital theory as cited in Eide and showalter (2010) forms the basis for most work in the economics of education. The study of human capital has proven to be an exceptionally fruitful vein of research that offers insights on topics as diverse as discrimination, inequality, unemployment, fertility, marriage markets, immigration, and productivity. This article briefly discusses several aspects of human capital theory, including theoretical and empirical considerations, as well as some prominent empirical results directly related to education.

### **Methodology**

Descriptive survey research design was employed for the conduct of this study, the design deals with the relationship between non-manipulated variables in a natural, rather than artificial setting. It involves hypotheses formulation and testing and it use logical methods of inductive- deductive reasoning to arrive at generalizations and often employ methods of randomization (Paniel, 2015). The study site comprises of some tertiary institutions in Kano Metropolis institutions selected for the study includes Sa'adatu Rimi college of education Kumbotso, Kano, Yusuf Maitama Sule University, Kano State polytechnic and federal college of education Kano. To ensure development of entrepreneurship education among students of tertiary institutions, government should do their best to ensure provision of entrepreneurial facilities in all institutions of higher learning for training the potential graduates before they leave their colleges. For example, Sa'adatu Rimi College of Education Kumbotso in Kano state is an exceptional example where all students most register and pass entrepreneurial course and should also register for skills acquisition practical one out of thirty-eight traits of practical skills at the skills acquisition center must be registered before their graduation. Although students were charged a token to provide practical's learning facilities but it was concluded the result pays as every year the immediate past students were brought back for testimonies and their net worth after they started business. Tracer studies were made and the college found 25 percent of the college students do not file application for civil service jobs. Entrepreneurship education cannot be limited to core or elective course or only the need to make it practical there by making the students derived economic benefit is paramount. The result of this is not limited to economic drive only but providing employment opportunities to low and menial carder employment among low resource members of the community as well as bringing services close to the community at this era of expensive cost of transport.

The population of the study comprises of all students of the respective tertiary institutions in Kano state. Cluster sampling technique was used for this study. Cluster sampling according to Bichi (2004) Cluster could be zonal education areas, within the zonal areas schools were sampled, within the schools and finally individuals were sampled within the classes. Based on the above simple random sampling technique was used to select number of participants to represent the sample size to be used for the conduct of the study. Simple random sampling technique was used to select the sample size for the study with 384 participants, obtained from Research Advisor table of sampling size 2016. The sample was selected proportionately based on institutions size i.e Bayero University Kano 146, Yusuf Maitama Sule University Kano 56, Sa'adatu Rimi College of Education Kumbotso, Kano 103 and Kano State Polytechnic 79. Instrument used for data collection was self-develop questionnaire entitled: Developing Entrepreneurship Skills for Self-Reliance Questionnaire (DESSR-Q). It's likert type 4 scale scored on Strongly agree 5, Agree 4, Disagree 4 and Strongly disagree 1. The instrument is 40 items scale in to four constructs skill acquisition, entrepreneurial self- efficacy, entrepreneurial job creation and entrepreneurial education, with each construct having ten items each. Content validity is when a questionnaire adequately reflects the underlying behavior or body of knowledge. Content validity is established by having experts evaluating the relevance of the test items (Orodho, 2008). For the research instrument to be valid and to measure what it is supposed to measure, the instrument was assessed and corrected by four (4) experts in entrepreneurial education and test and measurement. To measure the consistency of the instrument, pilot study was carried out using test-retest method where by fifty (50) questionnaires were pilot tested in some areas of the metropolis that are out of the sample population of this study to ascertain the reliability of the instrument. The respondents who form the pilot test are selected from Wudil University of science and technology, Federal college of education Kano and Audu Bako College of agriculture Dambatta.



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The objective of the pilot test is to ensure each of the items developed is reliable for information gathering. The result of the pilot test was subjected to scale test and obtain the reliability coefficient of .766. Data analysis procedure was made using descriptive and inferential statistics while simple percentage was used to summarize the demographic variables in study.

## Presentation of Results

Results of the field survey is summarized based on simple percentage, descriptive and inferential statistics.

### Summary of demographic variables

**Table 1: Distribution of Respondents by Demographic Variables**

Variables	Frequency	Percentage
Male students	273	71.1
Female students	111	28.9
Students from rural environment	209	54.4
Students from urban environment	175	45.6
Students from Bayero University Kano	146	38.0
Students from Yusuf Maitama Sule University Kano	56	14.6
Students from Sa'adatu Rimi College of Education Kano	103	26.8
Students from Kano Kano State Polytechnic	79	20.6

**Source: field data 2024: numbers in parenthesis below are in percentage**

Table 1 presents the demographic variables under study based on students' population in the respective university, college and polytechnic. A total of 273(71.1) students are male while 111(28.9) were female students. Students from urban environment who form the sample of the study are 209(54.4) while those who indicated they are from rural areas are 175 (45.6). Bayero university Kano has the highest respondents with 146(38.0). Yusuf Maitama Sule University have 56(14.6) students who form the sample of the study. Sa'adatu Rimi college of Education Kano has 103(26.8) respondents while Kano state polytechnic has 79(20.6) respondents who form the sample of the study. Based on the above the highest sample was recorded at Bayero University Kano while the lowest was recorded at Yusuf Maitama Sule University.

## Test of hypotheses

**Hypothesis 1:** There is no significant gender difference in perceived entrepreneurial education and skill acquisition among tertiary institution graduates in Kano State.

**Table 2: Gender difference in entrepreneurial education and skills acquisition among tertiary Institution graduates in Kano state**

Variables	N	Mean	SD	df	z-cal	sig	p-val	Decision	
Skills acquisition	Male	273	44.50	18.16	382	2.07	0.92	0.05	H <sub>1</sub> accept
	Female	111	44.90	1.82					

**Source: field data 2024**

Table 2 presents z-test of skills acquisition among gender. The test showed z cal = 2.07, p= 0.92 > 0.05 therefore null hypothesis which stated there is no significant difference between genders in perceived entrepreneurial education and skills acquisition among tertiary institutions' graduate students in Kano state was not rejected.

**Hypothesis 2:** There is no significant difference in perceived entrepreneurial education and skill acquisition between rural and urban students in Kano State.

**Table 3: Z- test Rural and Urban students in Entrepreneurial Education and skills acquisition**

Variables	N	Mean	SD	df	z-cal	sig	p-val	Decision	
Skills acquisition	Urban	209	44.50	1.84	382	0.91	0.60	0.05	H <sub>2</sub> accept
	Rural	175	44.70	1.81					

**Source: field data 2024**

Table 3 presents z test of skills acquisition and students' environment. The test showed no significant difference between students' environment (Urban and Rural) at z cal = 0.91, p= 0.60 > 0.05, the null hypothesis which stated there is no



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significant difference between urban and rural students in perceived entrepreneurial education and skills acquisition among tertiary institutions' graduate students in Kano state was accepted.

**Hypothesis 3:** There is no significant difference in perceived entrepreneurial education and skill acquisition among tertiary institutions in Kano State.

**Table 4: Difference in skills acquisition among tertiary Institutions in Kano state**

Variables	Sum of Sq	Mean Sq	df	F-cal	sig	p-val	Decision
Between Groups	1.70	0.58	3				
Within Groups	1696.80	4.46	380	0.13	0.94	0.05	H <sub>3</sub> Accepted
Total	1698.50		383				

**Source: field data 2024**

Table 4 presents F-test of perceived instructional delivery between the universities under study. The test showed F-cal = 0.13, P = 0.94 > 0.05 null hypothesis which states there is no significant difference between institutions in perceived entrepreneurial education and skills acquisition instructional delivery among tertiary institutions under study in Kano state was accepted

**Hypothesis 4:** There is no significant interactive relationship between students' skill acquisition, entrepreneurial self-efficacy, entrepreneurial job creation, and entrepreneurial education among tertiary education graduates in Kano State.

**Table 5: Correlation matrix between variables and entrepreneurship education**

Variables	SAI	ESE	EJC	EE
SAI	1			
ESE	0.53	1		
EJC	0.56	0.59	1	
EE	0.47	0.44	0.39	1

**Source: field data 2024**

Table 5 presents correlation matrix between students' skills acquisition, self-efficacy, job creation and perceived entrepreneurial education. The test showed moderate relationship among the variables at r 0.47 between skills acquisition and perceived entrepreneurial education, r = 0.44 between students self-efficacy and perceived entrepreneurial education while r = 0.39 between job creation and perceived entrepreneurial education. The results were all recorded at p < 0.05. Based on the above we conclude the null hypothesis which states there is no significant relationship between students' skills acquisition, entrepreneurial self-efficacy, entrepreneurial job creation and perceived entrepreneurial education among tertiary institutions' graduate students in Kano state was rejected.

### Summary of Focus Group Discussion

Below are some of the responses of part of the sample entrepreneurship educators who are contacted during the survey who happen to be parents and care givers of the university undergraduate students.

*From Bayero University Kano:*

*Skills acquisition could be the best system of education as our students will graduate well prepared to start enterprising themselves without waiting for government to employ them after graduation.*

*From Sa'adatu Rimi College of Education Kumbotso, Kano:*

*If this system is in place why shall we waste our time going for rigorous education system that wasted the future of our youth? This type of system gives them knowledge on how to write a business plan to help themselves and others.*

*From Kano State Polytechnic:*

*Entrepreneurial education should be given more priority in terms of learning period and practical to help equipped the students with necessary requisite of becoming self-reliant.*

Above are responses from Bayero University Kano, Yusuf Maitama Sule and Sa'adatu Rimi University of Education by Entrepreneurship educators respectively.



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### **Summary of the Findings**

1. No significant difference was found between gender male and female students in perceived entrepreneurial education and skills acquisition
2. No significant difference was found between urban and rural students in perceived entrepreneurial education and skills acquisition
3. No significant difference was found between students in perceived entrepreneurial education and skills acquisition instructional delivery among tertiary institutions under study in Kano state.
4. There is significant but moderate relationship between students' skills acquisition, students' self-efficacy, job creation and perceived entrepreneurial education among graduate in Kano state

### **Discussion of Findings**

Lack of gender difference as revealed by the study is an encouraging finding which suggest that entrepreneurship education in Kano state is not a gender perpetuating gender bases, the findings support the national policy goals of inclusivity among gender. The study indicates both urban and rural graduates do not differ in their struggle to become self-reliant. The national economic policy that affects private sector operation due to poor power supply, custom and excise duty has forced many companies to close. The graduates have then mounted pressure in public sector which makes employment very difficult.

The study has not shown any disparity between the tertiary institutions, university, colleges and polytechnic. This equally indicates entrepreneurial education can be taught at any higher institution of learning in Kano state. Irrespective of the program they are offering. This clearly showed the need of national policy goals to produce self-reliant citizens. The moderated correlations between states that while entrepreneurial education is related to skill and self-efficacy, other factors in this study like graduates' access to startup capital, community and family support, broader economic climate also plays a critical role in determining self-reliance. Overall, the study's findings have implications for educators and policymakers seeking to promote entrepreneurial education and skills acquisition among university students. By understanding the relationships between variables, stakeholders can develop targeted interventions to support students from diverse backgrounds and enhance their entrepreneurial capabilities.

### **Conclusion**

Based on the major findings above, entrepreneurial training and education should be given to all irrespective of their gender difference. It is an approach for training the mind of students before they graduate to enable them possesses skills that will make them self-reliant. Students did not differ based on the environment they come from as both urban and rural students were the same in the quest for entrepreneurial education. The study showed no difference between the universities in the training of entrepreneurial education this may be due to same regulatory body governing the operation of the Nigeria universities as well as similar curriculum operated by the universities. The state polytechnic and the colleges of education have different curriculum but may be due to national policy and federal ministry of education guide they do not differ in provision of entrepreneurial education training. Moderate relationship between students' skills acquisition, students' self-efficacy, job creation and perceived entrepreneurial education among students were recorded as the area of entrepreneurial education study is new both staff students and teachers are doing their best to make and gain insight in the new programme.

### **Recommendations**

There is need to provide entrepreneurial education to all students irrespective of their gender. The issues of this knowledge is not limited to male or female graduates, all should register with the course and should be compulsory. Students' background or environment should not be taken into account while registering entrepreneurial education courses has to be taught to reflect the need of both rural and urban skills need. All tertiary institutions irrespective of their mandate should train their students' entrepreneurial education and skill acquisitions to avoid redundancy and expectations in private and public sector employment. Parents, government and CBOs should focus on entrepreneurial education capacity building to enhance students' self-efficacy.

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## Qualitative Study on Narrative and Parenthetical Context-Based Multiple In-text References: A Systematic Review of In-text Citations

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### Abstract

*Clear and concise presentation of facts and findings, in well-packaged and systematic way using the approved standards, is one of the concerns of scholars; and, facts and findings packaged in this manner used in scholarly publication for researchers is called academic writing. One element which distinguishes academic writing from other forms of writing, apart from being evidenced-based, is reference and referencing which give the work genuineness. Many researchers, especially novice mistake one for the other between reference and referencing. Referencing is more technical than reference. Novice researchers often acknowledge sources imperfectly, especially when citing different ideas from different sources embedded within a sentence. This paper reviews the distinction between the two concepts, and provides illustrations of the science of acknowledging sources for embedded ideas with multiple sources, paying special attention to all technicalities. Reference is a detailed list of sources cited within that comes at the end of the work. Referencing is the science of how sources from different works are acknowledged within the work. There are two approaches of referencing: sentence-inclusion (narrative or integral) citation and sentence-exclusion (parenthetical or non-integral) in-text citation. Each of the approaches has some rules in accordance with the number of authors, and why to cite. Therefore, reference and referencing are two distinct concepts. Hence, researchers have a choice to select from the different styles and should conform to their rules in both in-text citations and end-of-list references.*

**Keyword:** Bibliography, Citation, In-text citation, Reference, Referencing,

### Introduction

Academic writing is a well-scripted work that presents research discovery (new ideas, methods, and/or principles) to contribute to the existing body of knowledge (Jayawardane, 2007). It shows the author's mastery of a particular field of research by following a formal style of expression of findings. In such writing, the author is expected to be formal, thoughtful, meticulous, objective, and above all critical. To maintain these qualities, members of the academia ought to be exposed to the nitty-gritty of writing quality academic work. One of the most important elements in academic writing is the avoidance of plagiarism (Bašić, Kružić, Jerković, Buljan, & Marušić, 2019). Plagiarism is an act of presenting a scholar's work without giving credit to the source (Bašić et al., 2019). This act is a serious crime (Agrawal, 2020) and is considered an act of thievery (Maina, Maina, & Jauro, 2014). Thus, students and novice writers should be exposed to its dangers and methods of avoiding it. A writer will be caught up with the new technologies, such as Plagiarism Checker, Turnitin, etc. One of the methods of reducing plagiarism is proper citation (acknowledgement) of sources and inclusion of all cited sources in the end-list references. Proper citation is a way of adhering to the rules of acknowledging evidences for sources of ideas and claims in line with convention of a particular style. Proper citation requires a mastery of the concept (reference and referencing) and its science (how and when to cite). Many researchers first think of an end-of-list reference as the only reference required in academic work – assignments, course projects, and final-year projects (Saeed, Aamir, & Ramzan, 2011). This perception may be due to the inability to distinguish reference and referencing in a research field (Bašić et al., 2019). Reference, on the one hand, is a detailed description (at the end of the work) of the sources of ideas that one gives credit to under a section called 'References' (Elgin, 1983). Researchers sometimes use a bibliography instead. Like reference, the bibliography list includes sources relevant to the work and important for the readers but are not necessarily cited in the work. On the other hand, referencing is the acknowledgement of others' ideas within your main work. It is the provision of a source of reference in the main body of the work, which must be captured in detail at the end-list reference at the end of the work. That is why in academic writing, writers are expected to cite (acknowledge) sources



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for any claim or authoritative ideas by way of supporting assertions and claims. And, what has been cited must be captured in the end-list reference, otherwise, it will amount to poor scholarship. Referencing is used interchangeably with citation, in-text citation, and within-text citation (Elgin, 1983). For many researchers, especially students, the concepts (reference and referencing) seem to be confusing. For this reason, this paper discusses the concepts using simple illustrations to x-ray their distinction. In addition to this, skilful citation for embedded ideas presented in a sentence as well as understanding proper citation using punctuations; when and where to provide sources, are explicitly discussed.

## Reference

To Elgin (1983), a reference is a collection of a list of sources cited throughout the research that appears at the end of a research work. The reference entry incorporates details of the sources to aid in searching for further reading. The details differ according to the type of research cited (journal articles, books, conference proceedings, reports, newspapers, magazine, and other online sources such as videos) (Miller, 2016). The detailed elements contained in the reference list (depending on the style of reference) include the author's name (the author could be single or multiple); date (date of publication and sometimes retrieval date); title; and, source (database information) (White, 1991). It is important to study the proper use of punctuation marks in citation, which tells which style is employed. For more detailed description, please, study the manual of the individual style. Note that there are about 495 different styles of reference in use (Bradley, Noble, & Hendricks, 2020). Notable among these styles are: American Psychological Association (APA), Modern Language Association (MLA), Numbered System, Harvard Style, Vancouver Style, Chicago System, Institute of Electrical and Electronics Engineers (IEEE Style), British Medical Journal (BMJ), Modern Humanities Research Association (MHRA Style), and Oxford Standard for Citation of Legal Authorities (OSCOLA) for law (Pandey et al., 2020). In this review, all examples and illustrations are taken from the popular and common referencing style, The APA. This style seems common and popular among scholars. The table below provides few information about the common reference styles in use for easy recall:

**Table 1:** *List of Common Reference Styles with Discipline they are associated with*

Reference Style	Discipline
APA	This is used in the fields of education, psychology, and sciences.
MLA	Used in the field of Humanities.
Chicago System	This is mostly used by businesses, historians, and those in the fine arts industry.
The Numbered System	This system is commonly used in the fields of engineering and chemistry.
IEEE	This style is used in the field of electronics and other related disciplines.
BMJ	This system is used by medical trade journals.
The Harvard	This style is used in various fields such as Biochemistry, Biology, Economics, Environment, and Health Sciences, among others.
The Vancouver	This style is mostly used in the fields of medical sciences, biology, and biochemistry.
OSCOLA	This system is commonly used in the field of law.

Note: From APA Manual 2007.

## Referencing

What distinguishes academic writing from most writings is the referencing (in-text citation/within-the-text citation), henceforth, citation. Citation is an act of acknowledging sources within the text. Any assertion in academic work is required to be provided with a source to support it. There are two ways to cite sources within the main body of work: narrative citation (or sentence inclusion) and parenthetical citation (sentence exclusion) (Nazir et al., 2020). These are considered the two types of in-text citations.

### ***Sentence Inclusion In-Text Citation***

Sentence inclusion citation is a citation that begins a sentence. It is when a writer provides a source to any assertion within the main body of the work starting with the source as part of the narration (Boyack, van Eck, Colavizza, & Waltman, 2018) (author's surname and only date in bracket). That is why it is called a narrative citation. For instance: "Nasiri (2012) observes that the use of hedging would be determined by the writer's background". The citation 'Nasiri (2012) ...' is typical of a sentence inclusion in-text citation. It is provided by the writer to support that the assertion is from the source cited. Often, such citation is to indicate that a new idea or explanation is presented. It opens with an indicating phrase, for example, 'According to Nasiri (2012) ...'; 'In his study, Nasiri (2012) ...'; or without any phrase such as in the example



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above, 'Nasir (2012) ...'. These phrases are followed by verbs such as define, state, say, explain, assert, etc. Note that when more than one source is provided, it should be separated by a semicolon and no use of conjunction: either 'and' or the ampersand '&'. This formality (the use of semicolons to separate more than one source) is applicable in both narrative and parenthetical citations, as illustrated below:

According to Galti (2017); Ahmed (2020); Umar (2012) who assert that ... Or, In their separate studies, Babikkoi and Galti (2016); Galti (2017); Hyland (1996) concluded that ....

**Note:** The primary conjunction 'and' can be used when acknowledging sources with more than one author as in the second example above 'Babikkoi and Galti (2016)'. The use of ampersand '&' is found in sentence exclusion citation, examples of which will be given later

#### ***Sentence Exclusion In-Text Citation***

Sentence exclusion in-text citation is an acknowledgement of source that occurs end of an idea (Putnam & Phelps, 2017). The detail of the source is packaged in parenthesis marking the end of idea. This is why it is called a parenthetical citation. For example: "Hedges in research articles might create a good relationship between the writer and his target audience (Galti, 2016). Some language learners dodge speaking tasks and assessments, especially when it is face-face, except it is unavoidably necessary (Cui, 2011). Such citation is mostly to report findings or supply more information as can be seen above. This means, when the position of the scholar is the focus of the reporting, the parenthetical citation is applicable. Unlike in the end-list reference, the within-text citation entry, often, appears to be the same for article papers, textbooks, reports and so on, except for a few referencing styles. A few styles such as Vancouver (for Medicine), Numbered (for generic), and BMJ (for medicine) used numbering instead (Stevens & Duque, 2019). Importantly, writers cite not the authors of the work, but most times, the idea (Bornmann & Daniel, 2008). It is a convention to acknowledge others' ideas in a research work. Not only convention to cite but a moral obligation whenever a writer makes an authoritative statement in a research work, the writer must and ought to provide a source (cite where the idea is gotten). One can cite as many sources as possible for an idea as one can cite only one source for an idea. This phenomenon is referred in the circle of academics as Multiple In-text References (Crawley & Stevenson, 1990). Consider the two examples provided below:

- i. Music plays an important role in vocabulary retention (Chi, 2015; Galti, 2016; Hyland, 2012; Oxford and John, 2012; Priyatmojo, 2009).
- ii. Young language learners enjoy learning vocabulary without fear of evaluation (Galti, 2018).
- iii. ... is quite prevalent in the study population, diabetes (Alisjhbana, et al., 2006) alcohol consumption (Lonnroth, et al., 2008), indoor air pollution (Kolappan & Subramani, 2009; Pokhrel et al., 2010), ... which are features that is common across the study area, or a combination of a host of these factors.

In example I, there are five sources despite presenting a single idea. This indicates that all five sources have presented the same idea in their separate and independent research works. In example ii, the idea is attributed to only one source. A skilful writer can be identified by his ability to provide independent sources for different ideas embedded in a single sentence showcasing the writer's competence in academic writing. For example:

- iv. ... suggestopedia method is considered one of the effective methods for teaching language vocabulary (Priyatmojo, 2009) which could accelerate learning (Lozanov, 1988).
- v. ... what teachers present as input should allow for learners to process through negotiation for meaning (Thuraisingam, 2001) and modification as interaction (Gass & Varonis, 1994) and then the development of intake for production (Fang, 2010).

From example iii, the writer's skilful use of the two independent sources for two different ideas embedded in sentence iii seems to be superb and scholarly. Though, two different papers are conjointly used to support interrelated ideas complementarily in the writer's work. This means that Priyatmojo presented the first part of the sentence while Lozanov concluded the second part of the sentence. In example iv, the writer tactfully shows his mastery of the research topic and how vast he read about it. Here, three independent ideas are embedded in a single sentence but attributed each claim in the sentence to its original researcher. Notice that the focal idea in the sentence is the statement: 'What teacher presents as input should allow for (sic) learners to process through...', (a) negotiation for meaning, according to (Thuraisingam, 2001); (b) modification as interaction, according to (Gass & Varonis, 1994); and, (c) development of intake for production, according to (Fang, 2010). Each of the authors sees the process of learning input in different ways. But, the writer skillfully



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embedded the whole ideas after critical analysis of each and presented in a single sentence. Unfortunately, most novice writers, especially students, provide improper citations when a chunk of ideas are culled from different and independent sources. For instance, the following has different possible interpretations:

vi. ... suggestopedia method is considered one of the effective methods for teaching language vocabulary which could accelerate learning (Lozanov, 1988; Priyatmojo, 2009).

Example v. has been wrongly cited for the following reasons. The presupposition of the sentence states that both the authors agreed on the two ideas 'effectiveness of suggestopedia and accelerates learning', which is not true. By so doing, one is attributing ideas not stated by an author. This is also dishonesty in academic writing (Chanock, 2008; Hyland, 1999; Moten, 2014). Novice writers make such presentations of in-text citations on embedded ideas for lack of know-how about proper citation. There is a need for a wider study about referencing and skilful use of the citation in general. Writers should understand when and where to cite in their writing. In the traditional belief, citation is only done in the literature review section. Citations should and ought to be in every section of your work. What writers cite is claim irrespective of section where the claim occurs. This shows scholarship and mastery of research area. Most novice writers do not scale through plagiarism if sources are not acknowledged for every claim irrespective of section. Besides the literature review section, this paper provides instances where sources are required to be acknowledged in introduction, methodology, discussion, and conclusion sections. Instances where sources must be acknowledged in the introduction (background) section is when a writer wants to announcing importance of research or generalized a topic to establish a boundary, the writer may put, for example: (i) Recent researches have shown that there is spade of interest in hording beans in Northern Nigeria (Ahmed, 2022). (ii) Discovering medicine that cures malaria is of great concern in African sub-region (Musa, 2021). (iii) The concept of infixation as a recognized word formation process in English is still a debatable among linguists (Ahmed, 2020; Galti, 2021). Or, when a writer wants to establish a gap to be filled by counter claiming, indicating gap, raising question, or continuing a tradition, then source is required to be acknowledged. For example: (i) Ndimele (2003) asserted that infix is not recognised in the morphology of English; however, there are words of English that accommodate infix for plural formation, one of which is sponsful (see Ahmed & Galti, 2021). (ii) Earlier studies revealed that semantic effect for multiple negative prefixes.

In methodology section, where there the need arises for supporting a claim source must be provided. Here, the claims could be relating to use of a method of data collection, analysis, or sampling technique, design etc. such instances can be found in the following instances: (i) The instrument used for data collection is the modified inventory for language anxiety designed by Horwitz, Horwitz, and Cope (1986). (ii) The proximate analysis was performed by Thermogravimetric analysis based on the procedure described (Donahue & Rais, (2009).

In the former example, the writer supports his use of instrument by providing source that shows its origin, probably to showcase the reliability of the instrument. In the later, a science method was adopted in the experiment where the writer supports his claim for the use of the method with a source.

In discussion section, writers acknowledge sources to support their findings and results. This is to indicate that the result and findings of the research are still valid and fertile. For example: (i) The result shows that learners of English as L2 attach *un-* as common negative prefix to adjectives whose negative prefixes are uncommon. This finding agrees with the assertion of Dzuganova (2006). (ii) It can be seen that the sample G (75%w/v) conforms to that of polyvincl acetate having standard specific gravity of 1.19 (Rodriguez et al., 2003).

In conclusion section, a writer can provide sources to indicate that he is not alone in making such deduction (logical ending). As such, sources are use in making your conclusion strong and relevant. Although, citations are not necessary in the conclusion section because they are your own findings, explanations, and interpretations. However, few examples are illustrated below: (i) The paper concludes that novice writers find it difficult to cloud their claims with hedging. This agreed with what Salager Meyer (2006) examined in her study.



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Note: in conclusion section, citation of sources seems to be rare as many writers draw their conclusion with authority. Experts recommend use of hedging for claims to avoid open criticism even when evidence is provided (Galti et al, 2016), to increase credibility of claims (Elif Tokdemir Demirel, 2019).

## Conclusion

Based on the explanative discussions in this paper, academic writing is an art of presenting research ideas to particular discourse community in conformity to the science of writing academic text involving in-text citation. In-text citation is a systematic way to acknowledge sources for quotation and paraphrasing ideas of others in research work. In-text citation is used interchangeably with citation, within-the-text citation, or referencing. There are two types of citation – sentence inclusion and sentence exclusion. Sentence inclusion citation is a kind that begins an idea. Sentence exclusion is a kind that ends an idea. Referencing is different from reference which is concerned with the list of sources with details (database information) at the end of the research work. The reference entries are different from the entries of referencing. Such entries in reference is based on the individual style adopted. There are about 495 referencing styles in academic field. For appropriate citation within a text, writers can cite more than single author (one author) or single source (one article paper) within a sentence where different ideas are embedded differently – this is called Multiple In-text References (MIR). The MIR shows expertise of the writer. The paper also revealed that appropriate use punctuation in research shows mastery. Provision of sources for claims comes in all the rhetorical sections of a research, except for conclusion section which is uncommon.

## Recommendations

Based on the conclusion, the following recommendations are forth put to better the academic writing of scholars in line with the best practices, especially writings of novice.

- i. Departments of faculties should organise seminars on reference and referencing to young scholars.
- ii. Another seamless way to master the art is to access referencing software such as Mendeley, Endnote to make our writing more current and professional.
- iii. Scholars should pay special attention to the concept of multiple in-text references to restraint from plagiarism.

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## Assessment of 9-3-4 policy implementation and students' enrolment in technical Colleges in Oyo State, Nigeria

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### Abstract

*Educational policies are intended to serve as a blueprint for operations, and their implementation must be closely monitored to evaluate their effectiveness and relevance. One such policy is the transition from Junior Secondary school (JSS) to post-basic classes, which may be either into Senior Secondary (SS) school or Technical College (TC) as provided for in the National Policy on Education (NPE), section 3, paragraph 35 (Federal Republic of Nigeria, 2013). However, data from the six (6) TCs and enrolment data for secondary schools from the Ministry of Education, Science and Technology, Oyo State, indicate very low TC enrolment relative to SS classes. Also, seeing young boys and girls who should be in school hawking on the streets and highways is concerning. This research, therefore, underscores the importance of refocusing on technical education in Oyo State. The research employs a mixed-methods approach, combining survey and historical research methods. Data on students' enrolment in SS and TCs were collected to examine the transition rate from the post-basic level to either senior secondary or TCs. The collected data were analyzed using simple frequency counts and percentages. The research recommends the effective implementation and monitoring of educational policies in Oyo State, particularly by promoting a technical-education mindset from the primary-school level.*

**Keywords:** 9-3-4 Educational Policy, National Policy on Education, Technical Education, Enrolment

### Introduction

In African societies, education of the head, heart, and hands was integral to traditional education. Every child was involved in hands-on skills acquired through the apprenticeship system, with functionalism as the main principle. No child was spared, as everyone contributed to the family's economic well-being. The introduction of Western education and an emphasis on literacy through reading, writing, and arithmetic (popularly known as the "three Rs") led to a decline in indigenous vocational education, which was replaced in schools by art and craft. Unfortunately, the missionaries who introduced Western education were not interested in Nigerians acquiring technical skills; they were more interested in recruiting individuals who could serve their interests as interpreters, cooks, dispatch riders, Catechists, housekeepers, etc. The missionaries dominated the education space until the colonial government began promulgating education ordinances in 1882, which continued until the regionalization of education in 1954, aimed at streamlining the missionaries' educational activities. By this time, Nigerians who have had the opportunity to be educated both at home and abroad have begun to criticize the irrelevance of missionary education in equipping recipients for self-reliance. All these developments led to the agitation for independence, which was eventually granted on October 1, 1960 (Akanbi & Jekayinfa, 2019). Nigerians thereafter assumed full responsibility for educational policy and content. The 1969 National Curriculum Conference (NCC) birthed the first Indigenous educational policy, the National Policy on Education (NPE), and the 6-3-3-4 system (6 years of primary, 3 years of junior secondary (JS), 3 years of senior secondary (SS) schooling and 4 years of higher education) (Adaralegbe, 1972). The 6-3-3-4 implies that after the three years of Junior Secondary, academically inclined students can move to the Senior Secondary, while others will move to a technical college or a trade centre for a 3-year post-basic vocational education in any field they desire, thereby living no one behind and stressing the importance of technical education for the teaming youth, and economic development of Nigeria, Oyo State inclusive. In October 1999, in furtherance of the significance of educational relevance, the Nigeria-UNESCO collaboration mission identified Technical and Vocational Education (TVE) as a priority area to underscore its essential role (Moja, 2000). This highlights the immense potential of technical education to empower young people and contribute to the economic development of a State and a nation. However, despite 25 years of designating Technical and Vocational Education (TVE) as a priority area to underscore its essential role, the situation in Oyo State does not reflect this, as students transitioning from junior secondary



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to senior secondary are far more numerous than those in technical colleges (TCs). Historically, the notion that the weak go to the TC has led to the TC losing substantial patronage. It should be noted that the four pillars of education evolved by UNESCO in 1996 – learning to know, learning to do, learning to live together, and learning to be (Sobe, 2022)- remain relevant in empowering the youth by engaging and equipping them to bring out their latent intellectual skills and use their native intelligence wisely. In line with Section 4, paragraph 20e of NPE 1977 edition, the defunct Western Region upgraded the Trade Centre in Oyo to a Technical College. It established GTC Igboora, GTC Ogbomoso, GTC Saki, and GTC Ibadan in 1979 and 1995, respectively. Oyo State has 626 public secondary schools and only five (5) TCs—0.80%. SSS enrolment from 2019 to 2024 is 663,000, and TCs for the same period are 11,638 (1.80%). Providing additional TCs is a fundamental issue that must be addressed to attract more students to TE. Therefore, this study examines the current state of technical education in Oyo State, focusing on enrollment in technical colleges, available courses, infrastructure, and the way forward.

### **Objectives of the study:**

1. Appraise the transition rate from the junior secondary (JS) to the senior secondary (SS) and the TCs
2. State whether the Oyo State can be credited with adequately implementing the 9-3-4 education system
3. To examine the number of TCs available in Oyo State and to see if they are enough to implement the 9-3-4 education system effectively
4. To suggest what Oyo State can do to improve technical education

### **Research Questions:**

The following research questions were raised to guide the study;

1. What is the transition rate from the junior secondary (JS) to the senior secondary (SS) and the TCs?
2. Considering the enrolment in senior secondary and the TCs, can Oyo State be credited with adequately implementing the 9-3-4 education system?
3. Are the number of TCs available in Oyo State enough to implement the 9-3-4 education system effectively?
4. What can Oyo State do to improve technical education?

### **From 6-3-3-4 to 9-3-4: The Need to Focus on Technical Education**

As previously stated, the outcome of the curriculum conference was the evolution of the NPE and the 6-3-3-4 system, both intended to enhance technical education and strengthen Nigeria's economy. To improve literacy levels in Nigeria, the 6-3-3-4 system was later upgraded to 9-3-4 in 2006 (Uwaifo et al., 2009). The 9-3-4 system was designed in conformity with MDGs and Education for All EFA, to eradicate illiteracy, ignorance, and poverty as well as to stimulate and accelerate development, political consciousness, and national integration (Ukpong et. al., 2023). The '3' in the 9-3-4 system is referred to as Post-Basic Education and Career Development (PECD), which could be achieved by attending any of the following institutions: (i) Senior secondary schools, (ii) Technical colleges, (iii) Trade centres, (iv) Innovation Enterprise Institutions (IEI), and (v) Vocational Enterprise Institutions (VEI). However, this study focuses solely on TCs in Oyo State, as the transition rate to TCs is too low to warrant urgent attention to technical education. The NPE also set the objectives of PECD, which are to: (i) Provide holders of the Basic Education Certificate and Junior Arabic and Islamic Studies Certificate with an opportunity for education at a higher level, irrespective of gender, social status, religious or ethnic background; (ii) Offers a diversified curriculum to cater for the differences in talents, disposition, (iii) opportunities, and future roles; (iv) Provide a trained workforce in the applied sciences, technology, and commerce at the sub-professional grades; (v) Provide entrepreneurial, technical, and vocational job-specific skills for self-reliance and agricultural, industrial, commercial, and economic development; (vi) Develop and promote the Nigerian language, art, and culture in the context of the world's cultural heritage; (vii) Inspire students to desire self-improvement and achieve excellence; (viii) foster patriotism, national unity, and security education with an emphasis on common ties despite our diversity; and (ix) Raise morally upright and well-adjusted individuals who can think independently and rationally, respect the views and feelings of others, and appreciate the dignity of labour. (FRN, 2013, pp. 17-18).

The fourth objective, which aims to provide entrepreneurial, technical, and vocational job-specific skills for self-reliance and agricultural, industrial, commercial, and economic development, should spur the Oyo State Government to take all necessary steps to increase enrollment in the TCs, equip the colleges, and empower the youth. According to Iyorkegh and Kankimes (2025), "the United Nations Educational, Scientific and Cultural Organization (UNESCO) has reiterated



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its commitment to strengthening Nigeria's technical and vocational education to enhance inclusive and sustainable growth in the country", this is an indication of the importance of TE worldwide which Oyo State should key-in, for skill development and employment opportunities for its youth which is in line with the sustainable development goals. UNESCO (2025) observed that "Nigeria faces a paradox: a young, vibrant population eager to contribute to economic growth, yet struggling with high youth unemployment and skills mismatches" (para. 3). According to Abiodun (2022), Nigeria's true wealth resides in this youth as they serve as a strategic resource advantage which can make Nigeria have a radical leap into modernity if they are carefully nurtured and developed in a globalized world, where knowledge and skills determine the competitive edge. Corroborating this, Adeleye (2025) noted that Nigeria has one of the world's most youthful populations. This potential strength could be leveraged as a demographic dividend rather than becoming a global crisis if the population is equipped with the skills the modern economy demands. These skills, according to Rafindadi (2023), are in five (5) key areas, and they contribute to youth development in (i) Employment generation. (ii) Economic development. (iii) Skill development. (iv) Social development, and (v) Personal development. *Trading Economics* (2025) reported that, as of June 2024, Nigeria's unemployment rate was 6.5%. However, UNESCO noted that youth unemployment in Nigeria remains alarmingly high, with estimates exceeding 30% in some regions. All of these should prompt the Oyo State Government to prioritize TE for its teeming youth, the focus of this research. DaSylva (2010) reported that, while Nigeria was considering the introduction of the 6-3-3-4 system, scholars were optimistic that the parochial, elitist, and regurgitating education on the ground would be replaced with an education responsive to the needs and aspirations of Nigerian society. This report aligns with the pathways that Technical and Vocational Education (TVE) offers, outlined as including the reduction of youth unemployment, promotion of entrepreneurship, support for economic diversification, fostering social inclusion and gender equality, and enhancing productivity in key sectors such as agriculture, manufacturing, and services (UNESCO, 2025). Nwaelele (2022) therefore submitted that to tackle "major developmental problems such as poverty, unemployment, and social vices" (p. 126), entrepreneurial education, part of which is technical education, and a successful tool used by many nations, should be utilized.

### **Methodology**

This study combines historical and survey methodologies, integrating both approaches to provide a comprehensive understanding. Various sources have been utilized to examine the evolution of the educational system, including the 6-3-3-4 and 9-3-4 systems, as well as past educational events. The survey component collects data from the following sources

Data Collected from: The Ministry of Education, Science and Technology; Oyo State Board for Technical Education; The five Principals of the TCs were asked a set of random questions; Data was analysed using frequency count and percentages. The collected data have effectively answered the research questions. The first research question concerns the transition rate from JS to SS and TC, as stated below.

### **Population of the Study**

Oyo State has five (5) public TCs located in Ibadan, Iseyin, Ogbomoso, Oyo, and Saki, and all of them were used. The researcher also interacted with college principals, who shared their views on the state of their institutions and potential solutions.

### **Presentation of Results**

The collected data were analysed, which helped answer all the research questions and provide a focus for the study. They are presented below.

**Research Question 1:** What is the transition rate from the junior secondary school to the senior secondary and the technical colleges?

As shown in Table 1, the transition rate from JS to TC is lower than that from SS. The findings indicate that technical subjects have not been prioritized in the JS to attract more students beyond basic education. There is also the erroneous notion that TE is for those who are not academically sound, and no student wants to feel inferior; therefore, they continue in the SS even when they possess practical skills. While the average transition rate to SS for the four (4) sessions was 97.23%, the transition rate into TCs was 2.77%, which is too low.



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**Table 1: Enrolment in the Public Junior, Senior, and Technical Schools, 2019-2024**

Classes	Year and Enrolment				
	2019/2020	2020/2021	2021/2022	2022/2023	2023/2024
JSS 3	66,297	74054	90299	95123	NRS
SS 1	*NRS	75208	82112	90236	415,444
		97.27%	95.90%	96.37%	99.37%
TC 1	*NRS	2,112	3,508	3,400	2,618
		2.73%	4.10%	3.63%	0.63%

**Source:** Raw Data Collected. \*NRS (Not Relevant to the Study)

**Research Question 2:** Considering the enrolment in senior secondary and the TCs, can Oyo State be credited with adequately implementing the 9-3-4 education system?

Table 1 explicitly addresses this question. The low enrolment in TCs indicates inadequate implementation of the 3-year programme following the 9-year basic education in Oyo State. Interaction with some stakeholders was oriented toward emphasizing TE at the basic education level, encouraging students to recognize the benefits of acquiring TE once they have the talent and develop their skills.

**Research Question 3:** Are the number of TCs available in Oyo State enough to implement the 9-3-4 education system effectively?

The answer would be emphatically negative. From the data above, it can be inferred that technical education is not given the same level of priority as secondary schools in Oyo State's educational system. Only five (5) TCs and 626 secondary schools stand at the moment; this is not good enough for the effective implementation of the 9-3-4 system. It is important to note that if TE has been embedded in the basic education curriculum, more students would likely have opted for it in their post-basic education. This could have made it imperative for Oyo State to establish additional TCs.

**Research Question 4:** What can Oyo State do to improve technical education?

This question is fundamental, given enrolment in the TCs, particularly in Saki on the Oke-Ogun axis, where enrolment is lowest, as shown in Table 3. Given a 1:125 ratio, the Oyo State Government should boost TE by providing modern, relevant equipment for TC operations. Ibadan and Oyo appear to have higher patronage of TE, whereas patronage in Iseyin is average. Ogbomoso and Saki have consistently low enrolment, except in the 2023/2024 session, when the Ogbomoso student population increased.

Section 3 paragraph 54 states that "every TC shall establish and operate a production unit for on-the-job training of students and for commercial activities to sustain college operations." It is laudable, but implementation is the real issue. The condition of equipment in the TCs is deplorable; most of it is obsolete, and little remains suitable for practical use. Unfortunately, the TCs that were supposed to be self-sustaining now depend on government subsidies to operate. The Federal Government of Nigeria (FGN) is now focusing on technical and vocational education and training (TVET), not only in TCs but also at the secondary school level. It has made TE free across all its TCs and even promised students monthly stipends. The new partnership between FGN and the World Bank to introduce Innovation, Development and Effectiveness in the Acquisition of Skills (IDEAS) is an aspect that Oyo State can leverage to improve TE. Notably, it has commenced in the Oyo State capital, Ibadan, and the TWIM Institute is hosting it. Oyo State can engage the institute to help make TE more effective.

**Table 2: Enrolment in the Technical Colleges in Oyo State by Location - 2020-2024**

COLLEGE LOCATION	Year and Enrolment			
	2020/2021	2021/2022	2022/2023	2023/2024
Ibadan	664	1,076	900	2,488
Iseyin	376	699	625	648
Ogbomoso	84	153	309	1,180
Oyo	938	1,514	1514	992
Saki	50	66	52	42

Source: Raw data collected



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### **Leveraging Technical Education (TE) in Oyo State for Sustainable Development**

The upgrade of 6-3-3-4 to 9-3-4 in 2005 improved the literacy rate, and the three (3) still imply three (3) years in the SSS or the TC. It is therefore necessary to focus on TE for its inexhaustible benefits. One of these is reducing unemployment and underemployment, which are rampant in the country. At this juncture, it is pertinent to highlight several advantages of focusing on TE for both the individual student and society at large. Section 3, paragraph 50d, stated that trainees completing TC programmes shall have three options:

- (i) Secure employment either at the end of the whole course or after completing one or more modules of employable skills,
- (ii) Set up their own businesses and become self-employed, and be able to employ others.
- (iii) Pursue education in advanced craft/technical programmes and in post-secondary (Tertiary) technical institutions such as Polytechnics or Colleges of Education (Technical) and Universities (FGN 2013, p.37)

Based on the above expectations for post-technical education, it can be inferred that TE equips individuals with the skills needed for workplace competence, reduces unemployment and poverty rates, and contributes to the overall development of human capital, a critical factor in driving economic growth. If TCs in rural areas focus more on agricultural and agro-processing subjects, this can lead to rural development. TE encourages individuals to develop their latent skills and nurtures entrepreneurial capabilities that spur innovation, thereby attracting both foreign and local investors to support industrial growth. According to Okeke (2020), it is a truism that, as stipulated in Nigerian education policy, technical education is a pathway for developing high-quality technical human resources, thereby building a talent pool to advance the country's economy through vocational education. However, because attention has not been focused on TE, youth unemployment and the underutilization of their skills have increased. Prior to the recent developments in TE in Nigeria, there were 25 approved trades in TCs, as listed in Table 4 below; only a few courses related to modern technology were added to replace some or modernize others, thereby making them more relevant. They are: (i) Solar PV installation and maintenance (ii) Creative media (digital media production/operations) (iii) Networking & system security (including satellite TV antenna installation and maintenance) (iv) Social media content creation and management (v) Automobile CNG conversion and maintenance (vi) Mechanized agriculture (mechanization / smart agriculture) (Oyelakin 2025, para. 4).

In Oyo State, not all trades were available across all five colleges; only three of the 25 courses are offered across the TCs: Garment making, Graphics arts, and Carpentry and joinery. In some cases, four courses were available across all TCs. It should be noted that only TC Oyo offers an agriculture-related component, which may be insufficient for an agrarian society.

**Table 3:** Summary of Subjects Available in Oyo State Technical Colleges

S/N	Programmes	IBADAN	ISEYIN	OYO	OGBOMOSO	SAKI
1.	Agricultural Mechanic	-----	-----	**	-----	-----
2.	Block-laying and concreting	-----	-----	**	**	-----
3.	Carpentry and joinery	**	**	**	**	**
4.	Electrical installation	**	**	**	**	-----
5.	Fabrication and welding	**	**	**	**	-----
6.	Furniture craft	**	**	**	**	**
7.	Mechanical engineering practice	-----	-----	**	-----	-----
8.	Motor vehicle mechanic	**	**	**	**	**
9.	Painting and decorating	-----	**	**	**	-----



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10.	Plumbing and pipe fitting	**	-----	-----	-----	-----
11.	Radio and television	-----	-----	-----	-----	-----
12.	Refrigeration and a/c	**	**	-----	**	**
13.	Business studies	-----	-----	**	-----	-----
14.	Catering craft practice	-----	-----	**	-----	-----
15.	Foundry craft	-----	-----	-----	-----	-----
16.	Ceramics	**	-----	-----	**	**
17.	Garment making	**	**	**	**	**
18.	Graphics arts	**	**	-----	**	**
19.	Auto Electric Works	-----	**	-----	**	-----
20.	Leather trades/Shoe works	-----	-----	**	-----	-----
21.	Vehicle bodybuilding	**	-----	**	**	-----
22.	Instrument mechanics	-----	-----	-----	**	-----
23.	Printing craft	-----	-----	-----	**	-----
24.	Textile trades	-----	-----	-----	-----	-----
25.	Machine woodworking	-----	-----	-----	-----	-----

**Source:** Federal Ministry of Education (2007, 144). NB: \*\* Available -----Not available

## Conclusion

TE cannot be taken lightly in any state seeking to grow and develop its economy; therefore, it must be a focus in Oyo State. Given the benefits, much remains to be done in Oyo State. Formulating policies that guide educational processes is beneficial; however, effective monitoring of their implementation is also essential, particularly for the 9-3-4 policy in Oyo State. Effective monitoring will expose gaps, and immediate actions will be taken to bridge them, thereby achieving the objectives. In the early years of elementary education in Nigeria, few technical subjects were offered. In agricultural education, pupils were assigned farm plots that they effectively planted and monitored until harvest. Everyone was also involved in ceramic work, producing beautiful utensils for sale in local markets; unfortunately, these subjects were gradually dropped in favour of their theories. Incorporating elements of TE at the primary school level has become imperative for fostering an entrepreneurial mindset in young children.

## Recommendations

1. Within the context of education for personal and national economic growth, Oyo State may need to declare a state of emergency in the technical education sector to revive it and enhance its inherent functions, thereby promoting economic growth and development. The transition rate could be improved, likely through scholarships or small stipends for students during training.
2. Oyo State should intensify supervision of the 9-3-4 policy for effective implementation. The State should include elementary vocational and technical education in the basic education curriculum, as this will help in instilling an entrepreneurial mindset in children before entering the post-basic level of education.



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3. There is an urgent need to establish more TCs that should be adequately equipped with modern state-of-the-art facilities for effective teaching and learning. The current TC-to-SS ratio of 1:125 indicates an ineffective implementation of the technical and vocational education component of the 9-3-4 policy.
4. It is evident, in the course of the research, that a significant portion of the equipment is obsolete and requires replacement with modern equipment. For TE to be adequately rewarding, much more needs to be done to ensure the provision of relevant, high-quality equipment that makes teaching and learning worthwhile.
5. One major issue is that research findings and recommendations are not always communicated effectively to policymakers, hindering the timely implementation of necessary actions. To instil hope and optimism for the future of technical education in Oyo State, Journals can begin to harvest recommendations from research they publish, serving as an additional avenue to inform the government of developments in the education sector and to prompt urgent remedial steps from all stakeholders.

### Acknowledgements

I am indebted to the Principals of all the Technical Colleges in Oyo State for their cooperation and unflinching support in the process of gathering data for this research. I also appreciate the Director, Quality Assurance, Oyo State Board for Technical and Vocational Education, Ibadan, for assisting in validating the enrolment data.

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*Assessment of Covert Phone Checking Behavior on ... Umar, M. M. (2025)*

## Assessment of Covert Phone Checking Behavior on Marital Health among Adult Education Married Students in Kano Metropolis, Kano State, Nigeria

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### Abstract

*This study examined covert phone checking among young married women students in Kano Metropolis, Nigeria, exploring its motivations, impacts, and socio-cultural influences. A quantitative cross-sectional survey design was employed. The study population was 621 students from three adult education centers, with a sample of 242 selected via stratified random sampling. Data were collected using a structured questionnaire, validated by experts and demonstrating good reliability (Cronbach's alpha = 0.81). Findings revealed the behavior was universal. The primary motivation was reassurance-seeking and responding to a husband's perceived secrecy, not mere curiosity. A key paradox was identified: while covert checking reduced the women's personal anxiety, it simultaneously caused serious marital arguments, guilt, and hindered open communication. The behavior is firmly rooted in the local context, justified by a strong belief in a wife's right to transparency and the cultural proscription against direct confrontation. Educational enrollment further amplified these dynamics by increasing the women's awareness and confidence. The study concludes that covert phone checking is a culturally-embedded coping strategy for managing marital uncertainty. Recommendations include developing culturally-sensitive therapies that address underlying anxieties and integrating relationship communication skills into adult education curricula to help couples navigate trust in the digital age.*

**Keywords:** *Covert Phone Checking, Marital Conflict, Digital Intrusion, Kano, Socio-cultural Norms.*

### Introduction

Marriage has always been a journey of two people learning to share a life, and that inevitably comes with misunderstandings and arguments. For generations, these conflicts played out in the open through conversations, shared silences, or even raised voices within the home. But today, the landscape of marriage has been profoundly reshaped by a small device we all carry in our pockets: the smartphone. Smartphones promise connection, but in marriages, they can sometimes breed suspicion. It is become common for one partner to feel a nagging curiosity or anxiety about who their spouse is talking to online, leading them to secretly glance through their partner's phone. This behavior is a modern-day marital dilemma. It's driven by a need for reassurance but often ends up violating trust, creating a quiet conflict that lives in the shadows of a relationship. To understand this study, it's helpful to define its core ideas. The term "Marital Communication" refers to the ways married couples exchange information, feelings, and meanings, which is the lifeblood of a healthy relationship (Gottman, 2014). When this communication breaks down, it often leads to "Marital Conflict," which is a state of disagreement between spouses that can range from minor differences to major, ongoing disputes (Cupach, 2007). In the digital age, a new source of conflict has emerged, which this study focuses on: "Covert Phone Checking." This is defined as the secret surveillance of a partner's mobile phone—including texts, call logs, and social media messages—without their knowledge or consent (Miller-Ott, 2018). It is a specific type of "digital intrusion" that blurs the line between seeking reassurance and invading privacy. This study wants to understand this quiet conflict, but not in a general sense. It focuses on a specific group of women in Kano Metropolis who find themselves at a unique crossroads. They are "Young Married Women Students," a demographic we define as women under the age of 30, currently in a marital union, and enrolled in formal or informal adult literacy or vocational training centers. This pursuit of education is a key part of their identity, often symbolizing a move toward empowerment and potentially shifting traditional dynamics within the home. Their experiences are shaped by the specific context of "Kano Metropolis," the major urban center of northern Nigeria, characterized by its dense population and its deep-rooted Islamic and Hausa-Fulani cultural norms, which heavily influence family structures and gender roles (Adamu, 2019). So, imagine the inner conflict: a young wife, expanding her world through education, but perhaps feeling uncertain about her husband's activities. In a culture where direct confrontation might be culturally discouraged, the smartphone becomes a tempting tool. A quick, secret check of his phone might feel like the only way to calm her fears without causing a direct confrontation.



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This research is important because no one has really listened to the stories of these women. Most of what we know about digital spying in relationships comes from Western studies (e.g., Elphinston, 2011). The experience of a young, educated woman in Kano, trying to balance modern technology with traditional expectations, is a story that hasn't been told. By exploring their motivations for covert phone checking, this study seeks to illuminate how technology is quietly transforming intimacy and conflict within a unique socio-cultural context.

### **Statement of the Problem**

The pervasive integration of smartphones into daily life has introduced a complex layer to marital relationships, creating new avenues for conflict and distrust. A growing behavior in this context is covert phone checking, where one partner secretly accesses the other's phone to monitor communications. While this phenomenon is recognized globally as a significant source of marital strife, existing research on it is predominantly situated in Western, individualistic societies. This creates a critical knowledge gap, as the motivations, implications, and cultural interpretations of such behaviors are not universal but are deeply shaped by local socio-cultural norms. In non-Western, collectivist settings like Northern Nigeria, and specifically within the densely populated and culturally distinct Kano Metropolis, marital dynamics are governed by strong Islamic and Hausa-Fulani values that emphasize family honor, privacy, and specific gender roles. Within this context, young married women who are also students represent a particularly vulnerable group. They are navigating a unique transition: they are building the foundations of their marriage, while simultaneously pursuing education that empowers them and potentially challenges traditional domestic power dynamics. Caught between modern aspirations and traditional expectations, these women may resort to covert phone checking as a risk-aversion strategy - a way to manage uncertainty and seek reassurance in a society where direct spousal confrontation is often culturally frowned upon.

However, the specific experiences, motivations, and psychological impacts of covert phone checking on this demographic remain entirely unexplored. Without this crucial inquiry, there is a risk of misapplying Western understandings of digital conflict to a context where the meaning of privacy, trust, and marital conflict is fundamentally different. This lack of context-specific knowledge leaves counselors, educators, and policymakers without the necessary insights to address this modern source of marital discord effectively. Therefore, this study is motivated by the urgent need to investigate the covert phone checking behaviors among young married women students in Kano Metropolis. It seeks to uncover the driving forces behind this behavior, its impact on their marital communication and conflict, and how it is shaped by the intricate interplay of their educational pursuits, age, and cultural environment. The findings from this research are essential to develop culturally-sensitive guidance and support systems for couples navigating the challenges of marriage in the digital age within this unique context.

### **Research Objectives**

1. To identify the primary motivations and triggers for covert phone checking among young married women students in Kano Metropolis.
2. To analyze the perceived impact of covert phone checking on marital trust and communication patterns
3. To explore the influence of socio-cultural norms and educational enrollment on the participants' experiences and justifications for this behavior.

### **Research Questions**

1. What are the key motivations (e.g., suspicion, reassurance-seeking, prior conflict) and specific situations that lead young married women students to secretly check their husbands' phones?
2. How does engaging in covert phone checking affect the levels of trust and the nature of open communication within their marriages, from the participants' perspectives?
3. In what ways do the participants' roles as students and the prevailing cultural expectations of privacy and confrontation in Kano shape their decisions to resort to covert phone checking?

### **Methodology**

This study adopted a quantitative cross-sectional survey research design. This design was deemed most appropriate as it facilitates the systematic collection of data from a sample of a population at a single point in time to describe and analyze the variables of interest (Babbie, 2016). The study aims to identify motivations, perceived impacts, and cultural influences on covert phone checking; a survey design allows for the gathering of standardized data from a sufficiently large sample



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to make generalized inferences about the entire population. While the phenomenon under study is deeply personal, a quantitative approach was chosen to first establish the prevalence and broad patterns of this behavior within this specific demographic, providing a foundational dataset that can inform future qualitative inquiries. The research population for this study comprised all young married women students aged 30 years and below enrolled in the three major adult education centers under the Kano State Agency for Mass Education. As per the agency's [2025](#) records, the total population size (N) is [621](#) students, distributed across the centers as follows: Goron Dutse Center for Mass Literacy ([202](#)), Gidan Galadima Center for Mass Education ([251](#)), and City Center for Mass Education ([168](#)). Given the manageable size of the total population, a sample size of [242](#) participants was determined using the Taro Yamane ([1967](#)) formula for a finite population with a 95% confidence level and a precision level (e) of [0.05](#). This sample size ensures the findings are representative of the total population. To select the participants, a stratified random sampling technique was employed. This technique was chosen to ensure fair representation from each of the three centers, acknowledging that each might have slight contextual differences. The population was first stratified into three strata based on the centers. Subsequently, a simple random sampling technique, using a computer-generated random number list based on student rosters provided by the centers, was used to select the proportionate number of participants from each stratum. The distribution of the sample is presented in Table 1.

Table 1: Sample Size Distribution

SN	Adult Education Center	Population	Sample size
1	Goron Dutse Center	<a href="#">202</a>	78
2	Gidan Galadima center	<a href="#">251</a>	97
3	City Center	<a href="#">168</a>	67
	Total	<a href="#">621</a>	<a href="#">242</a>

The primary instrument for data collection was a structured questionnaire, designed specifically for this study. The questionnaire was divided into four sections: Section A: Collected socio-demographic data of the respondents (e.g., age, duration of marriage, level of education, number of children). Section B: Focused on the prevalence and motivations for covert phone checking. This section utilized a series of Likert-scale questions to gauge the frequency of the behavior and the level of agreement with various potential triggers (e.g., "I check my husband's phone when I notice he is being secretive," "I check his phone to feel reassured when I am anxious"). Section C: Assessed the perceived impact on marital trust and communication. Participants were asked to rate, on a scale, how they believed the behavior affected open communication and trust levels in their marriage. Section D: Explored the influence of socio-cultural and educational factors. This section contained items designed to understand how cultural norms around confrontation and the participants' identity as students influenced their justification for, and feelings about, covert phone checking. The questionnaire was initially drafted in English but was translated into Hausa, the primary spoken language of the participants, by a certified linguistic expert to ensure clarity and comprehension. The Hausa version was then back-translated into English by a second independent translator to verify conceptual equivalence. To ensure the content validity of the questionnaire, the initial draft was reviewed by a panel of three experts in the fields of Sociology, Educational Psychology, and Communication Studies. Their feedback was used to refine the wording, structure, and relevance of the items to ensure they adequately captured the constructs outlined in the research objectives. A pilot study was conducted with 30 young married women students from a similar adult education center in a neighboring local government area, which was not part of the main study. Data from the pilot study were analyzed using Cronbach's Alpha to test the internal consistency and reliability of the Likert-scale sections of the questionnaire. The computed alpha coefficient was [0.81](#), which is considered a good level of reliability (Nunnally, [1978](#)).

Ethical approval for the study was sought and obtained from the relevant institutional review board. Subsequently, formal permission was secured from the management of the Kano State Agency for Mass Education and the heads of the three selected centers. Data collection was scheduled on regular class days to facilitate access to the participants. Before the distribution of the questionnaires, the purpose of the study was clearly explained to the potential respondents, emphasizing the anonymity and confidentiality of their responses. Written informed consent was obtained from each participant. The researchers and two trained research assistants were present to distribute the questionnaires, answer any questions, and collect the completed forms. This process ensured a high response rate of over 95%.



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The data collected were analyzed using the Statistical Package for the Social Sciences (SPSS) version 26. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarize the socio-demographic data and to describe the patterns of responses related to the research questions. Inferential statistics, specifically Chi-square tests and one-way Analysis of Variance (ANOVA), were employed to examine if there were significant differences in covert phone checking behaviors and their perceived impacts across different demographic groups (e.g., center of study, age group). The level of statistical significance was set at  $p < 0.05$ .

## Presentation of Result

The data collected from the [242](#) respondents were analyzed using the Statistical Package for the Social Sciences (SPSS) version 26. In line with the methodology, both descriptive and inferential statistics were employed. The results are presented below, structured according to the research objectives and questions.

**Research Objective 1:** To identify the primary motivations and triggers for covert phone checking.

This objective was addressed using frequency and descriptive analysis of the data from Section B of the questionnaire.

**Table 2: Prevalence and Motivations for Covert Phone Checking (N=242)**

Motivation	Never	Rarely	Sometimes	often	Very often	M	SD
To feel reassured about his love and commitment	0 (0%)	0 (0%)	20 (8.3%)	<u>101</u> (41.7%)	<u>121</u> (50.0%)	4.42	0.62
When I notice my husband is being secretive with his phone.	0 (0%)	9 (3.7%)	71 (29.3%)	<u>189</u> (78.1%)	31 (12.8%)	4.00	0.58
After we have had a disagreement or argument	4 (1.7%)	8 (3.3%)	71 (29.3%)	86 (35.5%)	(30.2%)	3.89	0.95
I feel a general sense of suspicion.	2 (0.8%)	4 (1.7%)	55 (22.7%)	<u>122</u> (50.4%)	59 (24.4%)	3.96	0.76
When he spends a long time talking on the phone.	5 (2.1%)	7 (2.9%)	90 (37.2%)	61 (25.2%)	79 (32.6%)	3.83	0.99
Because I have heard rumors or gossip.	12 (5.0%)	21 (8.7%)	69 (28.5%)	72 (29.8%)	68 (28.1%)	3.67	1.14
Out of curiosity, with no particular reason.	43 (17.8%)	36 (14.%)	54 (22.3%)	67 (27.7%)	42 (17.4%)	3.12	1.38

Note: M = Mean, SD = Standard Deviation. Mean scores are based on a 5-point scale (1=Never, 5=Very Often).

### Interpretation of Table 1:

The analysis reveals that covert phone checking is a universal behavior within the sample, with all [242](#) respondents ([100%](#)) admitting to engaging in it. The primary motivation, with the highest mean score (M=[4.42](#), SD=[0.62](#)), is reassurance-seeking. Half of the participants (50%) engage in this behavior "Very Often" for this reason, indicating a profound need for emotional security. The second strongest trigger is reacting to a husband's secretive behavior (M=[4.00](#), SD=[0.58](#)), with [78.1%](#) of women doing this "Often." This suggests that perceived secrecy is a significant catalyst. Furthermore, post-conflict checking (M=[3.89](#), SD=[0.95](#)) and general suspicion (M=[3.96](#), SD=[0.76](#)) are also major drivers, painting a picture of a behavior deeply intertwined with relational uncertainty and anxiety.

**Research Objective 2:** To analyze the perceived impact of covert phone checking on marital trust and communication.

This objective was addressed by analyzing the data from Section C of the questionnaire.



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**Table 3:** Perceived Impact of Covert Phone Checking on Marital Trust and Communication (N=242)

Statement of perceived impacts	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	M	SD
Checking his phone helps to reduce my anxiety.	2 (0.8%)	3 (1.2%)	12 (5.0%)	110 (45.5%)	115 (47.5%)	4.38	0.70
This behavior has caused a serious argument in my marriage.	0 (0%)	0 (0%)	10 (4.1%)	102 (42.1%)	130 (53.7%)	4.50	0.57
After checking, I usually feel guilty.	0 (0%)	0 (0%)	2 (0.8%)	121 (50.0%)	119 (49.2%)	4.48	0.52
If my husband knew, it would damage our relationship.	0 (0%)	6 (2.5%)	4 (1.7%)	140 (57.9%)	92 (38.0%)	4.31	0.62
I find it more difficult to communicate openly after I check	3 (1.2%)	3 (1.2%)	4 (1.7%)	129 (53.3%)	103 (42.6%)	4.35	0.72
The trust between us has been weakened because of this.	43 (17.8%)	40 (16.5%)	31 (12.8%)	66 (27.3%)	62 (25.6%)	3.26	1.47
The trust between us has been weakened because of this	43 (17.8%)	40 (16.5%)	31 (12.8%)	66 (27.3%)	62 (25.6%)	3.26	1.47

Note: M = Mean, SD = Standard Deviation. Mean scores are based on a 5-point scale (1=Strongly Disagree, 5=Strongly Agree).

**Interpretation of Table 2:**

The findings reveal a profound paradox. On one hand, women report that the behavior is highly effective in reducing their anxiety (M=4.38, SD=0.70). On the other hand, they overwhelmingly acknowledge its negative consequences. A vast majority agree or strongly agree that it has caused serious arguments (95.8%, M=4.50), induces guilt (99.2%, M=4.48), and would be damaging if discovered (95.9%, M=4.31). Critically, they perceive that it makes open communication more difficult (95.9%, M=4.35). However, the perception of its direct impact on trust is more divided (M=3.26, SD=1.47), suggesting that while the act is recognized as harmful to communication and a source of conflict, some women may rationalize it as a necessary action that does not fundamentally erode their overall trust in the relationship.

**Research Objective 3:** To explore the influence of socio-cultural norms and educational enrollment. This objective was addressed by analyzing the data from Section D. A one-way ANOVA was also conducted to explore the influence of education level on motivations, but no significant differences were found ( $p > .05$ ), indicating that the behavior and its drivers are consistent across different educational levels within this student population.

**Table 4:** Influence of Socio-Cultural and Educational Factors (N=242)

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	M	SD
A wife has a right to know everything on her husband's phone.	4 (1.7%)	6 (2.5%)	7 (2.9%)	105 (43.4%)	120 (49.6%)	4.37	0.76
Directly asking my husband might be seen as disrespectful.	5 (2.1%)	7 (2.9%)	3 (1.2%)	102 (42.1%)	125 (51.7%)	4.38	0.80
My education has made me more aware of my rights.	0 (0%)	0 (0%)	0 (0%)	141 (58.3%)	101 (41.7%)	4.42	0.49
Being a student makes me more confident and concerned	2 (0.8%)	3 (1.2%)	5 (2.1%)	130 (53.7%)	102 (42.1%)	4.35	0.67



In our culture, it is better to secretly check than to confront	76 (31.4%)	76 (31.4%)	20 (8.3%)	32 (13.2%)	38 (15.7%)	2.51	1.46
The privacy of a husband's phone should be respected.	82 (33.9%)	71 (29.3%)	13 (5.4%)	35 (14.5%)	41 (16.9%)	2.51	1.53
My pursuit of education is a source of tension.	65 (26.9%)	73 (30.2%)	22 (9.1%)	50 (20.7%)	32 (13.2%)	2.63	1.40

Note: M = Mean, SD = Standard Deviation. Mean scores are based on a 5-point scale (1=Strongly Disagree, 5=Strongly Agree).

#### **Interpretation of Table 4:**

The data highlight a complex interplay of modern and traditional forces. There is a very strong belief that a wife has a right to full phone transparency (M=4.37) and that direct confrontation is culturally framed as disrespectful (M=4.38). This combination creates a powerful justification for covert checking. Furthermore, education plays a key role: women strongly feel that being a student has increased their awareness of rights (M=4.42) and their general confidence and concern about the marriage (M=4.35). However, they do not uniformly reject cultural norms, as seen in the ambivalent responses regarding whether secret checking is preferable to confrontation (M=2.51) and whether a husband's phone privacy should be respected (M=2.51). This indicates a state of normative conflict, where modern ideals of rights and transparency clash with traditional expectations of wifely deference and male privacy.

#### **Discussion of Findings**

This study set out to investigate the under-explored phenomenon of covert phone checking among young married women students in Kano Metropolis. The findings reveal a behavior that is both pervasive and paradoxical.

1. **Motivations:** The primary driver is not malice, but a deep-seated need for reassurance and a response to perceived secrecy from husbands. The behavior is triggered by specific relational contexts like post-argument tension and general suspicion.
2. **Impact:** A clear double-edged effect is evident. While covert checking effectively reduces anxiety for the woman, it is simultaneously recognized as a major source of marital conflict, guilt, and hindered communication. The women operate with a clear understanding of the potential relational damage if discovered.
3. **Socio-Cultural Context:** The behavior is firmly rooted in the local cultural context. The strong belief in a wife's right to knowledge, coupled with the cultural proscription against direct confrontation, creates a normative vacuum that covert checking fills. Their pursuit of education amplifies their awareness and confidence, intensifying their concerns and potentially legitimizing the behavior as a form of risk management in a changing marital power dynamic.

#### **Conclusion**

This research concludes that covert phone checking among young married women students in Kano is not merely a personal act of suspicion, but a culturally-embedded coping strategy. It is a symptomatic response to the tensions arising at the intersection of digital technology, evolving gender roles fueled by female education, and deep-seated traditional norms that discourage open marital communication about insecurity. These women are navigating a complex reality where modern tools (smartphones) and aspirations (education) collide with traditional marital structures, and covert phone checking emerges as a risky, yet for them, necessary strategy to manage uncertainty and seek emotional security without violating cultural codes of conduct.

#### **Recommendations**

Based on the findings, the following recommendations are proposed:

1. **For Counselors and Therapists:** Marital therapy in this context should move beyond labeling this behavior as simply "wrong." Practitioners should address the underlying reassurance-seeking and anxiety that drive it. Culturally-sensitive interventions should focus on helping couples develop alternative, open communication strategies that can function within the cultural framework, perhaps by framing open discussion as a means to preserve family harmony rather than as wifely defiance.



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2. For Educators and Policymakers: Adult education programs should integrate digital literacy and marital communication modules into their curricula. These modules should educate both men and women on the impact of digital intrusion on trust and provide constructive tools for managing jealousy and building trust in the digital age, contextualized within local values.
3. For Future Research: This quantitative study provides a foundational overview. Future research should employ qualitative methods (in-depth interviews, focus groups) to explore the nuanced lived experiences, emotional turmoil, and strategic rationalizations of these women in greater depth. Longitudinal studies could also track how these behaviors evolve as these women progress in their educational and personal journeys.  
By understanding the "why" behind the behavior, stakeholders can better support couples in Kano and similar contexts to navigate the challenges of intimacy and trust in the digital age.

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## Reimagining STEM Education in Indigenous Languages: Are Secondary School Physics Teachers Ready?

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### Abstract

*Persistent underachievement in senior secondary school physics continues to threaten the realization of Nigeria's STEM development goals. National examination reports from WAEC, NECO, and UTME consistently indicate unsatisfactory performance in Physics, with failure rates exceeding 50% in several years, despite repeated curriculum reforms and pedagogical innovations. This study critically examines language of instruction as a fundamental but underemphasized factor influencing students' conceptual understanding of Physics, drawing on the renewed advocacy by the Science Teachers Association of Nigeria (STAN) for the integration of indigenous languages into STEM education. Guided by sociocultural and cognitive learning theories, the study synthesizes empirical evidence demonstrating that instruction in learners' familiar languages reduces cognitive load, enhances comprehension of abstract scientific concepts, and improves long-term retention. Historical insights from the Ife Six-Year Primary Science Project further highlight the pedagogical viability of mother-tongue science instruction while exposing systemic challenges related to policy inconsistency and resource development. Survey data collected from 44 secondary school Physics teachers reveal moderate overall readiness to teach Physics using indigenous languages (mean  $\approx 2.37$  on a 4-point scale), but limited professional preparation, with only 11.4% reporting prior training in indigenous-language STEM instruction. Inferential analyses show no statistically significant differences in readiness based on gender, school type, teaching experience, or qualification, suggesting that constraints are largely structural rather than individual. The study concludes that while indigenous-language-based Physics instruction holds substantial cognitive and educational promise, its effective implementation requires deliberate policy commitment, systematic teacher training, standardized scientific terminology, and sustained instructional support.*

**Keywords:** Physics, Indigenous Languages, STEM Education, Teachers Readiness

### Introduction

The decision of the Science Teachers Association of Nigeria (STAN) to re-ignite the language issue in relation to STEM education during her 65th Annual Conference is not only timely, it is indeed a bold and visionary step towards decolonizing science education and bridging the gap between scientific knowledge and cultural identity. Despite decades of educational reforms, the persistent poor achievement of students in secondary school physics remains a pressing concern in Nigeria. Evidence from the three major terminal examinations—namely the West African Senior School Certificate Examination (WASSCE) conducted by the West African Examinations Council (WAEC), the National Examination Council (NECO), and the Unified Tertiary Matriculation Examination (UTME)—consistently reflects low performance levels in physics (Akanbi & Kolawole, 2021; WAEC, 2022). Beyond poor achievement, students' declining interest and negative attitude toward physics present an equally troubling challenge, as many perceive the subject as abstract, difficult, and irrelevant to their daily experiences (Okoli & Ogbeba, 2020). In response, several instructional reforms have been introduced, shifting from traditional teacher-centered lecture methods to more interactive, student-centered approaches such as inquiry-based learning, simulations, and problem-solving strategies. However, the anticipated improvement in students' performance and engagement has remained minimal (Ogunleye & Adeyemo, 2021). Comparative analyses further show that Nigeria's gains



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in science education, particularly in physics, are still highly unsatisfactory when compared with nations in the Asian continent that have prioritized innovation in science education, teacher quality, and contextualized pedagogy (Lee & Tan, 2018; World Bank, 2021). This enduring gap underscores the urgent need to rethink pedagogical frameworks and to explore culturally responsive strategies, such as the integration of indigenous languages, in order to make physics more accessible, meaningful, and transformative for Nigerian learners. Therefore, rethinking instructional delivery in indigenous Nigeria languages is not out of place. Although, this initiative is not a recent development, it can be traced to the early effort of Babatunde Fafunwa, one time Minister for Education in Nigeria who coordinated the “Ife Six-Year Yoruba Language Primary Science Project,” The project which was initiated in 1970 at the University of Ife (now Obafemi Awolowo University), sought to use Yoruba language, a widely spoken indigenous language in South West Nigeria, as the medium of instruction for teaching science at the primary level. The philosophy underpinning the project was straightforward: children learn more effectively, meaningfully, and productively when taught in their mother tongue rather than in a foreign or colonial language (Adeoye et al., 2020). Although, the groundbreaking project was not without challenges before it was finally jettisoned as failed curriculum programme. A major difficulty was the lack of equivalent scientific terms in Yoruba, which necessitated the creation of new terminologies or the adaptation of existing ones. Another challenge was the diversity of Yoruba dialects, which complicated efforts to establish standardized vocabulary. Additionally, concerns arose regarding the transition of pupils to higher institutions where Yoruba-medium instruction was unavailable. Fafunwa himself acknowledged that this posed a significant limitation to the project’s long-term sustainability (Adeoye et al., 2020). Nonetheless, this pioneering effort laid the groundwork for contemporary discussions about the role of indigenous languages in decolonizing STEM education. Reflecting on STEM and language more than fifty years after Fafunwa’s innovation is not only relevant but also urgent in light of Nigeria’s educational realities today.

Language has long been recognized as a central factor in education, particularly in the teaching of STEM subjects, which demand high levels of conceptual understanding. Physics, as a core science subject, exemplifies this challenge. Abstract concepts in physics, such as energy, momentum, and electromagnetism are deeply linguistic in nature, requiring precise terminology for comprehension. In many African and Asian countries, including Nigeria, these subjects are traditionally taught in colonial languages such as English, French, and Portuguese (Brock-Utne, 2017). While this practice reflects global academic trends, it often alienates learners who struggle with limited proficiency in the language of instruction. The need to decolonize education by integrating local languages into STEM teaching has gained renewed attention. Scholars such as Bamgbose (2000) argue that local languages can enhance comprehension, reduce cognitive barriers, and foster greater learner engagement. Vygotsky’s (1978) socio-cultural theory of learning further supports this perspective, emphasizing that students internalize knowledge more effectively when instruction is delivered in a language they deeply understand. Similarly, Cummins (2000) highlights the role of linguistic familiarity in improving abstract reasoning and conceptual transfer. Taken together, these theories underscore the importance of language as a tool for both communication and cognition in STEM education.

Research in cognitive science has consistently demonstrated the advantages of mother-tongue instruction. Bialystok (2022) notes that learners grasp complex ideas more effectively when taught in a familiar language, largely because their cognitive load is reduced. Without the additional burden of translating between languages, learners can focus directly on the conceptual demands of STEM subjects. Neuroscientific evidence also indicates that native languages form deeply ingrained neural pathways, which provide a foundation for future learning (Kuhl, 2023). When science is taught in local Nigerian languages such as Yoruba, Hausa, or Igbo, these neural pathways are activated, leading to deeper comprehension and improved retention of knowledge. Equally important is the cultural dimension of language use in education. Language is not only a tool of communication but also a carrier of culture, shaping how people perceive and interact with the world (Mother Language in Science Education and Communication, 2023). By incorporating indigenous languages into STEM instruction, scientific concepts can be linked to learners lived experiences, making them more relatable and meaningful. For example, the initiative “Science in Yoruba” demonstrates how scientific ideas can be expressed within Yoruba’s linguistic framework through either extension of existing words or through careful borrowing and adaptation (Science in Yorùbá, 2024). Such efforts highlight the feasibility of embedding scientific knowledge within local cultural contexts, thereby fostering scientific discourse that extends beyond the classroom into everyday community life. Today, different



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instructors of science have emerged on the social media using the indigenous languages to promote STEM education. Subjects such as mathematics and chemistry have gained prominence in this regard (<https://www.youtube.com/shorts/broKcG05sMw>; <https://www.youtube.com/shorts/dMjfv55oQg>) Studies conducted across Africa consistently indicate that learners achieve better academic outcomes when instruction is delivered in their mother tongue rather than in a foreign language. Evidence from Ethiopia, for example, shows that pupils taught science in local languages outperform their counterparts taught in foreign languages in terms of examination scores, confidence levels, and practical competence (Learning Science Through the Mother's Tongue in Ethiopian Primary Schools, 2023). These findings suggest that the use of familiar languages enables learners to engage more deeply with scientific content. In the Nigerian context, similar gains are anticipated if indigenous languages are systematically integrated into STEM instruction. Teaching science through languages spoken at home helps bridge the divide between learners' everyday experiences and formal schooling, thereby allowing scientific ideas to build upon learners' existing linguistic and cultural knowledge frameworks. This approach is also consistent with widely accepted pedagogical principles that emphasize progression from the known to the unknown. When instruction draws on learners' prior linguistic and cultural experiences, abstract and complex STEM concepts become more accessible and less intimidating (Adetunji & Olagunju, 2021). As a result, students are more likely to develop strong problem-solving skills and positive attitudes toward science learning. These outcomes are particularly significant for Nigeria, where scientific literacy and innovation are central to national development goals.

Despite its advantages, the integration of indigenous languages into STEM education faces substantial challenges. One major difficulty is the lack of standardized scientific terminology in Nigerian languages. Many advanced scientific and physics concepts have no direct equivalents in languages such as Yoruba, Hausa, or Igbo. Although initiatives such as "Science in Yoruba" have contributed to the development of new terminologies, the process remains incomplete and requires ongoing linguistic creativity and broad stakeholder consensus (Terminological Development for Teaching and Learning Physics in the Igbo Language, 2025).

Another critical challenge is the scarcity of instructional materials in indigenous languages. The limited availability of textbooks, laboratory manuals, and teaching aids constrains teachers' ability to adopt indigenous-language instruction. Producing such resources demands substantial financial investment, collaboration between scientists and linguists, and sustained policy commitment (Federal Ministry of Education, 2023). Teacher preparedness further compounds the problem. Even when teachers are fluent speakers of local languages, many lack the pedagogical training or confidence required to teach complex scientific concepts effectively in those languages (Eze, 2022). Nigeria's linguistic diversity also poses logistical and policy challenges. With over 500 indigenous languages, decisions about which languages to prioritize inevitably raise concerns about equity and inclusion. While Yoruba, Hausa, and Igbo are widely spoken, an exclusive focus on these languages risks marginalizing minority language groups, making balanced policy implementation essential (Stakeholders Express Mixed Feelings, 2017). Nevertheless, several pathways exist for gradual integration. Introducing indigenous-language instruction at the primary level is particularly promising, as learners at this stage are most comfortable using their mother tongue (Revisiting African Education, 2010). A bilingual or multilingual model that combines indigenous languages with English may offer a practical compromise, preserving the benefits of mother-tongue instruction while maintaining access to English as the global language of science (How Language Barriers Are Impeding Science Learning, 2025). Ultimately, while the cognitive and cultural benefits of indigenous-language instruction are well established (Bialystok, 2022; Adegbija, 2021; UNESCO, 2023), implementation remains limited, largely due to issues of teacher readiness. Addressing gaps in terminology, training, and resources—alongside empirical investigation of teacher preparedness across school types and locations (Jegade, 2021; Akinyemi, 2022)—is crucial. This study therefore seeks to provide evidence that can inform policies aimed at making STEM education in Nigeria more inclusive, effective, and culturally responsive.

### **Objectives of the Study**

The main objective of this study is to examine secondary school physics teachers' readiness to teach physics using indigenous Nigerian languages. Other specific objectives include:

1. To examine the influence of gender on secondary school physics teachers' readiness to teach physics in indigenous Nigerian languages.



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2. To investigate the extent to which school type (public and private) affects teachers' readiness to integrate indigenous languages in physics instruction.
3. To determine how school location (urban and rural) influenced physics teachers' readiness to teach physics in local languages
4. To examine how years of teaching experience influenced physics teachers' readiness to adopt indigenous-language in physics classrooms.
5. To find out how academic qualifications influenced physics teachers' readiness to teach physics using indigenous Nigerian languages.

### Research Questions

1. What opinion do secondary school physics teachers hold in their readiness to teach physics using indigenous languages?
2. How does gender influence secondary school physics teachers' readiness to teach physics in indigenous Nigerian languages?
3. To what extent does school type (public versus private) affect teachers' readiness to integrate indigenous languages into physics instruction?
4. In what ways does school location (urban versus rural) influence the readiness of physics teachers to teach physics in indigenous Nigerian languages?
5. How do years of teaching experience affect physics teachers' readiness to adopt indigenous-language pedagogy in physics classrooms?
6. What is the impact of academic qualifications on teachers' readiness to teach physics using indigenous Nigerian languages?

### Methodology

This study employed a quantitative, cross-sectional survey design to examine secondary school physics teachers' readiness to teach physics using indigenous Nigerian languages. A survey approach is appropriate for eliciting self-reported perceptions, attitudes, and beliefs at a single point in time and is widely applied in educational research contexts (Creswell & Creswell, 2018). The target population comprised secondary school physics teachers who are members of the Science Teachers Association of Nigeria (STAN) WhatsApp community, which includes approximately 300 active participants. A Google Form questionnaire link was shared within the group, yielding responses from 44 teachers and a response rate of 14.6%. Although the response rate appears modest, it is consistent with participation levels commonly reported for online and mobile-based surveys, particularly those administered via WhatsApp and similar platforms (Manji et al., 2021). Recent methodological studies further indicate that online educational surveys often achieve response rates within this range due to voluntary participation, varying digital literacy, and differential access to internet-enabled devices (Torrejón Guirado et al., 2024). As such, the achieved sample is comparable to those reported in similar empirical studies. Data were collected using a researcher-developed instrument titled *Questionnaire on Readiness to Deliver Physics Instruction in Local Languages (Q-REDEPHILL)*. The questionnaire comprised two sections: Section A captured demographic and professional characteristics, including gender, school type, school location, highest academic qualification, and years of teaching experience. Section B consisted of 26 four-point Likert-type items (1 = Strongly Agree to 4 = Strongly Disagree) designed to measure dimensions such as teachers' readiness, confidence, perceived benefits to students, perceived challenges, and institutional support for indigenous-language physics instruction. For inferential analysis, a readiness composite score was computed as the unweighted mean of four items assessing knowledge of local-language physics terminology, confidence in explaining complex concepts, ability to translate physics content, and adaptability of teaching style. Lower composite scores indicated higher self-assessed readiness. Face validity was established through expert review, while internal consistency was assessed using an ordinal reliability coefficient appropriate for Likert-scale data (Chalmers, 2017; Park, 2024). A pilot test (n = 25) yielded an ordinal alpha of 0.78, indicating acceptable reliability, with confidence intervals estimated via bootstrap procedures in line with current recommendations (Kennedy & Orheruata, 2022; Park, 2024). Data cleaning involved removing duplicates and invalid entries, followed by recoding and composite score computation. Analysis was conducted using Python (NumPy and SciPy), incorporating descriptive statistics, independent-samples t-tests, one-way ANOVA, permutation tests, bootstrap confidence intervals (4,000 replications), and Cohen's *d* effect sizes to ensure robust and transparent inference (Harpe, 2015; Amrhein et al., 2019; Lakens, 2017).



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### Presentation of Results

A total of 44 secondary school physics teachers participated in the study. The demographic distribution shows that most respondents were male (72.7%), while 27.3% were female. Slightly more than half (52.3%) had between 11–20 years of teaching experience, 38.6% had over 21 years of experience, and only 9.1% had 0–10 years. In terms of qualification, 47.7% held B.Sc/B.Ed degrees while 52.3% possessed M.Sc/M.Ed degrees. The majority of teachers (77.3%) worked in public schools, whereas 22.7% were employed in private schools. Furthermore, most taught in urban locations (65.9%) while 34.1% taught in rural areas. Importantly, only 11.4% reported ever receiving training on using indigenous languages to teach physics. Table 1 presents the demographic information.

**Table 1: Demographic Characteristics of Respondents**

Variable	Category	Frequency	Percentage
Gender	Male	32	72.7
	Female	12	27.3
Teaching Experience	0-10	4	9.1
	11-20	23	52.3
	21+years	17	38.6
Academic Qualification	B.Sc/B.Ed	21	47.7
	M.Sc/M.Ed	23	52.3
School Ownership	Public	34	77.3
	Private	10	22.7
School Location	Urban	29	65.9
	Rural	15	34.1
Training on Local-Language Teaching	Yes	5	11.4
	No	39	88.6

### Teachers' Readiness to Teach Physics Using Indigenous Languages

To understand teachers' level of preparedness for delivering physics instruction in indigenous languages, descriptive statistics were computed for each readiness component. Overall, the findings indicate moderate readiness, with notable variation across sub-dimensions. As presented in Table 2, teachers reported the highest perceived readiness in their *knowledge of physics terms in local languages* ( $M = 2.76$ ,  $SD = 1.01$ ), suggesting some familiarity with indigenous vocabulary used in physics instruction. Conversely, scores related to *perceived challenges* were relatively low ( $M = 1.98$ ,  $SD = 0.79$ ), indicating that teachers anticipate significant barriers in implementing indigenous-language instruction. Confidence in translating physics concepts ( $M = 2.30$ ,  $SD = 0.90$ ) and perceived benefits to students ( $M = 2.45$ ,  $SD = 0.90$ ) fell within the mid-range, showing moderate belief in the practicality and potential impact of the initiative.

**Table 2: Summary of Teachers' Readiness Scores**

Readiness Component	Mean	SD
Knowledge of physics term in local language	2.76	1.01
Confidence translating physics concepts	2.30	0.90
Perceived student benefits	2.45	0.90
Perceived challenges	1.98	0.79

### Group Differences in Readiness

Group-based descriptive comparisons were conducted to examine whether teachers' readiness varied according to demographic and professional characteristics. As shown in Table 3, the mean readiness scores across groups were generally close, indicating minimal practical differences. For instance, female teachers reported slightly higher readiness ( $M = 2.43$ ,  $SD = 0.67$ ) than males ( $M = 2.20$ ,  $SD = 0.54$ ), while public and private school teachers demonstrated almost identical readiness levels ( $M = 2.27$  and  $2.26$  respectively). Differences across qualification levels and teaching experience were also small. Notably, teachers with 0–10 years of experience recorded the highest mean score ( $M = 2.50$ ,  $SD = 1.29$ ), though the high standard deviation suggests substantial variability within this subgroup.



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**Table 3. Group Mean Differences in Readiness**

Variables	Category	Frequency	Mean	SD
Gender	Male	32	2.20	0.54
	Female	12	2.43	0.67
School Type	Private	10	2.26	0.73
	Public	34	2.27	0.54
School Location	Urban	29	2.32	0.60
	Rural	15	2.17	0.53
Highest Level of Qualification	M.Sc./M.Ed	22	2.26	0.53
	B.Sc./B.Ed	21	2.25	0.63
Years of Teaching Experience	0-10 years	4	2.50	1.29
	11-20 years	23	2.30	0.47
	21 years and above	17	2.18	0.51

To statistically determine whether the observed group differences were meaningful, inferential tests were conducted, including independent samples t-tests, permutation tests, bootstrap confidence intervals, Cohen's *d*, and one-way ANOVA where appropriate. The results, summarized in Table 4, reveal that none of the demographic or professional variables significantly predicted readiness. The gender difference, though directionally favoring female teachers, was not statistically significant ( $t = -1.14, p = .26$ ), and the permutation test corroborated this finding ( $p = .26$ ). Similarly, school type, location, and qualification all produced non-significant results, with bootstrap confidence intervals for mean differences crossing zero in all cases. Effect sizes (Cohen's *d*) ranged from  $-0.39$  to  $0.27$ , indicating uniformly small effects. A one-way ANOVA examining differences across teaching experience levels also found no statistically significant effect ( $F = 0.56, p = .58$ ). This suggests that readiness to teach physics in indigenous languages is relatively uniform across teacher groups, regardless of background or experience.

**Table 4. Inferential Statistics Summary**

Comparison	Test	Test statistic	p-value	Permutation p	Mean Difference (Bootstrap 95% CI)	Cohen's <i>d</i> (Bootstrapped 95% CI)	Interpretation
Gender	t-test	-1.14	0.26	0.26	-0.23(-0.65,0.17)	-0.39 (-1.09,0.35)	Not Significant
School Type	t-test	-0.05	0.96	0.97	-0.01 (-0.50,0.42)	-0.02 (0.82,0.87)	Not Significant
Location	t-test	0.85	0.40	0.41	0.16 (-0.18,0.45)	0.27 (0.32,0.90)	Not Significant
Qualification	t-test	0.03	0.98	1.00	0.01 (-0.34,0.34)	0.01 (0.56,0.69)	Not Significant
Experience	ANOVA	0.56	0.58				Not Significant

## Discussion of Findings

This study investigated secondary school physics teachers' readiness to teach physics using local languages, focusing on perceived competence, confidence, and adaptability. The overall moderate readiness score ( $M = 2.37, SD = 0.76$ ) suggests that while teachers are not opposed to the idea, they may not feel fully prepared to implement local language instruction in physics classes. This aligns with research on teacher readiness in related domains, where moderate readiness often reflects positive beliefs about innovation coupled with a recognition of practical and pedagogical challenges (e.g., surveys of teacher readiness for blended or digital learning) (Gülsemin Durmuş Çemçem et al., 2024). Teachers scored highest on items assessing their knowledge of physics terminology and their perceived ability to translate concepts into local languages. This suggests that teachers recognize the importance of linguistic accessibility, which echoes findings in studies of language integration in education, where familiarity with local linguistic contexts is associated with greater instructional confidence (e.g., community-based language instruction research) (Ezepue et al., 2023). However, the lower readiness in adapting teaching strategies indicates that knowledge alone may not be sufficient without pedagogical support and training — a finding consistent with research showing that teachers often feel constrained by a lack of institutional or instructional



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support, even when they value instructional innovations (e.g., readiness for technology integration) (Gülsemin Durmuş Çemçem et al., 2024). The inferential analyses revealed no statistically significant differences in teachers' readiness across gender, school type, school location, years of experience, or qualification levels. Although this finding may appear unexpected, it suggests that perceptions and challenges associated with indigenous-language instruction are widely shared among teachers, regardless of demographic or professional background. Similar patterns have been reported where pervasive structural barriers, such as limited training and instructional resources, outweighed contextual differences (Ezepue et al., 2023). Additionally, the relatively small and uneven subgroup sizes ( $N = 44$ ) may have limited the detection of subtle effects; however, the application of permutation tests and bootstrap confidence intervals strengthens the robustness of the findings and confirms that observed effects were negligible to small (Gülsemin Durmuş Çemçem et al., 2024). Furthermore, years of experience and formal qualifications alone may not translate into competence in localized pedagogy, particularly when teacher education programs insufficiently emphasize indigenous-language instructional strategies, resulting in uniformly moderate readiness across groups (Dzormeku et al., 2024). The findings have important implications for professional development and policy. Moderate readiness — particularly around applying localized teaching strategies — underscores the need for targeted in-service training, curriculum support, and instruction materials developed in local languages. International evidence indicates that successful implementation of local or bilingual instruction requires more than positive attitudes; it demands structured preparation, adequate materials, and continuous support systems for teachers (e.g., studies of local language instruction initiatives in Nigerian and African education contexts) (Ezepue et al., 2023). Furthermore, the uniformity of readiness across groups suggests that interventions should be system-wide rather than targeted at specific demographics. Training programs that focus on pedagogical adaptation, bridging subject content with local language competencies, and reflective practice are likely to be beneficial.

While this study contributes novel empirical evidence on physics teachers' readiness to teach in local languages, several limitations should be acknowledged. The use of self-report measures may be subject to social desirability bias. The small sample size and cross-sectional design limit causal inference, though the use of robust resampling methods strengthens the reliability of findings under these constraints. Future research could employ longitudinal designs and mixed methods to capture evolving perceptions and contextual factors in more depth.

## Conclusion

This study investigated secondary school physics teachers' readiness to teach physics using local languages in Nigeria, and the findings revealed a moderate overall readiness score, reflecting a balance between positive attitudes and perceived limitations in instructional competence. Moderate readiness, in contexts where teachers acknowledge the *value of localized instruction but lack full confidence or systematic training*, aligns with research showing that teachers' beliefs about language use influence their instructional practices in linguistically diverse settings (Rinker & Ekinici, 2025). Teachers' higher scores on content knowledge and translation ability affirm that many educators recognize the benefits that local languages can bring to conceptual understanding. However, lower scores in adapting teaching strategies indicate a need for targeted professional development—something education research consistently emphasizes when pedagogical innovation is required (Obiakor, 2024). The absence of significant group differences (e.g., by gender, school type, experience) suggests that the perceived challenges and readiness levels are shared widely across diverse teacher subgroups, rather than concentrated among specific demographics. This pattern mirrors findings from research on language of instruction policies in Nigeria, where differences in implementation often reflect systemic constraints rather than individual teacher characteristics (Obiakor, 2024). Given that Nigeria's educational policy environment mandates localized instruction at early grades—but shows mixed implementation outcomes in secondary settings—the current results point to the importance of *institutional support systems*, resource development, and sustained teacher training initiatives. Research on language of instruction policy indicates that policy adherence varies by context and highlights the need for curriculum alignment and teacher readiness planning to support multilingual instruction (Obiakor, 2024). Moreover, educational research on multilingualism underscores that teachers' beliefs and preparedness for multilingual classrooms shape student learning outcomes and instructional strategies, suggesting that teacher education programs should embed linguistic diversity competencies into both pre-service and in-service training (Rinker & Ekinici, 2025).



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Despite the study's modest sample size, the use of resampling methods (permutation tests and bootstrap confidence intervals) strengthened the reliability of inferences under minimal statistical assumptions. This approach aligns with contemporary statistical guidance for small-sample educational research and provides robust evidence for interpreting group comparisons even when classical assumptions are not fully satisfied (Neuhäuser & Ruxton, 2024). Overall, the findings contribute valuable insight into the readiness of Nigerian secondary school physics teachers to adopt local language pedagogy, indicating that while teachers generally recognize its potential benefits, more comprehensive professional development, instructional resources, and policy support are required to translate readiness into effective classroom practices.

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*Effect of Think-Pair-Share Instructional Strategy on ... Yahaya, S. & Adamu, H. (2025)*

## Effect of Think-Pair-Share Instructional Strategy on Performance in Hausa Language Concepts among Senior Secondary School Students in Kaduna State, Nigeria

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### Abstract

*This study investigated the effects of Think-Pair-Share (TPS) instruction on students' performance in Hausa Language in senior secondary schools in Kaduna State, Nigeria. The study adopted a quasi-experimental design, using pre-test and post-test measures on 124 students from two co-educational schools: Government Secondary School Kofar Kibo (experimental group, n=62) and Government Secondary School Kofar Doka (control group, n=62). The experimental group was taught using TPS, while the control group received conventional lecture-based instruction. The Hausa Language Performance (HLP) was used for data collection, with a reliability index of 0.89. Results showed a significant improvement in the post-test performance of students taught with TPS (mean=42.12) compared to their pre-test scores (mean=29.11), with a mean difference of 13.01 ( $p=0.000$ ). Additionally, the TPS group outperformed the conventional method group (mean=33.70), with a mean difference of 8.6613 ( $p=0.003$ ). The findings indicate that TPS enhances student engagement, collaboration, and retention, leading to better academic outcomes in Hausa Language. The study concludes that TPS is more effective than conventional methods in improving students' performance in Hausa Language. It recommends that school management create a conducive environment for TPS implementation and that Hausa Language teachers adopt interactive strategies like TPS to foster active learning, critical thinking, and knowledge retention. These measures could help reverse the declining performance trend and promote better learning outcomes in Hausa Language education.*

**Keywords:** Think-Pair-Share, Hausa Language, Academic Performance, Secondary Education.

### Introduction

Hausa is one of the most widely spoken indigenous languages in Nigeria and across sub-Saharan Africa. It ranks as the second most commonly spoken language in Nigeria after English and is also spoken by millions across West Africa. According to Abdulmumin (2024), Hausa is estimated to have over 150 million speakers, making it the eleventh most spoken language globally. Furniss (1996) highlights that the core Hausa-speaking regions include Kano, Katsina, Sokoto, and Kaduna States, as well as parts of the Republic of Niger, with Hausa communities spread across West and Central Africa. In Nigeria, Hausa is not only a medium of communication but also a subject taught in senior secondary schools. Its inclusion in the curriculum is aimed at preserving cultural values, instilling moral discipline, and fostering national identity. However, despite its significance, student interest and academic performance in Hausa language have been on the decline, particularly in Kaduna State. This decline has been linked to ineffective teaching methodologies that rely heavily on conventional lecture-based instruction, which is teacher-centred and limits student engagement and interaction. Conventional teaching methods, such as the lecture method, emphasise content delivery with minimal opportunities for student participation. As Mbacho (2013) and Macharla, Githua, and Mboroki (2009) observe, such approaches often lead to surface learning, increased student anxiety, reduced motivation, and poor academic outcomes. Muraya and Kimamo (2011) stress the importance of adopting effective teaching strategies that promote active learning and facilitate meaningful knowledge acquisition. One promising student-centred approach is the Think-Pair-Share (TPS) instructional strategy. TPS is a cooperative learning technique where students first think independently about a question or problem, then pair up to discuss their thoughts, and finally share their conclusions with the larger class. Jennifer (2019) and Ayinla (2015) note that TPS helps improve students' ability to recall information, enhances communication skills, and fosters deeper understanding through peer interaction and discussion. Evidence from prior studies supports the effectiveness of TPS and other cooperative learning strategies in improving academic performance across various subjects, such as Government, Economics, Arabic, and Islamic Studies (Dunia, 2011; Nadrah, Muhammad & Muris, 2017). These studies demonstrate



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that TPS promotes critical thinking, collaboration, and student engagement, which are essential for effective learning, particularly in language subjects like Hausa. In the context of Hausa language instruction, where students often struggle with complex content, unfamiliar terminologies, and low motivation, the use of TPS may offer a more dynamic and inclusive learning experience. As noted by Adamu (2015), when students underperform, teaching methodology should be among the first variables investigated. TPS allows learners to actively process information, communicate their ideas, and receive feedback in a supportive environment, thereby promoting both academic performances.

Academic performance refers to the measurable outcomes of student learning, including test scores, grades, and other forms of evaluation (Nwakocha & Amadike, 2005). Academic retention, on the other hand, involves the ability of students to remember and apply what they have learned over time (Obeka, 2010). Both performance and retention are influenced by the quality of instructional delivery. According to Obeka (2010), meaningful learning—where understanding and long-term retention are achieved—is best supported through active, student-centred methods like TPS. Given the declining performance of students in Hausa language in Kaduna State and the limitations of conventional teaching methods, it is imperative to explore innovative instructional strategies. This study, therefore, investigates the effects of Think-Pair-Share instruction on students' academic performance in Hausa language in senior secondary schools in Kaduna State, Nigeria.

### **Statement of the Problem**

The persistent decline in students' performance in Hausa Language in senior secondary schools in Kaduna State has become a source of concern to educators, parents, and policymakers. Despite the relevance of Hausa Language in cultural preservation and communication, students continue to perform poorly in the subject, as observed in internal and external examinations. One of the major factors attributed to this poor performance is the continued reliance on conventional, teacher-centred instructional methods that encourage rote memorisation rather than meaningful understanding. In many secondary schools across Kaduna State, teachers predominantly use lecture-based methods that limit student interaction, critical thinking, and active participation in the learning process. Such methods often fail to cater to the diverse learning needs of students and do not sufficiently stimulate interest or enhance retention of knowledge. Research has shown that instructional strategies play a vital role in shaping students' academic outcomes. Adamu (2015) pointed out that inappropriate teaching methods, among other factors, contribute to students' low academic achievement. Conversely, interactive instructional strategies such as the Think-Pair-Share (TPS) technique have been shown to foster collaboration, communication, and deeper understanding of content. TPS encourages students to think individually, discuss with a peer, and share their ideas with the larger group, thus promoting active learning. Van and Ramon (2012) highlighted the effectiveness of such strategies in enhancing student engagement and performance. Given the urgent need to improve students' academic performance in Hausa Language, this study seeks to investigate the effects of the Think-Pair-Share instructional strategy on the performance of senior secondary school students in Hausa Language in Kaduna State. The aim is to determine whether TPS can serve as a more effective alternative to the traditional teaching methods currently in use.

### **Objectives of the Study**

The study has the following specific objectives:

1. Examine the pre-test and post-test performance of Hausa Language students taught using think-pair-share instruction in senior secondary schools in Kaduna State, Nigeria.
2. Ascertain the post-test performance of Hausa Language students taught using think-pair-share instruction and those taught with the conventional method in senior secondary schools in Kaduna State, Nigeria.

### **Research Questions**

This study was guided by the following research questions:

1. What is the pre-test and post-test performance of Hausa Language students taught using think-pair-share instruction in senior secondary schools in Kaduna State, Nigeria?
2. What is the post-test performance of Hausa Language students taught using think-pair-share and those taught using conventional materials in senior secondary schools in Kaduna State, Nigeria?

### **Hypotheses**

The following hypotheses were stated to guide the study:



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1. There is no significant difference between the pre-test and post-test performance of Hausa Language students using think-pair-share instruction in senior secondary schools in Kaduna State, Nigeria.
2. There is no significant difference between the post-test performance of Hausa Language students using think-pair-share instruction and those taught with the conventional method in senior secondary schools in Kaduna State, Nigeria.

### **Methodology**

This study adopted a quasi-experimental design involving pre-test, post-test, and delayed post-test procedures as proposed by Musa (2014). This design was deemed appropriate due to its flexibility in using intact classes, which is essential when school authorities restrict randomisation to avoid disruption of classroom routines (Dawaki, 2014; Achor & Amadu, 2015). The design helped minimise the influence of extraneous or confounding variables that could compromise the internal or external validity of the study. In this design, the experimental group received instruction using the Think-Pair-Share (TPS) strategy, while the control group was exposed to the traditional "chalk and talk" method. Both groups were administered a pre-test to assess their baseline knowledge. The design, adapted from Umar (2018), is symbolically represented as follows:

EG: O1 — X — O2 (experimental group: pre-test, treatment, post-test),

CG: O1 — X<sub>0</sub> — O2 (control group: pre-test, traditional instruction, post-test).

The population of the study comprised all Senior Secondary School II students enrolled in public schools across Kaduna State, Nigeria, with a total of 18,720 students from 234 schools spread across 12 educational zones. For sampling, a total of 124 students were purposively selected from three schools within the Zaria educational zone. These included Government Secondary School Kofar Kibo (assigned as the experimental group with 62 students) and Government Secondary School Kofar Doka (assigned as the control group with 62 students). The selection of schools was purposive to ensure a gender-balanced representation. All selected schools were co-educational, used the same Hausa curriculum, and operated under the same educational standards, which contributed to the homogeneity of the sample. The classes used were intact, and the same researcher conducted the instructions in both groups with the assistance of trained teachers to ensure consistency and uniform delivery.

For data collection, the instrument used was a Teacher-Made Test (TMT) called the Hausa Language Performance (HLP). The HLP consisted of 50 multiple-choice items covering topics from the SS II Hausa curriculum. A table of specifications was developed to ensure a balanced representation of content areas and cognitive levels, with emphasis on traditional herbs, traditional crafts, and spirit-related cultural concepts. The cognitive levels tested included knowledge, comprehension, application, analysis, synthesis, and evaluation. The instrument was subjected to face and content validation by experts in Educational Foundations and Curriculum as well as Hausa language specialists at Ahmadu Bello University, Zaria. A pilot study was conducted at Government Secondary School Kofar Kuyanbana with 30 students not involved in the main study to assess the test's reliability and appropriateness. The test-retest method was used with a two-week interval, and analysis using Pearson Product-Moment Correlation Coefficient yielded a reliability index of 0.89, indicating that the instrument was both valid and reliable.

The treatment and data collection procedure spanned over 9 weeks. The first week involved orientation for the research assistants and administration of the pre-test. The actual treatment lasted for eight weeks, during which the experimental group received TPS-based instruction and the control group was taught using the traditional lecture method. The content taught included traditional herbs, traditional crafts, and spirits, with activities tailored to suit the assigned instructional method. Research assistants were trained extensively to ensure proper implementation of the lesson plans and administration of the HLP. After the treatment, a post-test was administered in week nine. Data from pre-test and post-test scores were used to answer the research questions and test the hypotheses. Descriptive statistics (mean and standard deviation) were employed to analyse the research questions, while paired sample t-test and independent sample t-test were used to test Hypotheses 1 and 2, respectively.

### **Presentation of Results**

**Research Question One:** What is the pre-test and post-test performance of Hausa language students taught using think-pair-share instruction in senior secondary schools in Kaduna State, Nigeria?



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**Table 1: Mean and Standard Deviation of pre-test and post-test performance of Hausa language students taught using think-pair-share instruction**

Variable	N	Mean	Std. Dev.	Mean Diff
Pre-test think-pair-share instruction	62	29.11	2.959	13.01
Post-test think-pair-share instruction	62	42.12	1.885	

*Source: Field study Data 2023/2024 academic session*

The analysis of data in Table 1 shows the pre-test and post-test performance of Hausa language students taught using think-pair-share instruction in senior secondary schools in Kaduna State, Nigeria. The results revealed 29.11 pre-test and 42.12 post-test means with a mean difference of 13.01 for students taught Hausa language using think-pair-share instruction. The post-test is higher than the pre-test performance, which implies that think-pair-share instruction is effective in teaching students the Hausa language in senior secondary schools in Kaduna State, Nigeria.

**Research Question Two:** What is the post-test performance of Hausa language students taught using think-pair-share instruction and conventional method in senior secondary schools in Kaduna State, Nigeria?

**Table 2: Mean and Standard Deviation of post-test performance of Hausa language students taught using think-pair-share instruction and conventional method**

Variable	N	Mean	Std. Dev.	Mean Diff
Post-test think-pair-share instruction	62	42.12	1.885	8.6613
Post-test conventional method	62	33.70	2.168	

*Source: Field study Data 2023/2024 academic session*

The analysis of data in Table 2 shows post-test performance of Hausa language students taught using think-pair-share instruction and conventional method in senior secondary schools in Kaduna State, Nigeria. The results revealed 42.12 and 33.70 post-test mean performances with a mean difference of 8.6613 of students taught Hausa language using think-pair-share instruction and conventional method. The post-test performance of students taught using think-pair-share instruction is higher than those taught with the conventional method, which implies that think-pair-share instruction is effective in teaching students the Hausa language in senior secondary schools in Kaduna State, Nigeria.

### Test of Hypotheses

**Hypothesis One:** There is no significant difference between the pre-test and post-test performance of Hausa language students using think-pair-share instruction in senior secondary schools in Kaduna State, Nigeria

**Table 3: t-test statistics on pre-test and post-test performance of Hausa language students taught using think – pair – share instruction in senior secondary schools**

Variable	N	df	t-cal.	p-value
Pre-test think-pair-share instruction	62	61	30.277	.000
Post-test think-pair-share instruction				

*Source: Field study Data 2023/2024 academic session*

The analysis of data in Table 3 shows the difference between the pre-test and post-test performance of Hausa language students using think-pair-share instruction in senior secondary schools in Kaduna State, Nigeria. The results revealed a p-value of .000, which is less than the 0.05 level of significance. The hypothesis was rejected; hence, the difference between the pre-test and post-test performance of Hausa language students taught using think-pair-share is significant, which means that think-pair-share instruction is effective in teaching Hausa language in senior secondary schools in Kaduna State, Nigeria.

**Hypothesis Two:** There is no significant difference between the post-test performance of Hausa language students using Think-Pair-Share and those taught with the conventional method in senior secondary schools in Kaduna State, Nigeria

**Table 4: t-test statistics on post-test performance of Hausa language students taught using Think-Pair-Share and those with the conventional method in senior secondary schools**



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Variable	N	df	t-cal.	p-value
Post-test think-pair-share instruction	122	120	3.103	.003
Post-test conventional method				

*Source: Field study Data 2023/2024 academic session*

The analysis of data in Table 4 shows there is a significant difference between the post-test performance of Hausa Language students taught using Think-Pair-Share and those taught with the conventional method in Senior Secondary Schools. The result revealed a P value of .003, which is less than the 0.05 level of significance. The hypothesis is rejected hence the difference between the performances of students taught using think-pair-share is significant. The performance of favours students taught with think-pair-share instruction, which means that it is effective in teaching Hausa Language in senior secondary in Kaduna State, Nigeria.

### Discussion of Findings

The findings of the study revealed that think-pair-share instruction has a positive effect on the performance of students taught Hausa language in senior secondary schools in Kaduna State, Nigeria. The result indicated that students taught Hausa language using the think-pair-share instructional method recorded a higher performance score in the post-test administered to them compared to the pre-test. The finding revealed that there was a significant difference in the pre-test and post-test performance of Hausa language students taught using think-pair share instruction in senior secondary schools in Kaduna State ( $p = 0.000$ ). This result implies that student recorded better post-test performance in Hausa language after the application of the think-pair-share instruction compared to their pre-test performance (that is, before the use of the think-pair-share instruction). Consequently, the hypothesis, which states that there was no significant difference in the pre-test and post-test performance of Hausa language students taught using think-pair-share instructional senior secondary schools in Kaduna State, Nigeria, is rejected. These findings were consistent with the findings of previous researchers. Sampsel (2013), for example, discovered that think-pair-share has a positive impact on students' performance. The result also showed that students' participation increased. Students' comfort and confidence when contributing to class discussion also increased. Students also indicated that they enjoyed participating more in class discussions. The findings of Kaddoura (2013) also revealed that the students performance significantly increase over time, throughout the 17 week course, with the use of think-pair-share teaching/learning strategy, the result suggest that think-pair share is an effective strategy to foster performance of students and could be used by educators to foster learners performance in their courses. The result of the data analysis conducted by Naluraya, Nadrun and Budi (2014) showed that the use of the think-pair-share technique can increase the performance of the eleventh-grade students. The researcher confirms that the think-pair-share technique is effective in increasing performance over time. The findings confirm the result of the study conducted by Sugianto and Sumarsono (2014), which discovered that students' ability in reading narrative text improves after the implementation of the think-pair-share model. The findings also indicate that there is a significant improvement in terms of students' ability in reading English narrative text after they were treated using think-pair-share. There is no denying the fact that the use of think-pair-share instruction is capable of enhancing the performance of students. This has been demonstrated in the present study.

The findings of the study also revealed that there was a difference in the performance of students taught Hausa language using think-pair-share instruction and those taught using the conventional method in senior secondary schools in Kaduna State, Nigeria. The standard deviation at each level implies that students' performance is at variance with each other. The study further revealed that there was no significance of students taught Hausa language using think-pair-share instruction and those taught using conventional methods in senior secondary schools in Kaduna State, Nigeria ( $p = 0.003$ ). Consequently, the null hypothesis was rejected because there was a statistically significant difference between the performance of students taught Hausa language using think-pair-share instruction and those taught using the conventional method in senior secondary schools in Kaduna State, Nigeria. The implication of this result is that students taught Hausa language using think-pair-share had better performance compared to their counterparts taught using conventional instruction in senior secondary schools in Kaduna State, Nigeria. These findings are in agreement with some previously conducted studies. Raba (2017), for instance, analysed the collected data in the study and found that think-pair-share instruction plays a positive role in improving students' oral communicative skills, creating a cooperative learning environment and enhancing students' motivation to learn better than when taught using conventional instruction.



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Furthermore, students taught some applied concepts using the think-pair-share strategy responded better than students taught similar concepts using the conventional method. The effectiveness of think-pair instruction can be overemphasised. This was substantiated by the findings of Fidrayani (2017) revealed that think-pair-share encourages a high degree of students' response and can help keep students on task. The think-pair-share has some advantages. Students have a lot of time to think, respond, and help each other. It helps students to remember their original thoughts, as well as helps students to have confidence about their thoughts because they have to talk about what they have written down. It helps to structure students' discussions. The instruction encouraged students to be enthusiastic in working together. Therefore, by applying the think-pair-share instruction, the learning outcomes of students who learning on their own are better. Hence, the application of think-pair-share instruction in the learning process in the class has been found by Fidrayani (2017) to be very influential towards the achievement of learning objectives, as well as improving students' performance.

### **Conclusion**

Based on the findings, the study concludes that the students taught Hausa Language using think-pair-share instruction outperformed their counterparts taught using conventional instruction in senior secondary schools. Overall differences exist in the performance of students taught Hausa Language using think-pair-share Instruction and those taught using the conventional method in senior secondary schools in Kaduna State, Nigeria. For emphasis's sake, think-pair-share instruction is more effective in teaching Hausa Language than the conventional method.

### **Recommendations**

The following recommendations were made in the study:

1. The school management should motivate Hausa Language teachers by providing an environment that is conducive for effective application of think-pair-share Instruction. This is to ensure continued improvement in students' performance in Hausa Language.
2. Teachers should always adopt think-pair-shares instruction for effective teaching of Hausa Language to develop and provide students with the opportunity to think, interact, work together, share ideas as well and expand their knowledge of the subject.

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## Assessment of Artificial Intelligence and Film-Based Media integration in Innovative Language teaching among Secondary School Teachers in Okitipupa Metropolis

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### Abstract

*This study investigated teachers' perceptions of integrating artificial intelligence (AI) tools and film-based media to enhance learner engagement, motivation, and linguistic competence in English and Yorùbá classrooms in Okitipupa metropolis. Using a cross-sectional survey design, a stratified purposive sample of 50 practising senior secondary school teachers representing public and private schools and language specialisations was selected. Data were collected through a validated structured Likert-scale questionnaire, with a reliability coefficient of 0.72. Descriptive statistics, including frequencies, percentages, means, medians, and standard deviations, were used to summarise responses. Findings indicated that English teachers reported higher frequency of using AI and films, while Yorùbá teachers exhibited greater confidence in their integration. Both groups perceived positive effects on learner engagement, motivation, and linguistic competence, with Yorùbá teachers highlighting focus and interaction and English teachers emphasising contextual language understanding. The study concluded that perceived competence did not always align with actual usage and recommended professional development, resource access, and sharing of best practices to support effective classroom integration.*

**Keywords:** Artificial intelligence, film-based media, language teaching, English and Yorùbá classrooms

### Introduction

Innovation in the teaching and learning of languages has become a pressing requirement in contemporary educational environments, as learners negotiate increasingly complex demands in terms of digital literacy, intercultural awareness and multimodal communication. According to Richards and Rodgers (2014), innovation in language pedagogy entails the adoption of methods, technologies or practices that transcend traditional paradigms and foster more flexible, learner-centred and interactive experiences. Within the domain of language education, this imperative is heightened by the need for learners to engage not only with linguistic competence but also with the technology-mediated contexts and media-rich environments in which languages are used and learned. Against this backdrop, the emergence of artificial intelligence (AI) in education has attracted considerable attention. According to Holmes and Tuomi (2022), recent developments in educational AI have generated high expectations regarding the potential of AI-based systems to transform teaching and learning, yet these expectations are often grounded in limited understandings of the technological possibilities or the educational functions they support. AI systems such as intelligent tutoring systems, adaptive learning platforms and automated feedback tools are increasingly being mobilised in language education to personalise instruction, respond to individual learner needs and support teacher functionality. The United Nations Educational, Scientific and Cultural Organization (UNESCO, 2021) also underscores that AI has the capacity to address longstanding educational challenges and to innovate teaching and learning practices. Alongside AI, the pedagogical value of films and visual media in language classrooms has been well established. Visual media such as films provide rich, authentic language input in realistic communicative contexts, integrating auditory, visual and cultural cues that extend beyond the limitations of traditional textbook-based instruction. For instance, Sánchez-Auñón, et al. (2022) demonstrate that film-based tasks in English-as-a-foreign-language (EFL) settings support vocabulary acquisition, idiomatic expression, listening comprehension and learner motivation. Thus, visual media hold strong potential for enhancing language teaching and learning through multimodal



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engagement and enhanced learner interest. The integration of AI and films in language education therefore presents a promising pathway for innovation. When AI is applied to film-based pedagogy, the adaptive analytics, personalisation and scaffolding potential of AI can be leveraged alongside the motivational, contextual and cultural affordances of film. In practice, an AI-augmented film-based learning environment could recommend film segments matched to learner proficiency, generate tailored comprehension or production tasks, track learner responses and adapt the sequence of activities to maximise engagement and competence development. Such an integrated approach offers the prospect of more effective, engaging and learner-centred language teaching by combining technology and media in a coherent pedagogical framework. In the Nigerian educational context, where language teaching often contends with resource constraints, large class sizes and multilingual realities, the relevance of integrating AI and films is significant. Nigeria's medium of instruction is frequently the English language, while indigenous languages and local cultural media remain under-utilised in formal pedagogy. Introducing AI-enhanced film-based tools in language classrooms may offer scalable and contextually relevant means of addressing issues such as learner disengagement, limited instructional innovation and under-exploited media resources. Although much of the existing literature has centred on EFL in European or Asian contexts, little attention has been given to how AI-film integration might be operationalised in Nigerian language classrooms, especially those that blend global and local languages. Despite the strong promise of this integrated approach, a distinct research gap remains. While there is an emerging body of work on AI in education (Holmes & Tuomi, 2022) and on film-based language pedagogy (Sánchez-Auñón et al., 2022), very few studies explore their conjunction in language classrooms. In view of the foregoing, this study proposes to explore how artificial intelligence and film-based media can be integrated to support innovative teaching in English and Yorùbá language classrooms.

### **Research Objectives**

1. To investigate the effectiveness of integrating films and AI tools in enhancing learners' engagement, motivation and linguistic competence in English and Yorùbá language classrooms.

### **Research Questions**

1. In what ways does the integration of films and AI tools influence learners' engagement, motivation and linguistic competence in English and Yorùbá language classrooms?

### **Literature Review**

#### **Artificial Intelligence in Language Education**

Scholarly discussions on artificial intelligence (AI) in education consistently emphasise its role as a set of computational techniques that enable machines to perform tasks typically requiring human intelligence. According to Luckin et al. (2016), AI comprises systems capable of perception, reasoning, learning, and problem-solving, all of which have significant implications for instructional design and language pedagogy. Within educational contexts, AI is often operationalised through machine learning, natural language processing (NLP), and adaptive learning environments. Machine learning has been described by Jordan and Mitchell (2015) as a field concerned with algorithms that improve their performance through experience, making it essential for systems that personalise learning pathways. NLP, which allows computers to process and generate human language, underpins a large proportion of AI-driven language learning tools. As Godwin-Jones (2019) explains, the advances in NLP have enabled more sophisticated applications such as automated writing evaluation, intelligent chatbots, and speech recognition systems for pronunciation training. Generative AI, a rapidly advancing branch of machine learning, produces new content such as text, speech, or images based on learned patterns. According to Floridi and Chiriatti (2020), developments in large language models mark a significant shift in the capabilities of generative systems, offering new possibilities for language learning tasks involving dialogue simulation or creative production. Complementing these systems are adaptive learning platforms. Holmes et al. (2019) note that adaptive systems draw on machine learning models to adjust task difficulty, feedback, and learning resources according to each learner's performance, thus providing tailored learning experiences that are difficult to achieve through conventional pedagogy. These technological foundations collectively frame the current interest in AI-enhanced language education.

#### **Applications of AI in Language Learning**

##### **Intelligent Tutoring Systems**

Intelligent tutoring systems (ITS) represent one of the earliest and most widely researched applications of AI in education. As observed by Nkambou, Bourdeau and Mizoguchi (2010), ITS simulate one-to-one human tutoring by diagnosing learner



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needs and delivering targeted instruction. In the domain of language learning, ITS have been used to scaffold grammar instruction, vocabulary development, and reading comprehension. Zawacki-Richter et al. (2019) argue that the increasing sophistication of ITS indicates their potential to support learning at scale, particularly in contexts where teacher–student ratios are imbalanced. The personalised interactions facilitated by ITS are especially relevant for multilingual classrooms such as those in Nigeria, where learners may require differentiated support in both English and Yorùbá.

#### **Automated Feedback and Assessment Tools**

Automated feedback technologies have become central to AI-assisted language learning. According to Li, Link and Hegelheimer (2021), automated writing evaluation systems provide instantaneous feedback on features such as grammar, coherence, and lexical choice, enabling learners to revise their work iteratively. Such tools rely heavily on NLP and machine learning, and they have demonstrated effectiveness in improving second language (L2) writing outcomes. Godwin-Jones (2019) contends that automated assessment enhances learner autonomy by offering continuous formative assessment that would be otherwise infeasible for teachers to deliver consistently. In pronunciation and fluency assessment, speech recognition algorithms allow systems to evaluate learners' spoken output, providing corrective feedback that supports the acquisition of prosodic features.

#### **AI-Supported Pronunciation and Fluency Training**

Technology-supported pronunciation training has gained prominence through advances in speech analysis. According to Thomson and Derwing (2015), digital systems capable of analysing segmental and suprasegmental accuracy provide learners with detailed feedback beyond what teachers can typically offer. More recent research by Li et al. (2020) demonstrates that AI-driven speech recognition has achieved greater reliability, making it suitable for pronunciation training in L2 classrooms. Such tools are particularly relevant to Yorùbá language learning, given the tonal nature of the language. While most current systems are optimised for global languages such as English and Mandarin, emerging research in African language speech technologies (Adebara and Suleiman, 2020) indicates growing possibilities for AI-supported pronunciation training in low-resource languages.

#### **Chatbots and Conversational Agents for L2 Practice**

Conversational agents have become increasingly prevalent in language education owing to improvements in NLP and speech generation. According to Winkler and Söllner (2018), chatbots provide learners with low-anxiety environments for practising language skills and receiving immediate, contextually appropriate feedback. Research by Hsu, Chen and Chou (2020) indicates that chatbots can significantly enhance vocabulary acquisition, speaking confidence and learner engagement. In addition, Fryer and Carpenter (2006) demonstrate that learners often perceive conversational agents as less threatening than human interlocutors, making them particularly effective for promoting communicative competence. Recent developments in generative AI have substantially expanded chatbot capabilities. As noted by Graham (2022), large language models now produce more natural and interactive dialogue, making them suitable for role-play tasks, pronunciation practice, and culturally authentic conversations. These developments hold promise for bilingual contexts such as English and Yorùbá instruction, where learners benefit from consistent, scaffolded opportunities for oral interaction that classrooms alone may not provide.

#### **Film-Based Media in Language Education**

Film-based media have long been recognised as valuable pedagogical tools in language education because they provide rich, authentic, and contextually embedded linguistic input. According to Sherman (2003), films offer learners exposure to naturally occurring speech, including variations in accent, pragmatics, gestures and cultural norms that textbooks rarely capture. The multimodal nature of films aligns with Mayer's (2009) cognitive theory of multimedia learning, which argues that learners comprehend information more effectively when it is presented through coordinated verbal and visual channels. This dual coding supports deeper language processing, making film a powerful resource for developing listening comprehension, vocabulary, and intercultural awareness. In the African context, film-based materials also serve important cultural and identity functions. Adejunmobi (2015) explains that Nigerian films, particularly those produced in indigenous languages such as Yorùbá, transmit cultural values, oral traditions and sociolinguistic patterns that are crucial for holistic language learning. For English language instruction, films produced in English-speaking environments allow learners to experience communicative norms, idiomatic expressions, and sociocultural practices that are essential for communicative competence. Thus, film-based media offer pedagogical benefits that extend beyond linguistic accuracy to include cultural fluency and critical thinking.



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### **Film Media in English and Yorùbá Language Classrooms**

The use of film in English language teaching (ELT) has been widely documented. According to Champoux (2016), films can stimulate classroom discussion, enhance motivation and help learners contextualise new vocabulary. In Nigerian ELT settings, Akinwale (2019) notes that films improve learner engagement because they reflect contemporary societal realities familiar to students. Research on indigenous language education, though less extensive, shows similar benefits for African languages. According to Olayemi (2020), Yorùbá films and animated folktales support both heritage learners and second-language learners by providing accessible models of tonal patterns, culturally embedded expressions, and everyday interactional routines. Additionally, digital streaming platforms have increased the accessibility of films for educational purposes. As argued by Kusumarsdyati (2019), students are increasingly comfortable learning through audiovisual media, which aligns with contemporary digital literacy skills. This widespread familiarity strengthens the pedagogical value of film, particularly for younger learners. Despite its benefits, film-based instruction faces several challenges. According to Webb (2015), learners may become distracted by visual elements, limiting their focus on linguistic features. Time constraints within school curricula can also restrict the effective use of films unless teachers design purposeful, scaffolded activities. Copyright restrictions and inconsistent technological infrastructure present further obstacles, especially in low-resource educational environments. In the case of African languages such as Yorùbá, Ojo (2021) notes that the quality of available film materials varies considerably, requiring teachers to select content carefully to ensure linguistic accuracy and cultural authenticity.

### **Integration of Artificial Intelligence and Film-Based Media**

The convergence of AI and film-based media represents an emerging frontier in language pedagogy. According to Pardo et al. (2019), AI-powered video platforms can automatically generate subtitles, identify key scenes, and provide personalised viewing recommendations based on learner performance. These systems leverage advances in computer vision, NLP, and machine learning to enhance comprehension and engagement. Similarly, Wang (2021) observes that AI tools can analyse learner interactions with videos—such as pausing, replaying, or seeking specific segments—to offer adaptive feedback and tailor subsequent learning tasks. Generative AI has further expanded possibilities for AI–film integration. As noted by Buchholz (2022), large-scale generative models can produce realistic dialogues, summarise film segments, or generate alternative storylines that can be adapted for classroom activities. Such technologies support creative pedagogy and provide new opportunities for student-led storytelling. The combination of AI and film media offers distinctive pedagogical advantages. AI-generated subtitles and speech recognition tools can support learners' comprehension of complex dialogues by providing real-time transcription and translation. According to Li and Sun (2020), AI-enhanced captioning improves vocabulary acquisition and helps learners notice key linguistic features. These tools are particularly valuable for tonal languages such as Yorùbá, where AI-generated tonal markings or prosodic cues can support accurate pronunciation. Moreover, AI-based analytics allow teachers to track learners' engagement with film content. As Chen et al. (2020) argue, learning analytics derived from video interactions can help teachers identify which scenes challenge learners and where additional scaffolding is required. Chatbots that accompany film content can also encourage learners to practise speaking or summarising scenes. According to Hill et al. (2015), conversational agents create interactive, low-anxiety opportunities for learners to use language in context, complementing the communicative affordances of film. AI further facilitates personalised learning. Adaptive systems can adjust film difficulty, recommend scenes that match learner proficiency, or generate comprehension questions based on previous learner responses. This contrasts with traditional film-based instruction, which typically adopts a one-size-fits-all approach. In bilingual classrooms such as those involving English and Yorùbá, AI–film integration allows teachers to deliver differentiated support despite diverse learner abilities. While promising, the integration of AI and film also presents several challenges. According to Holmes and Porayska-Pomsta (2021), AI systems often depend on robust datasets that may not exist for low-resource languages such as Yorùbá, leading to inaccuracies in transcription, translation, or speech analysis. Technical reliability is another issue; as Wang and Young (2022) point out, AI tools require stable digital infrastructure, which remains unevenly distributed across schools, particularly in sub-Saharan Africa. Ethical concerns also arise. Floridi (2019) highlights the risks of algorithmic bias, privacy violations, and opaque decision-making within AI systems. When integrated with film media—which may already carry cultural or ideological biases—AI tools must be carefully deployed to avoid reinforcing stereotypes or misrepresenting linguistic norms. Teachers therefore require training not only in how to use AI systems, but also in how to interpret their outputs critically.



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### Methodology

This study adopted a cross-sectional survey design to examine teachers' perceptions of how the integration of films and AI tools influences learners' engagement, motivation, and linguistic competence in English and Yorùbá classrooms. The target population comprised practising English and Yorùbá language teachers in senior secondary schools within the Okitipupa metropolis. Using a stratified purposive sampling technique, 50 teachers were selected to ensure representation across school types (public and private) and language specialisation. Data were collected through a structured questionnaire with closed-ended Likert-scale items. Content validity was established through expert review by three senior language education researchers and two practising senior teachers, who evaluated the clarity, relevance, and cultural appropriateness of items, particularly those in Yorùbá. A pilot study involving 10 teachers from comparable contexts was conducted to assess item clarity, administration logistics, and timing, and pilot data were used to compute initial reliability estimates and refine items. Internal consistency of the Likert subscales was verified using Cronbach's alpha ( $\alpha = 0.70$ ). Data analysis employed descriptive statistics, including frequencies and percentages for categorical items and mean, median, and standard deviation for Likert-scale responses, to summarise teachers' perceptions comprehensively.

### Analysis

This section presents the results of the descriptive analysis of teachers' responses on the integration of AI tools and film-based media in English and Yorùbá language classrooms. The analysis covers frequencies, percentages, and measures of central tendency (mean scores) to describe patterns in teachers' perceptions across four domains: extent of use, learner engagement, learner motivation, and linguistic competence.

**RQ1:** In what ways does the integration of films and AI tools influence learners' engagement, motivation and linguistic competence in English and Yorùbá language classrooms?

**Table 1: Descriptive Analysis of Teacher Responses**

S/N	Item	Eng SA	Eng A	Eng D	Eng SD	Yor SA	Yor A	Yor D	Yor SD	Eng Mean	Yor Mean
1.	Use films	18	4	3	0	14	7	1	2	3.68	3.13
2.	Use AI tools	21	4	0	0	11	8	4	2	4.32	2.83
3.	Combine AI & films	14	8	1	2	9	4	12	0	3.2	3.08
4.	Encourage learners AI	23	0	2	0	16	8	1	0	3.84	3.75
5.	Confidence integrating	22	3	0	0	24	0	1	0	3.88	4.08
6.	Attention	19	4	0	2	22	3	0	0	3.68	3.79
7.	Participation	11	14	0	0	16	9	0	0	3.44	3.54
8.	Focus	2	22	0	1	14	11	0	0	2.92	3.46
9.	Sustained interest	1	24	0	0	0	23	2	0	3.08	3.04
10.	Interaction	0	19	5	1	9	13	3	0	2.72	3.29
11.	Motivation—attention	11	14	0	0	21	4	0	0	3.44	3.88
12.	Motivation—focus	8	14	1	2	1	23	0	1	3.08	2.75
13.	Motivation—interest	21	4	0	0	16	8	1	0	3.84	3.63
14.	Digital interaction	13	11	0	1	21	4	0	0	3.44	3.88
15.	Vocabulary	11	14	0	0	14	9	2	0	3.44	3.38
16.	Contextual understanding	25	0	0	0	11	14	0	0	4.0	3.04
17.	Communication	14	9	1	1	9	12	4	0	3.04	3.13

The results on table I above indicate that English teachers generally report a higher frequency of using AI tools and film-based media than Yorùbá teachers. For example, a larger proportion of English teachers strongly agreed that they regularly use films for instruction, and their mean score for AI tool use was notably higher. However, despite their lower usage levels, Yorùbá teachers reported higher confidence in integrating these digital tools, suggesting that perceived competence does not necessarily correspond with actual frequency of use. In general, usage appears more common among English teachers, while both groups demonstrate strong self-efficacy in integrating AI and film-based media. Findings on learner engagement show that teachers in both subject areas generally believe that AI tools and films enhance learners' attention, participation, focus, and interaction with learning resources. Yorùbá teachers consistently reported slightly higher engagement levels than English teachers across most items. In particular, Yorùbá teachers indicated stronger perceptions of improved learner focus and interaction when these tools were used, while English teachers reported lower engagement



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especially in relation to learner interaction with digital and classroom resources. This suggests that although English teachers use these tools more frequently, Yorùbá teachers perceive greater engagement benefits for their learners. Patterns observed in learner motivation reveal that Yorùbá teachers rated the impact of AI tools and films highly in terms of sustaining attention and encouraging digital interaction. English teachers, however, perceived stronger effects in maintaining long-term learner interest, with higher scores for sustained motivation. They also reported greater influence on learner focus compared with Yorùbá teachers. Thus, both groups viewed AI and film-based media as valuable in motivating learners, though their perceptions of the areas of strongest influence differed slightly. Regarding linguistic competence, both groups agreed that AI tools and film-based instruction enhance vocabulary and meaningful communication. English teachers reported a particularly strong belief that these tools support contextual language understanding, with the highest mean score across all items, while Yorùbá teachers expressed a more moderate view on this aspect. Perceptions of improvements in meaningful communication were similar for both groups, indicating shared recognition of the linguistic value of these instructional resources. Consequently, English teachers tended to report stronger linguistic benefits, especially in contextual comprehension, while both groups acknowledged positive effects on vocabulary and communicative competence.

### **Discussion of Findings**

The findings reveal notable disparities in how English and Yorùbá teachers integrate AI tools and film-based media. English teachers reported more frequent use, consistent with Chen and Chan's (2021) observation that teachers of subjects with broader digital content tend to adopt technology more readily. Yorùbá teachers used these tools less but reported higher confidence, reflecting Bandura's (1997) notion that self-efficacy may not always align with actual use when resources are limited. Both groups saw AI and films as valuable for learner engagement, though Yorùbá teachers reported slightly higher levels, echoing Adegbija and Abioye's (2020) findings that digital tools can boost interest in low-resource subjects. English teachers' lower engagement ratings may reflect reduced novelty effects, as noted by Lai (2022). In terms of motivation, Yorùbá teachers highlighted immediate attention and interaction benefits, supporting Klimova's (2021) and Mayer's (2020) findings on culturally meaningful multimodal resources. English teachers emphasised long-term interest, aligning with Godwin-Jones's (2018) view that AI and films can sustain motivation through personalised feedback and authentic language exposure. Regarding linguistic competence, both groups agreed that AI and films support vocabulary and communication. Webb and Rodgers in (2020) demonstrated that multimodal exposure facilitates incidental vocabulary learning, while Eberhard et al. in (2021) noted that digital resources are more abundant for dominant languages like English, explaining English teachers' stronger perceptions of contextual understanding. Yorùbá teachers' moderate perceptions likely reflect the scarcity of Indigenous-language materials, yet both groups recognised the linguistic benefits, consistent with Passey's (2019) conclusions.

### **Conclusion**

In conclusion, the study highlights that while English teachers use AI tools and film-based media more frequently, Yorùbá teachers exhibit higher confidence in integrating these resources, and perceive stronger learner engagement benefits. Both teacher groups recognise the positive impact of these tools on motivation and linguistic competence, though English teachers emphasised contextual language understanding, and Yorùbá teachers highlighted enhanced focus and interaction. These findings suggest that frequency of use does not always align with perceived effectiveness, and that both subject areas can benefit from targeted support. It is recommended that professional development programmes encourage consistent and effective use of AI and film-based media across both English and Yorùbá classrooms, with attention to strategies that maximise learner engagement and linguistic outcomes. Schools should also facilitate resource access and sharing of best practices to ensure that teachers' confidence translates into regular, impactful classroom integration.

### **Recommendations**

Based on the findings presented, this paper recommended that although English teachers demonstrate higher frequency of AI and film-based media use, the comparatively high self-efficacy reported by Yorùbá teachers suggests strong latent capacity. Structured professional development programmes should therefore be organised to support both groups, with a particular focus on translating perceived competence among Yorùbá teachers into more consistent classroom use. Also, the disparity in usage frequency between English and Yorùbá teachers may reflect differences in access to instructional resources. Educational authorities should ensure equitable provision of AI-enabled tools, audio-visual materials, and supporting infrastructure across language subjects. This will encourage more regular use among Yorùbá teachers and



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sustain existing practices among English teachers. Finally, curriculum planners should explicitly incorporate AI tools and film-based media into language curricula, with clear guidelines on their pedagogical use for both English and indigenous languages. Policy frameworks should recognise the role of digital media in promoting vocabulary development, meaningful communication, and contextual comprehension.

### Acknowledgements

We acknowledge the English and Yorùbá language teachers in senior secondary schools in Okitipupa metropolis who participated in this study. Their willingness to share their experiences and professional insights contributed significantly to the success of the research. We are sincerely grateful for their cooperation and valuable contributions.

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## Assessment of Language Testing on Language Development among Pupils in Ibadan South-West Local Government Area of Oyo State, Nigeria

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### Abstract

*This paper assessed language testing on language development among pupils in Ibadan South-West Local Government Area of Oyo State, Nigeria. This study adopted the survey research design. Simple random sampling technique was used to select five schools from the public primary schools in Ibadan South West Local Government Area of Oyo State. Forty primary school pupils were randomly selected from each school, making a total of 200 pupils. In all, 200 pupils participated in the study. One research instrument was used for data collection: Questionnaire on Impact on the enhancement of language development ( $r=0.76$ ). The instrument was trial tested on 20 pupils that are not part of the schools selected for the study. Data collected were analysed using frequency counts, percentages, mean and standard deviation. Finding of the study indicated that a weighted mean of 2.74 which is greater than the threshold of 2.50. Based on the finding of this study, it was recommended that pupils should not allow their level of language development to decrease. Government should organise seminars and workshops for teachers on methods, strategies and techniques of using language testing to enhance language development in early childhood stage of education in primary schools.*

**Keywords:** Language testing, enhancement, language development, early childhood education

### Introduction

Education is one of the vital factors that help in the development of a human being. The fundamental right of every child is to learn and develop to his or her full potentials through equal access to quality education regardless of their age, gender, origin ethnicity and social background. However, Early Childhood Education provides the foundation of education in the pre-school education which forms an integral part of a child's early education, given formally or informally, in an educational institution to children ages two five years prior to entering the primary school (Nakopia, 2011). Education starts from cradle to grave. Experts opined that catching children young with quality education remains a veritable tool for lifelong development. Similarly, education is an indispensable tool in nation building. It is a process of systematic training and instruction designed to transmit knowledge and acquisition of skills, potentials and abilities which will enable an individual to contribute efficiently to the growth and development of society and nation. It involves all round development of an individual physically, socially, morally, intellectually, and mentally (Osakwe, 2009). Therefore, education is the right of every child and must not be denied for any reason. Early childhood care and education have thus been included and expanded in the worldwide Education for All Programme as a result of the World Summit on the Status of worldwide Children (Ajayi, 2008). This is yet to be a reality for every child, because some do not get the opportunity to start early; that is, having the early childhood school experience between the ages 3 and 5 years before embarking on primary education. Early childhood education is an activity that takes place before formal school. In this case, pre-school is part of early childhood, and the aim is the versatile development of child's personality and also helping the child to be ready and mature for a smooth transition to school. In other words, early childhood programme encompasses both qualitative education and care, which should not be separated but provided for a complementary fashion. Good early childhood education will earn a child a position or state of readiness for learning in a formal and non-formal setting. Disposition to learn refers to development of social skills and behaviour in formal educational environment, while readiness to learn is related to the fact that children will start schooling on a solid (footing) foundation to develop their potential. Emphatically, early childhood education is seen as an evolving field of study, research and practice, which concerns itself with all aspects of early life experience, from separation of anxiety to early literacy development. Early childhood education sometimes



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called early childhood care and education or early childhood care Development education refers to the education that children obtain during early stages of life. The nature of the educational environment, including the facilities, instructional materials, and environment to which the child is exposed throughout the first six years of life, is recognised to have a significant impact on learning (Bowen, Donovan & Burn 2001). Early Childhood is the first eight years of a child's life (Pre-school). Explicitly, it is the period before full-time schooling begins, for children aged 3 to 5. It includes the crèches, the nursery and kindergarten, while the primary education refers to education given to children between 6 and 11 years plus. The period is seen as a turning point in child development for building human capital in the form of the basic social, cognitive, and scholastic skills needed for educational achievement. It is also seen as a preventive measure to reduce the incidence of remedial classes, grade repetition, getting assigned to special-education classes, and later dropping out of school. As an equity issue, ECE is viewed as an equaliser between rich and poor, a way of providing children from disadvantaged backgrounds some of the human capital builders experienced by children from more advantaged households (Hammond & Plesca, 2010). Childhood development is the key to a full and productive life for a child and to the progress of a nation. Early Childhood is, therefore, a critical stage of development that forms the foundations for children's future well-being and learning. Research has shown that half of a person's intelligence potential is developed by age four and that Early Childhood interventions can have a lasting effect on intellectual capacity, personality, and social behaviour. Integrated programmes which focused on children in their very early years are critical for their mental and psychosocial development, as opined by the Organisation for Economic Cooperation and Development (OECD, 2000). In other words, a comprehensive and quality ECE programme can meet the educational and developmental needs of disadvantaged children and can help to equalise opportunities early in life. If every child can benefit from an early introduction to education whether provided by parents or professionals either at home or in a school environment, it is likely that it would have an impact on the academic achievement, social and moral behaviour of the child. For children of parents with full-time jobs, early childhood education may be the only opportunity these youngsters have to develop crucial social learning skills. Hence, today's increased demand for educational excellence combined with the economic need to work longer hours by parent is an equation that highly favours early childhood education.

In the past, Nigeria had experienced various forms of early childhood programmes across the regions of the country. For instance, in the Northern part of Nigeria, early childhood programmes were religious-based education. In their communities, Mallam teaches children as old as three years and above in Qur'an and the pronunciation of Arabic alphabet. Children were taught the practical skills needed to function successfully in traditional society by Mallam. Children within age three years above belonged to the same group, together they learned the custom of their community and were placed on specific duties within the village such as sweeping the lanes with the sole aim of keeping them busy while their parents were busy with their works (Ibrahim, 2010). In South-west Nigeria, the introduction of 'Jele-O-sinmi' currently reformed to 'modern day-care centres to children of aged 2 to 5 years was enriched by the informal traditional methods of bringing up children and makes them ready for pre-primary education. During this period of Jele-O-sinmi, significant numbers of parents willingly accepted the mode of the education which gave them a platform to rest and plan for their daily work before their children returned. In the Eastern part of Nigeria, early childhood programmes came in the form of Gospel religion through missionary. Children centres were established in the worship places in villages and communities to train and nurture children while their parents were not around mostly they were working in the farm. The churches then take the responsibilities of poor and average children by training them spiritually and academically (Gabriel, 2014).

The significance of the status accorded this level of education is also reflected in the role of the Federal Government towards the achievement of the objectives. For example, government in this period undertook to encourage private efforts in the provision of early childhood education which meant that she would not establish any, even as a model for other stakeholders to emulate; make provision in Teacher Training Institutions for student teachers who want to specialise in pre-primary education; ensure that the medium of instruction will be principally the mother-tongue or the language of the immediate community; develop the orthography for the many more Nigerian languages, and produce textbooks in Nigerian languages; ensure that the main method of teaching in the pre-primary institution will be through play, and that the curriculum of Teacher Training Colleges is appropriately oriented to achieve this; regulate and control the operation of pre-primary education as well as ensure that the staff of pre-primary institutions are adequately trained and that essential



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equipment is provided (FGN, 2013). In spite of the importance of early childhood education, studies have shown that there are numerous problems facing early childhood education in Nigeria. Efforts to address these problems have made scholars and researchers to carry out numerous studies. All these studies came up with useful insights to early childhood education but with less research focus on impact of language testing on the enhancement of language development in early childhood stage of education in primary schools especially in Ibadan South west Local Government Area of Oyo State. Messick (1994) argues that all testing involves making value judgements, and therefore language testing is open to a critical discussion of whose values are being represented and served; this in turn leads to a consideration of ethical conduct. Messick (1994, 1996) has redefined the scope of validity to include what he calls consequential validity - the consequences of test score interpretation and use. Davies (1997) argues that since tests often have a prescriptive or normative role, their social consequences are potentially far-reaching. He argues for a professional morality among language testers, both to protect the profession's members, and to protect individuals from misuse and abuse of tests.

Spolsky (1997) points out that tests and examinations have always been used as instruments of social policy and control, with the gate-keeping function of tests often justifying their existence. Shohamy (1997) claims that language tests which contain content or employ methods which are not fair to all test-takers are not ethical, and discusses ways of reducing various sources of unfairness. She also argues that uses of tests which exercise control and manipulate stakeholders rather than providing information on proficiency levels are also unethical, and she advocates the development of critical language testing (Shohamy, 1997). She urges testers to exercise vigilance to ensure that the tests they develop are fair and democratic, however that may be defined. Lynch (1997) also argues for an ethical approach to language testing and Rea-Dickins (1997) claims that taking full account of the views and interests of various stakeholder groups can democratize the testing process, promote fairness and therefore enhance an ethical approach.

### **Statement of the Research Problem**

Early childhood education is an activity that takes place before formal school, in this case, preschool is part of early childhood. The aim is the versatile development of child's personality and also helping the child to be ready and mature for a smooth transition to school. In spite of the importance of early childhood education, studies have shown that there are numerous problems affecting the language development of pupils in early childhood stage of education in Nigeria. Efforts to address these problems have made scholars and researchers to carry out numerous researches. All these studies came up with useful insights to early childhood education but with less research focus on impact of language testing on the enhancement of language development in early childhood stage of education in primary schools especially in Ibadan South West Local Government Area of Oyo State. Therefore, this study assessed language testing on language development among pupils in Ibadan South-West Local Government Area of Oyo State, Nigeria

### **Objectives of the study**

The study determined:

1. the level of impact of language testing on the enhancement of language development in early childhood stage of education in primary schools

### **Research Question**

The following research question was answered in the study:

1. What is the level of impact of language testing on the enhancement of language development in early childhood stage of education in primary schools?

### **Methodology**

This study adopted the survey research design. Simple random sampling technique was used to select five public primary schools from public primary schools in Ibadan South Local Government Area of Oyo State. Forty primary school pupils were randomly selected from each school, making a total of 200 pupils. In all, 200 pupils participated in the study. One research instrument was used for data collection: Questionnaire on Impact on the enhancement of language development ( $r=0.76$ ). The instrument was trial tested on 20 pupils that are not part of the schools selected for the study. Data collected were analysed using frequency counts, percentages, mean and standard deviation.



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### Presentation of Result

**Research Question one:** What is the level of impact of language testing on the enhancement of language development in early childhood stage of education in primary schools?

**Table One: Level of Impact of Language Testing on the Enhancement of Language Development**

s/n	Item	SA	A	D	SD	Mean	Std. D.
1	I ask myself language-related questions to help me focus on learning	71 (35.7%)	69 (34.7%)	33 (16.6%)	26 (13.1%)	2.92	1.02
2	I often skim for main idea in whatever I read	71 (35.5%)	89 (44.5%)	30 (15%)	10 (5%)	3.10	.835
3	I usually read in a place where I can concentrate	33 (16.5%)	37 (18.5%)	82 (41%)	48 (24%)	2.27	1.00
4	I scan for a specific piece of information in whatever I read	53 (26.5%)	79 (39.5%)	45 (22.5%)	23 (11.5%)	2.81	.958
5	I guess the meaning of difficult words	44 (22.1%)	52 (26.1%)	60 (30.2%)	43 (21.6%)	2.48	1.06
6	I draw inferences from whatever I read	61 (30.7%)	94 (47.2%)	28 (14.1%)	16 (8%)	3.00	.879
7	I draw conclusions from what I read	46 (23.1%)	41 (20.6%)	59 (29.6%)	53 (26.6%)	2.40	1.11
8	I distinguish facts from opinion	49 (24.5%)	50 (25%)	51 (25.5%)	50 (25%)	2.49	1.11
9	I suggest an alternative end to what I read	43 (21.5%)	41 (20.5%)	86 (43%)	30 (15%)	2.48	.992
10	I add details to support the main ideas in whatever I read	69 (34.5%)	96 (34.5%)	21 (10.5%)	14 (7%)	3.10	.850
11	I often feel bored anytime I read	68 (34%)	108 (54%)	22 (11%)	2 (1%)	3.21	.669
12	I try to read on my own without anybody's help	56 (28%)	85 (42.5%)	47 (23.5%)	12 (6%)	2.92	.867
13	I ask my teacher to clarify concepts that I don't understand	62 (31%)	106 (53%)	19 (9.5%)	13 (6.5%)	3.08	.813
14	I don't read passages that are not interesting.	41 (20.5%)	49 (24.5%)	59 (29.5%)	51 (25.5%)	2.40	1.07
15	I get confused anytime I read	49 (24.6%)	44 (22.1%)	53 (26.5%)	53 (26.5%)	2.44	1.13

**Standard Mean = 2.50; Weighted Mean = 2.74**

Table I shows the impact of language testing on the enhancement of language development in early childhood stage of education in primary schools in Ibadan South Local Government Area of Oyo State. The result indicates a weighted mean of 2.74 which is greater than the threshold of 2.50. This implies that the impact of language testing on the enhancement of language development in early childhood stage of education in primary schools in Ibadan South Local Government Area of Oyo State is high. Eight out of the fifteen items used contributed to this high level, since their means are greater than the weighted mean. In their order of magnitude, the items are: item 11 – I often feel bored anytime I read (Mean = 3.21>2.74); item 2 – I often skim for main idea in whatever I read (Mean = 3.10>2.74); item 10 – I add details to support the main ideas in whatever I read (Mean = 3.10>2.74); item 13 – I ask my teacher to clarify concepts that I don't understand (Mean = 3.08>2.74); item 6 – I draw inferences from whatever I read (Mean = 3.00>2.74); item 1 – I ask myself language-related questions to help me focus on learning (Mean = 2.92>2.74); item 12 – I try to read on my own without anybody's help (Mean = 2.92>2.74); and item 4 - I scan for a specific piece of information in literary texts that I read (Mean = 2.81>2.74). This implies that the impact of language testing on the enhancement of language development in early childhood stage of education in primary schools in Ibadan South Local Government Area of Oyo State is high.

### Discussion of Findings

Table I revealed that the impact of language testing on the enhancement of language development in early childhood stage of education in primary schools in Ibadan South Local Government Area of Oyo State is high. This is in line with the study



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of Adepoju (1985) who reported that students' level of self-regulated learning was high. This is contrary to the study of Shobayo and Ogunbaigbe (2019) who revealed that students' level of self-regulated learning was moderate.

### **Conclusion**

The study has provided a better understanding of the impact of language testing on the enhancement of language development in early childhood stage of education in primary schools in Ibadan South Local Government Area of Oyo State. The level of impact of language testing on the enhancement of language development in early childhood stage of education in primary schools in Ibadan South Local Government Area of Oyo State was found to be high. Therefore, it could be concluded from the study that language testing is essential in enhancing the language development in early childhood stage of education in primary schools.

### **Recommendations**

The following recommendations are made based on the finding of the study:

1. Pupils should not allow their level of language development to decrease.
2. Government should organize seminars and workshops for teachers on methods, strategies and techniques of using language testing to enhance language development in early childhood stage of education in primary schools
3. Teachers should encourage pupils to improve on their language development.
4. Parents should provide all the necessary materials for their children.

### **Acknowledgements**

The author gratefully acknowledges the invaluable contributions of the scholars and researchers whose works were consulted and cited in the course of this study. Their rigorous scholarship, insightful analyses, and pioneering research provided a strong intellectual foundation upon which this work was built. Through their published works, these scholars have advanced knowledge in the field and offered critical perspectives that enriched the conceptual framework, methodology, and discussions presented in this study. The author is deeply indebted to these academics for their commitment to research excellence and knowledge dissemination, which continue to inspire further inquiry and scholarly engagement. Their contributions not only guided the direction of this study but also strengthened its academic relevance and credibility. To all the researchers whose ideas, findings, and arguments informed this work, the author expresses sincere appreciation.

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## Qualitative Study on Integrating Artificial Intelligence Technology into Language Teaching and Learning in Nigeria

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### Abstract

*The field of language education is changing as a result of artificial intelligence (AI), which is bringing in a new era of international communication, intelligent tutoring, adaptive learning, and immediate feedback. As AI-driven learning platforms, automated assessment systems and sophisticated language models develop, they make it possible to provide highly customized training that meets the needs of each individual student, encourages self-reliance, and sustains engagement. AI improves learner outcomes and teaching effectiveness while also increasing access to high-quality language training across socioeconomic and geographic barriers, according to recent studies in educational technology. AI's transformational potential must be carefully weighed against ethical and pedagogical caution, though. Data privacy, algorithmic bias, digital equity and redefining teacher roles are all complicated issues that need careful consideration. If left unchecked, these problems could endanger students' rights, perpetuate inequality, and threaten the humanistic principles that are at the heart of education. Therefore, this study explores the various pedagogical possibilities of AI in language instruction and challenges the moral conundrums associated with its use. Drawing on ethical frameworks and human-centered educational concepts, it offers evidence-based approaches for integrating AI in a sustainable, inclusive and accountable manner. The main objective is to promote an AI-assisted language learning ecosystem in which human agency, creativity and meaningful engagement are enhanced rather than replaced by technology. It is recommended that educational institutions and regulatory agencies should put in place clear policies pertaining to data governance, permission, privacy, transparency and responsible AI use.*

**Keyword:** Artificial intelligence, Language teaching, Ethical AI

### Introduction

Artificial Intelligence (AI) has quickly developed into a crucial and revolutionary force in modern language teaching, changing how teachers plan, create, present, and evaluate lessons as well as how students acquire language proficiency. According to Zawacki-Richter et al. (2023), the incorporation of AI into language learning offers a change from static, teacher-centered education to dynamic, learner-centered, and adaptable learning experiences. By utilizing advanced Natural Language Processing (NLP) algorithms, Intelligent Tutoring Systems (ITS), conversational agents (chatbots), and Automatic Speech Recognition (ASR) technologies, artificial intelligence (AI) builds intelligent ecosystems that monitor progress, customize instruction, and offer support according to learner profiles (Wang & Vásquez, 2023; Lin & Warschauer, 2023). By analysing learners' spoken or written input using large language datasets and machine learning approaches, these systems are able to detect faults in pronunciation, grammar, semantics, and pragmatics with an accuracy that is not possible with traditional methods (Holmes et al., 2022). AI enables students to practice both productive (speaking and writing) and receptive (listening and reading) language abilities at their own speed by providing real-time, personalized scaffolding and corrective feedback. This adaptive feedback method fosters learner autonomy, intrinsic motivation, and sustained engagement in addition to improving accuracy and fluency (Wang & Vásquez, 2023; Beatty, 2019). Learners that engage



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with intelligent systems receive ongoing diagnostic feedback that promotes self-control, introspection, and goal-oriented development, resulting in more significant and long-lasting language acquisition (Li et al., 2022). According to Holmes et al. (2022), Zawacki-Richter et al. (2023), Sun and Zhang (2024), and other scholars, Artificial Intelligence (AI) is redefining second-language pedagogy by supporting data-driven, adaptive, and evidence-based instructional models that react dynamically to learner performance, linguistic challenges, and cognitive needs. By analysing vast amounts of learner data, these intelligent systems can spot trends in misconceptions or developmental mistakes, which enables teachers to improve their methods, personalize their resources, and create more focused interventions. As a result, AI allows for more effective use of instructional time and resources by changing the educator's position from that of a mere information transmitter to that of a facilitator, learning designer, and data-informed mentor (Lin & Warschauer, 2023; Holmes et al., 2022). Additionally, by creating realistic, dynamic, and context-rich experiences, AI-powered multimodal learning environments that incorporate speech, text, visuals, gestures, and immersive simulations expand the possibilities for language acquisition (Chiu et al., 2023). For example, learners can participate in simulated real-world interactions, cultural exchanges, and situational tasks that replicate genuine communicative environments through virtual and augmented reality applications (Gong et al., 2022). These encounters help students internalise language use beyond rote memorization by fostering international competency and pragmatic fluency. AI-driven platforms reduce geographical and temporal barriers in open and distance learning (ODL) environments by providing various populations of learners with flexible, on-demand, and personalised learning opportunities (Wang & Vásquez, 2023; Zawacki-Richter et al., 2023). Furthermore, intelligent language learning tools are becoming more widely available worldwide thanks to the convergence of AI with mobile technologies and cloud computing, which promotes inclusive education and lifelong learning (Beatty, 2019; Sun & Zhang, 2024). Inequalities in access to high-quality language instruction have decreased thanks to the availability of advanced virtual tutors, pronunciation coaches, and interactive writing assistance for learners in remote places. Through automated essay scoring, voice evaluation, and adaptive testing, AI also makes large-scale assessment possible, offering reliable and timely insights into student competence levels (Li et al., 2022; Holmes et al., 2022). All things considered, artificial intelligence is a revolutionary force in contemporary language instruction, creating a more adaptable, dynamic, and customized learning environment. AI improves language learning's effectiveness and accuracy by fusing cognitive science, computational linguistics, and educational psychology. It also supports the larger educational goal of equity, accessibility, and learner empowerment in the digital era. Its ongoing development holds the potential to further transform language teaching by providing educators and students with cutting-edge resources for attaining linguistic proficiency in a world growing more interconnected by the day (Zawacki-Richter et al., 2023; Wang & Vásquez, 2023).

Notwithstanding these encouraging developments in education, an increasing amount of research highlights the moral, philosophical, and professional conflicts that arise when artificial intelligence (AI) is used into language instruction. AI technologies raise important issues about data ethics, accountability, and human agency in educational environments, even as they promise increased efficiency and personalization (Selwyn, 2022; Williamson & Piattoeva, 2023). Data ownership and privacy are major problems, especially for AI systems that gather and analyze large volumes of learner-generated data for assessment and adaptive learning (Holmes et al., 2022; Sun & Zhang, 2024). There are still issues with algorithmic decision-making's transparency because many AI models function as "black boxes," making it challenging for teachers and students to comprehend how outputs like grades or feedback are produced (Selwyn, 2022; Knox, 2020). In educational evaluation, this opacity calls into question the values of accountability, justice, and trust. Furthermore, researchers have warned that AI systems may reinforce linguistic hierarchies, perpetuate algorithmic bias, and marginalize minority language varieties and cultural identities if they are trained primarily on data from dominant linguistic and cultural groups (Williamson & Piattoeva, 2023; Li et al., 2022). For instance, text-generation and voice recognition algorithms frequently perform poorly for speakers with non-standard accents or dialects, thereby favouring dominant linguistic norms and preventing marginalized learners from fully participating. If left unchecked, these biases run the risk of perpetuating rather than reducing current injustices, undercutting the inclusive goals of open and global education. The identity, autonomy, and professional agency of teachers are further areas of concern. Teachers' professional duties may be redefined when AI takes on more tasks including evaluation, feedback generation, and lesson planning (Holmes et al., 2022; Knox, 2020). According to Selwyn (2022) and Williamson & Piattoeva (2023), some academics caution that an over-reliance on AI could reduce teachers' authority and pedagogical inventiveness, turning them into managers of algorithmic systems rather than thoughtful practitioners and decision-makers. This conflict highlights the need for educational intentionality, ethical thinking, and human oversight in AI-mediated learning environments. AI-driven educational ecosystems have the potential to reinforce systemic injustices, favour technologically advanced areas, and jeopardise students' digital rights if they are not properly governed (Sun & Zhang, 2024). These dangers underscore the critical need for inclusive policy mechanisms, ethical design principles, and transparent governance frameworks to guarantee accountability and equity in the application of AI in a variety of linguistic and cultural contexts. As a result, current debate demands a critical and balanced viewpoint that upholds pedagogical ethics, human-centered values, and fair access to digital learning resources while embracing AI's revolutionary potential (Selwyn, 2022; Holmes et al., 2022). Therefore, in order to properly utilise AI's potential and



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guarantee that technological innovation in language instruction stays egalitarian, culturally sensitive, and sustainably aligned with fundamental educational principles, a thorough and nuanced examination is necessary.

## **Opportunities of AI in Language Teaching and Learning in Nigeria**

### **Personalised and Adaptive Learning in Nigeria**

The ability to personalise language learning environments in Nigeria has been greatly improved by artificial intelligence (AI), which has changed how students engage with educational materials and how teachers perceive individual differences in learning. Large amounts of learner-generated data, including response accuracy, pacing, error patterns, and cognitive engagement metrics, can be analyzed by AI-powered systems to create customized learning pathways that dynamically modify the difficulty, modality, and order of learning tasks (Wang & Vásquez, 2023). These systems enable real-time modification of content and activities in Nigerian classrooms in accordance with each learner's changing needs and goals by continuously assessing learner input and performance. This degree of responsiveness represents a paradigm shift from uniform instructional delivery to data-driven personalization, enabling learners to experience tailored instruction comparable to one-on-one human tutoring. Prominent language-learning platforms like Duolingo, Babbel, and Rosetta Stone are prime examples of how machine learning and natural language processing algorithms are used to track learner performance, forecast proficiency trajectories, and offer focused exercises that fill in particular skill gaps in vocabulary, grammar, or pronunciation (Wang & Vásquez, 2023; Li et al., 2022). By identifying strengths and weaknesses using learner analytics, these adaptive systems provide reward and remedial feedback to maintain the ideal degree of difficulty. As learners gain instantaneous, data-driven insights about their own development and performance patterns, the ongoing adaptation not only improves accuracy and fluency but also cultivates metacognitive awareness (Holmes et al., 2022; Lin & Warschauer, 2023). Beyond ease of use, AI-driven personalization encourages students to take charge of their education, which supports self-regulated learning. AI helps maintain motivation and engagement by addressing learners at their current proficiency level and gradually scaffolding tasks toward more sophisticated linguistic and communication competencies. By ensuring that instructional input is in line with the learner's zone of proximal development, this personalized trajectory lowers frustration and cognitive overload, two common obstacles in second-language acquisition (Vygotsky, 1978; Sun & Zhang, 2024). Additionally, by offering instant rewards and progress tracking, gamification features, which are frequently incorporated into AI-based platforms, improve emotional engagement and perseverance, reinforcing positive learning behaviors and intrinsic motivation (Beatty, 2019). These benefits are supported by empirical studies, which demonstrate that AI-powered adaptive learning environments increase student motivation, enhance information retention, and increase overall learning efficiency (Holmes et al., 2022; Li et al., 2022). Further research has shown that the personalized and multimodal nature of AI-assisted learning, which combines text, audio, and interactive simulations, allows for differentiated support that is as responsive and scalable as traditional human-mediated instruction, and in some cases even better (Wang & Vásquez, 2023; Zawacki-Richter et al., 2023). AI-driven personalization, which creates adaptable, learner-centered environments that bridge the gap between technology and pedagogy while facilitating equal access to high-quality education across contexts, is ultimately a key component of the digital transformation in language education.

### **Automated Feedback and Assessment in Nigeria**

Artificial intelligence's (AI) automated feedback and assessment capabilities, which have revolutionised traditional evaluation and error-correction procedures, are another significant benefit of AI in language instruction. Learners can receive immediate, comprehensive, and context-sensitive feedback on grammar, vocabulary usage, pronunciation, spelling, coherence, and overall communicative quality from AI-powered tools like Grammarly, E-rater, Criterion, and speech-recognition programs like Google Speech-to-Text and Microsoft Azure Cognitive Services. By establishing an instantaneous feedback loop that improves accuracy, engagement, and learner autonomy, this automation of feedback mechanisms tackles one of the ongoing issues in language education: assessment delays and a lack of teacher feedback (Li & Chen, 2022; Li et al., 2022). AI-based systems analyse linguistic data in real time, finding specific faults and proposing contextually relevant improvements, in contrast to traditional techniques that mostly rely on teacher input and delayed corrections. For instance, writing aids like Grammarly and automated essay scoring systems support higher-order writing development by assessing discourse organization, lexical sophistication, and stylistic appropriateness in addition to identifying superficial grammatical errors (Wang & Vásquez, 2023; Holmes et al., 2022). Similar phonetic-level feedback is provided by AI-enabled pronunciation software and Automatic Speech Recognition (ASR) tools, which enable learners to visualize their speech waveforms, compare their pronunciation with native models, and correct articulatory deviations through repeated practice (Gong et al., 2022). This iterative procedure maintains the task's communicative authenticity while promoting form-focused learning. Li and Chen (2022) claim that AI-driven feedback systems greatly improve writing fluency, syntactic accuracy, and pronunciation by offering constant, nonjudgmental guidance that motivates students to explore, edit, and self-correct. By encouraging learner autonomy and reducing reliance on teacher availability, these systems empower students to actively manage their learning trajectory and track their own progress (Lin & Warschauer, 2023). Additionally, automated feedback systems provide teachers with a useful way to reduce their workload, especially in big or open and distance learning (ODL) environments where scale typically limits personalised evaluation. Teachers



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can focus more on higher-order pedagogical activities, such developing critical thinking, communicative competence, and intercultural awareness, by assigning routine evaluative tasks to AI (Holmes et al., 2022; Zawacki-Richter et al., 2023). AI-supported assessment tools not only enhance learner performance results but also encourage formative assessment practices that are consistent with the concepts of continuous learning and reflection, according to additional empirical study (Li et al., 2022; Sun & Zhang, 2024). These technologies create a feedback-rich environment that improves motivation, maintains engagement, and closes the conventional gap between teaching, learning, and evaluation when they are skillfully incorporated into instructional design. Therefore, automated feedback is a crucial aspect of AI's revolutionary potential in language teaching, improving learner empowerment and instructional effectiveness in the digital era.

#### **Intelligent Tutoring Systems**

Numerous tasks that are typically carried out by human teachers are replicated by Intelligent Tutoring Systems (ITS). These systems provide personalized explanations, error-correction techniques, and grammar scaffolding by utilizing conversational AI, natural language processing, and predictive analytics. In addition to identifying language problems, ITS models proper usage, encourages reflection from learners, and instantly adjusts to their responses. According to research, integrating ITS into blended learning frameworks with instructor guidance significantly improves student performance and language development (Li & Chen, 2022; Zawacki-Richter et al., 2023). Thus, the combination of teacher experience and AI-mediated tutoring offers a potent model for enhancing the efficacy of training.

#### **Multilingual and Cross-Cultural Access to Learning Resources**

Artificial Intelligence (AI) has made multilingual education much more advanced by facilitating smooth cross-linguistic communication and cultural exchange in international learning environments. Learners can now interact effectively with speakers of various linguistic origins and access authentic resources in numerous languages thanks to the development of advanced machine translation technologies, AI-driven chatbots, and translanguing communication platforms. These tools use sophisticated neural machine translation (NMT) algorithms that can analyze idiomatic expressions, language context, and semantic subtleties to produce translations that resemble human fluency and cultural appropriateness (Eubanks, 2021; García & Otheguy, 2022). These technology affordances allow learners to collaborate, communicate, and co-create knowledge in real time across linguistic barriers. According to Eubanks (2021), these developments enable students to actively engage in multilingual digital environments and dismantle conventional barriers to intercultural communication. While conversational agents like ChatGPT, Replika, and Lingvanex bots offer multilingual conversational exercise that strengthens communicative skill, platforms like Google Translate, DeepL, and Microsoft Translator enable instantaneous translation of texts, audio, and video. By placing language learning within actual cross-cultural interactions, these applications not only increase learners' exposure to realistic linguistic input but also facilitate contextualized meaning-making (Wang & Vásquez, 2023; Lin & Warschauer, 2023). AI technologies support the development of intercultural communicative competence (ICC), which goes beyond language competency and is the capacity to communicate successfully and responsibly with people from different linguistic and cultural backgrounds (Byram, 2021). Learners develop cross-cultural awareness, empathy, and openness through ongoing exposure to a variety of language inputs and cultural references—qualities necessary for success in an increasingly globalized and multilingual knowledge society (Holmes et al., 2022; García & Otheguy, 2022). Additionally, translanguaging instruction is supported by AI-enhanced environments, which encourage students to seamlessly draw from their entire linguistic repertoires rather than seeing languages as distinct entities. This method respects the language identities of various learners and acknowledges the dynamic, hybrid nature of bilingual and multilingual communication (Li & Chen, 2022). As a result, the incorporation of AI into multilingual education signals a pedagogical shift that integrates language acquisition with international engagement, global citizenship, and inclusive communication, rather than just a technological advancement. In the 21st-century educational environment, AI fosters mutual understanding, diversity appreciation, and global connectedness by bridging linguistic and cultural divides. It also improves communicative competence and fosters the humanistic aspects of language learning (Eubanks, 2021; Wang & Vásquez, 2023).

#### **Accessibility and Inclusion in Nigeria**

AI technologies are essential in advancing inclusivity and equity in language acquisition. By removing obstacles to learning and communication, assistive technologies including speech-to-text converters, automated captioning, predictive text input systems, and audio description software empower students with impairments. According to UNESCO (2023), these developments increase the number of people with visual, auditory, and cognitive disabilities who have access to high-quality language instruction. AI helps create inclusive and socially equitable language-learning environments by providing multimodal learning affordances that accommodate a variety of learner demands.

#### **Ethical Considerations in AI-Enabled Language Education in Nigeria**

AI's pedagogical potential is becoming more widely acknowledged, but integrating it into language instruction also brings up important ethical concerns that need to be carefully considered. In AI-mediated learning environments, ethical decision-making takes into account learner privacy, equity, professional agency, technological access, and academic integrity. To guarantee that innovation supports equal learning outcomes and is consistent with human-centered educational objectives, it is imperative to address these issues.



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#### **Data Privacy and Educational Surveillance in Nigeria**

Significant amounts of sensitive learner data, such as linguistic blunders, biometric speech patterns, behavioral logs, and learning preferences, are gathered, analysed, and stored by AI-driven systems. These kinds of data are frequently utilised to improve algorithms and customise learning paths. However, issues with long-term surveillance, third-party sharing, data ownership, and informed permission come up. According to Selwyn (2022), AI may promote surveillance-oriented pedagogy that jeopardizes student trust, autonomy, and psychological safety in the absence of clear data governance frameworks. Therefore, protecting students' personal information requires strong privacy regulations, moral data usage guidelines, and instruction on digital rights.

#### **Algorithmic Bias and Linguistic Inequality in Nigeria**

AI systems that contain bias have the potential to exclude particular learning groups and maintain linguistic hierarchies. Research indicates that when processing a variety of accents, indigenous languages, and non-standard dialects, speech recognition engines and automated scoring systems frequently exhibit reduced accuracy (Eubanks, 2021; Wang & Vasquez, 2023). Equal learning chances may be hampered by this technology bias, which has the potential to reinforce linguistic discrimination and favor dominant language norms. Building equitable and culturally sensitive AI systems requires openness in algorithmic design, inclusive training datasets, and ongoing cultural-linguistic auditing.

#### **Teacher Professional Identity and Pedagogical Agency in Nigeria**

Concerns regarding the changing roles of educators are raised by the growing automation of instructional and evaluation processes in Nigeria. Some stakeholders worry that AI will replace teachers or make them less relevant in schools. But as Holmes et al. (2022) point out, teachers are still essential for encouraging critical thinking, emotional engagement, learner advocacy and cultural mediation; skills that AI cannot match. AI should be positioned as a helpful tool that increases teacher efficiency, fosters innovation and frees up professional time for mentoring and higher-order instruction rather than taking the place of educators in Nigeria.

#### **Digital Divide and Access Inequities in Nigeria**

In spite of AI's revolutionary potential, there is a significant disparity in who gains from AI-enhanced learning due to unequal access to reliable internet, digital devices and technological infrastructure. Access to emerging technologies is restricted for learners from low-income families, rural locations and developing regions due to systemic hurdles. AI deployment runs the risk of exacerbating already-existing educational disparities in the absence of focused digital-equity legislation. Governments and organizations must fund infrastructure, reasonably priced connectivity and initiatives to build digital skills in order to guarantee inclusive implementation.

#### **Academic Integrity and Authentic Learning in Nigeria**

The emergence of AI-generated content, translation tools, and language automation presents new issues about learner integrity and the creation of authentic knowledge. Hall (2023) warns that students may abuse AI tools for plagiarism, avoiding important skill development and cutting down on language practice. Nigerian schools must therefore develop ethical AI literacy, incorporate responsible-use guidelines and create tests that prioritize oral communication, creativity and process-based evaluation over submissions that are solely product-focused.

#### **Conclusion**

With its unparalleled potential for individualised training, real-time feedback, multilingual participation and inclusive instructional support, artificial intelligence has become a potent driver for innovation in language education. Its transformational potential in contemporary pedagogical settings is highlighted by its ability to automate assessment procedures, enhance interactive language practice and tailor instruction to specific learner profiles. Language learning is becoming more accessible, effective and learner-centered as global educational systems incorporate AI-driven platforms more and more. However, using AI in language instruction needs to be done with careful ethical consideration. Data privacy, algorithmic justice, digital equity, teacher identification and academic integrity are all complicated problems that should not be disregarded. Without the right protections, AI could exacerbate systemic prejudices, increase already-existing educational disparities and threaten the humanistic principles that are essential to education. In order to guarantee that AI applications promote educational equity and respect learner rights, ethical frameworks, legal regulations and institutional accountability systems are essential. The key to the future of AI-enhanced language instruction is to embrace a human-centered and balanced viewpoint that sees technology as an ally rather than a replacement for teachers. AI may significantly improve language learning experiences and help create more empowered, culturally sensitive and globally connected learners when it is based on thorough research, ethical standards and strong professional development. AI has the potential to greatly improve language proficiency and encourage global educational reform through careful and prudent application.

#### **Recommendations**



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The following are suggested to maximise AI's transformational potential while preserving moral, educational and equity-based values in Nigeria:

1. Students should get instruction on ethical AI use, critical thinking and academic integrity in order to prevent academic dishonesty and promote digital citizenship.
2. For marginalised and underprivileged learners to benefit from AI, implementing inclusive policies and making targeted infrastructure improvements is paramount.
3. Teachers should have periodic trainings on digital pedagogy, ethical technologies and AI literacy to improve the quality of learning, encourage creativity and guarantee ethical technology usage.
4. Educational institutions and regulatory agencies should put in place clear policies pertaining to data governance, permission, privacy, transparency and responsible AI use.
5. Rather than being used to replace teachers, AI should be viewed and implemented as a supplementary teaching tool.
6. Government and stakeholders in the Nigerian educational system should expand and provide equal access to tech digital devices, internet connectivity and accessible AI platforms.
7. To identify and reduce algorithmic bias, developers must train AI language models on a variety of linguistic datasets that represent dialects, accents and less-dominant languages.

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## Effect of Digital Games on Achievement in English Language Vocabulary among Junior Secondary School Students in Lokoja Education Zone of Kogi State

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### Abstract

*This study investigated the effect of digital games on achievement in English language vocabulary among junior secondary school students in Lokoja education zone of Kogi State. A single research question and a corresponding hypothesis guided the research. The study employed a quasi-experimental design. The total population for the study consisted of 2,170 JSS3 students in Lokoja education zone. Through a multistage sampling technique, 174 students were selected to participate. The English Achievement Test (EAT), specifically designed to assess vocabulary knowledge at the JSS3 level, served as the primary instrument for data collection. Data analysis involved the use of Analysis of Covariance (ANCOVA) at a 0.05 level of significance to examine differences in mean achievement scores between groups. Findings revealed that students taught using digital games significantly outperformed those taught through conventional methods. These findings provide compelling evidence supporting the integration of digital games into English language teaching to boost student engagement and learning outcomes.*

**Keywords:** English in Nigeria, Digital games, English Vocabulary, Achievement, Students' traditional method of teaching

### Introduction

The advent of digital games has significantly transformed the landscape of education, introducing new and engaging ways for students to learn and acquire skills. In junior secondary education, where students are at a crucial stage of cognitive development, digital games have become an innovative tool for enhancing academic achievement, particularly in English vocabulary acquisition (Bolton, 2020). These games offer interactive and captivating platforms that make learning enjoyable and motivating. As English vocabulary plays a vital role in academic success across subjects, educators and researchers are increasingly exploring the integration of digital games into the curriculum as a promising method for vocabulary development (Achebe, 2024). The combination of fun and learning through technology fosters greater engagement and retention among students, positioning digital games as a valuable pedagogical tool. English vocabulary, the cornerstone of effective communication and language proficiency, holds a pivotal role in shaping students' academic, professional, and social success. A rich vocabulary enhances linguistic fluency, cognitive development, and critical thinking, thereby supporting students' overall academic achievement (Garba, 2022). Traditional vocabulary teaching methods, such as rote memorization, often yield short-term results without fostering deep understanding (Alubaleze, 2022). In contrast, contextual and interactive approaches, including cooperative learning and technology-based activities, encourage meaningful learning experiences and improve retention (Dewey, 2022). Digital games, in particular, provide a multisensory and interactive environment where students encounter words repeatedly in engaging contexts, promoting long-term vocabulary mastery and application (Ivgin & Akcay, 2024). Academic achievement, a key indicator of students' educational success, encompasses not only grades and test scores but also the development of knowledge, skills, and critical thinking abilities (Omoruyi & Omofonmuan, 2024). The use of digital games in vocabulary instruction enhances these dimensions by motivating learners through feedback, rewards, and goal-oriented challenges (Ezeugo, 2024). By transforming vocabulary learning into an engaging and interactive experience, digital games contribute to enhanced



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comprehension, creativity, and problem-solving skills. This dynamic approach aligns with modern educational goals that emphasize holistic development and lifelong learning (Okafor, 2022). Ultimately, integrating digital games into English vocabulary instruction in junior secondary schools has the potential to boost academic achievement, foster engagement, and prepare learners for success in the digital age.

### **Statement of the Problem**

In contemporary education, there's a growing concern over the underperformance of junior secondary school students in English vocabulary acquisition. This issue is further compounded by the widespread use of traditional teaching methods that fail to engage students effectively. Reviews on digital games as an educational tool reveal a stark contrast in engagement and learning outcomes compared to conventional methods. One of the primary reasons behind the poor performance of junior secondary school students in English vocabulary is the ineffective teaching methods employed in many educational institutions. Traditional approaches often rely heavily on rote memorization and passive learning, which fail to stimulate students' interest or cater to diverse learning styles. As a result, students struggle to retain and apply English vocabulary effectively, leading to lower academic achievement and disengagement from the learning process. This highlights the urgent need to explore alternative teaching strategies that can foster active engagement and deeper understanding among students. Therefore, the problem of this study is stated in question form: What is the effect of digital games on junior secondary school students' achievement in English vocabulary learning in English?

### **Objective of the study**

The study aims to examine the effect of digital games on junior secondary school students' achievement in English vocabulary in Lokoja educational zone. Specifically, the study is set to: i. Determine the mean achievement scores of students taught English vocabulary with digital games and those taught with the conventional method.

### **Research Question**

The following research question guides the study:

- i. What is the mean achievement scores of students taught English vocabulary using digital games, and students taught using the conventional method?

### **Research Hypothesis**

The following null hypothesis was tested at 0.05 level of significance.

H<sub>01</sub>: There is no significant difference in the mean achievement scores of students taught English vocabulary using digital games and those taught using the conventional method

### **Literature Review**

#### **English Vocabulary**

English vocabulary is a cornerstone of language proficiency, serving as the building blocks for effective communication, comprehension, and academic achievement. From decoding written text to expressing ideas orally, a robust English vocabulary is essential for navigating the complexities of language across various domains (Mada, 2022). However, the acquisition and mastery of English vocabulary present significant challenges for learners, particularly in educational settings where traditional teaching methods may fall short in engaging students and fostering deep understanding. The stage for exploring the concept of English vocabulary and its critical role in language development, as well as the challenges and opportunities associated with its acquisition in educational contexts (Okafor, 2022). English vocabulary encompasses the words and phrases that individuals use to communicate and express meaning in a language. It encompasses not only the breadth of words a person knows but also their understanding of word meanings, nuances, and usage in different contexts. Okereke (2020) English vocabulary is not static but rather dynamic and evolving, shaped by experiences, interactions, and exposure to diverse language inputs. As such, developing a rich and varied English vocabulary is a lifelong process that begins in early childhood and continues to evolve throughout one's lifespan. In educational settings, English vocabulary plays a central role in academic success across various subjects, from reading and writing to mathematics and science (Chen, Tseng & Hsiao, 2018).



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A strong English vocabulary not only facilitates comprehension and expression but also enhances critical thinking skills, creativity, and problem-solving abilities. However, the acquisition of English vocabulary presents unique challenges for learners, including the sheer volume of words to be learned, the complexity of word meanings and usage, and the need for repeated exposure and practice to internalize new words effectively (Opara, 2024). Traditional approaches to English vocabulary instruction often rely on rote memorization, dictionary definitions, and isolated word lists, which may yield limited results in terms of long-term retention and application (Sleigh, 2022). Moreover, Okoye (2022) these methods may fail to engage students effectively or cater to diverse learning styles and preferences. In contrast, innovative approaches to English vocabulary instruction, such as interactive and experiential learning activities, digital games, and contextualized word usage, offer promising avenues for enhancing English vocabulary acquisition and fostering deeper understanding among learners (Chu & Hung, 2015). By embracing a holistic and dynamic approach to English vocabulary development, educators can empower students to become confident and proficient users of language, equipped with the linguistic skills necessary for success in academic and real-world contexts.

### **Digital Games and Academic Achievement**

Digital games, once relegated to the realm of entertainment, have emerged as potential tools for enhancing academic achievement (Okeke-Okosisi, 2023). This paradigm shift stems from the recognition of the cognitive, social, and motivational benefits inherent in gaming experiences. While traditional educational approaches often emphasize rote memorization and passive learning, digital games offer interactive and engaging environments that can stimulate critical thinking, problem-solving skills, and content mastery. Audu (2022), the heart of this intersection lies in the concept of gamification, wherein game elements and mechanics are integrated into non-game contexts, including educational settings. By leveraging the inherent appeal of games, educators can create immersive learning experiences that captivate students' attention and foster deeper engagement with academic content. Winsberg (2023) digital games offer numerous opportunities to scaffold learning experiences across various subjects and disciplines. For instance, educational games can simulate real-world scenarios, allowing students to apply theoretical concepts in practical contexts. Through simulation and role-playing mechanics, students can experiment, make decisions, and observe the consequences of their actions, thereby promoting experiential learning and knowledge retention (Achebe, 2024). Furthermore, Bolton (2020) digital games often feature adaptive difficulty levels and personalized feedback mechanisms, enabling educators to tailor instruction to individual students' needs and learning styles. This adaptive approach promotes differentiated instruction and allows students to progress at their own pace, mitigating the challenges associated with one-size-fits-all teaching methods. Moreover, Akaneme (2022), digital games have the potential to foster collaboration, communication, and teamwork skills among students through multiplayer and cooperative gameplay modes. By working together to achieve common goals, students learn to communicate effectively, resolve conflicts, and collaborate with peers, a crucial aspect of 21st-century skills development (Dogru & Kaleder, 2024). Importantly, research suggests that well-designed educational games can yield positive outcomes in terms of academic achievement. Studies have shown that students who engage with educational games demonstrate improved motivation, higher levels of engagement, and better academic performance compared to those who rely solely on traditional instructional methods (Ezeugo, 2024). However, Ejide (2022), it is essential to recognize that the effective integration of digital games into educational contexts requires careful planning, thoughtful design, and ongoing evaluation. Educators must consider factors such as game selection, alignment with curriculum standards, assessment strategies, and equitable access to technology to maximize the educational benefits of gaming experiences. Ibekwe (2024), digital games have the potential to enhance academic achievement by providing engaging, interactive, and personalized learning experiences. Kirschner, Sweller, and Clark (2022), leveraging the intrinsic appeal of games, educators can create dynamic learning environments that foster critical thinking,



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collaboration, and content mastery. Through thoughtful integration and pedagogical support, digital games can play a valuable role in promoting student success and advancing educational outcomes in the 21st century.

### Methodology

The design of this study is quasi-experimental. Specifically, it involves a pre-test post-test control group design comprising four groups, with two groups serving as the experimental groups and the other two groups functioning as the control groups. This design was adopted because the students who were used for the experiment were intact classes. Randomization would disrupt the existing structure of the school, thus posing some administrative problems. The population of the study consists of all 2,170 junior secondary school class three (JSS II) students enrolled in schools in Lokoja metropolis, drawn from various public and private schools. This diverse demographic includes students with different socio-economic backgrounds, academic abilities, and cultural identities. It encompasses varying levels of English language vocabulary, including those who are proficient, struggling, or at risk of academic underachievement. By employing a multistage sampling technique that combines random selection with stratification, a sample size of 174 students was selected, both representative of the population and capable of providing valuable insights into the impact of digital games on English language achievement among junior secondary school students in Lokoja education zone. The English Achievement Test (EAT) in English vocabulary serves as a crucial instrument for evaluating students' proficiency and comprehension of English vocabulary within the junior secondary school (JSS) curriculum, specifically tailored for JSS II level learners. With its primary focus on assessing English vocabulary mastery, the EAT aimed to provide educators with valuable insights into students' linguistic competencies and areas for improvement. Structured to encompass 30 item questions, the EAT was meticulously designed to cover a diverse range of English vocabulary concepts and applications pertinent to the JSS II curriculum. The reliability of the instruments was determined using the Kuder-Richardson formula 20. The reliability coefficient was based on this formula, which is adopted to assess the reliability coefficient because it is primarily applicable to tests that are dichotomously scored. The reliability assessment was conducted outside the scope of the study. Data collected from the study were analyzed quantitatively. The research questions were answered using mean and standard deviation. The hypothesis was tested using Analysis of Covariance (ANCOVA) at a 0.05 level of significance.

### Presentation of Results

**Research Question 1:** What is the Mean Achievement Scores of Students taught English Vocabulary using Digital Games and Students taught using the Conventional Method?

**Table 1: Descriptive Statistics Associated with Treatment (Digital games Method and Conventional Method)**

Groups	No of students	Pre-test	Post-Test	Mean Score	gain
		SD <sub>1</sub>	SD <sub>2</sub>		
		$\bar{X}_1$	$\bar{X}_2$		
Experimental	74	31.0	11.9	72.5	41.5
Group					
Control group	100	27.5	11.4	54.0	26.5

Based on the descriptive statistics provided in Table 1 for the experimental (digital games method) and control (conventional method) groups, several key observations can be made. The mean pre-test score for the experimental group was 31.0 with a standard deviation (SD<sub>1</sub>) of 11.9, while for the control group, it was 27.5 with SD<sub>2</sub> of 11.4, indicating that the groups started with somewhat comparable initial achievement levels.



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After the intervention, the experimental group's mean post-test score was notably higher at 72.5 (SD1 = 16.0) compared to the control group's mean post-test score of 54.0 (SD2 = 12.4). This suggests that students taught English vocabulary using digital games achieved higher post-test scores on average than those taught using conventional methods. Also, the mean gain score (difference between post-test and pre-test scores) was substantially larger for the experimental group (41.5) compared to the control group (26.5), implying that the digital games method led to greater improvements in English vocabulary achievement scores compared to the conventional method. These findings suggest a potential benefit of using digital games in teaching English vocabulary, as evidenced by higher post-test scores and greater gains in achievement compared to traditional teaching methods.

### Test of Hypothesis

**Hypothesis One:** There is no significant difference in the mean achievement scores of students taught English vocabulary using digital games and those taught using the conventional method.

**Table 2: ANCOVA of Post-Test Achievement Scores of Students by Treatment (Digital games and Conventional Method)**

Dependent Variable: personnel							
Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared	
Corrected Model	1109142.381 <sup>a</sup>	2	529571.172	425.126	.000	.861	
Intercept	202276.397	1	290476.397	326.551	.000	.574	
Achievement	10210.381	1	10566.381	8.429	.005	.040	
Teaching method	908822.102	1	836722.102	728.294	.000	.821	
Error	232337.619	172	1339.674				
Total	4535216.000	174					
Corrected Total	1398080.000	173					

a. R Squared = .855 (Adjusted R Squared = .852)

The ANCOVA results presented in Table 3 indicate several important findings regarding the hypothesis that there is no significant difference in the mean achievement scores of students taught English vocabulary using digital games versus conventional methods. The Corrected Model sums of squares (1109142.381) and the F-statistic (425.126) are both highly significant with a p-value of .000, suggesting that there is a significant overall difference in post-test achievement scores between the groups taught with digital games and those taught with conventional methods. Looking further into the breakdown of sources of variation, the partial eta squared values provide insight into the effect size of each factor. The teaching method (digital games vs. conventional) contributes significantly to the model (partial eta squared = .821), indicating that it explains a substantial amount of the variation in post-test achievement scores. This suggests that the choice of teaching method has a strong influence on students' English vocabulary achievement outcomes. Also, the Intercept and Achievement variables show significant effects on post-test scores, although to a lesser extent compared to the teaching method. The intercept's significant contribution (partial eta squared = .574) indicates the baseline differences in achievement scores across both groups before any intervention. Meanwhile, the Achievement variable's partial eta squared value of .040 suggests that differences in pre-test scores also modestly contribute to the variation in post-test scores. The ANCOVA results strongly reject the hypothesis of no significant difference in mean achievement scores between students taught English vocabulary using digital games and those taught using conventional methods. The substantial effect size of the teaching method indicates that using digital games leads to significantly higher post-test achievement scores compared to conventional



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methods. This finding underscores the effectiveness of digital games as an instructional tool for enhancing English vocabulary learning outcomes among students.

### Discussion of Findings

The evidence from the study showed a significant overall difference in post-test achievement scores between students taught English vocabulary using digital games and those taught using conventional methods. The findings are in line with Okereke's (2020) findings showed that the experimental group expressed a higher level of interest in learning the English language vocabulary than the control group. The researcher focused on the use of digital games on students' achievement and interest in the English language, and not on the use of digital games. Also, OkekeOkosisi's (2022) result revealed that digital games were more effective in facilitating students' achievement in English vocabulary. The findings showed that there was a significant difference between the mean achievement scores of Agricultural Science students taught with digital games and those taught with the traditional model.

### Conclusions

Based on the findings, the study concludes that the findings provide strong support for the integration of digital games into educational practices to enhance English vocabulary learning outcomes among junior secondary school students. The evidence suggests that digital games not only improve overall achievement but also cater to diverse learning needs influenced by factors such as school type. Moving forward, educators and policymakers can leverage these insights to design more effective and inclusive educational strategies that harness the potential of technology to foster student engagement and academic success.

### Recommendations

Based on the findings of this study, the following recommendations were made:

1. Educational institutions should consider integrating digital games into their curriculum for teaching English vocabulary, given their demonstrated effectiveness in improving post-test scores and enhancing learning outcomes. Teachers should receive training and support to effectively incorporate digital games into their lessons, ensuring they align with curriculum objectives and cater to diverse student needs.
2. Policymakers and school administrators should ensure equitable access to digital technologies across all types of schools (public and private). Efforts should be made to bridge the digital divide and provide necessary resources to maximize the benefits of digital games for all students, regardless of their socioeconomic background or school type.

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## Access, Equity and Quality of Vocational and Entrepreneurial Education in the Face of Insecurity in Nigeria

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### Abstract

*Nigeria's Vocational and Entrepreneurial Education (VEE) system face significant disruptions due to escalating insecurity, including insurgency in the Northeast, banditry mostly in the Northwest and North central, and communal clashes in Plateau and Benue States. These challenges hinder access, equity, and quality in skills development, exacerbating unemployment and socioeconomic instability. This paper examines the impact of insecurity on VEE through the lenses of Human Capital Theory, the Capability Approach, and Resilience Theory, arguing that systemic barriers-such as displacement, gender disparities, and institutional fragility-demand urgent policy interventions. The study highlights how conflict erodes human capital, restricts marginalized groups' capabilities, and necessitates adaptive education models. Proposed solutions include mobile and digital training platforms, gender-inclusive programs, public-private partnerships, and psychosocial support to enhance accessibility and learning outcomes. By integrating theoretical and practical perspectives, this paper provides a framework for policymakers to strengthen VEE as a tool for economic recovery and social equity in Nigeria's volatile climate.*

**Keywords:** vocational education, insecurity, human capital, equity, resilience, Nigeria.

### Introduction

Education is the pillar of development the world over; as such, nations and individuals have all agreed that the way out of various problems in life is through education. Thus, the educational standards set up by every nation must be challenging to meet the needs of the students and the society (Atsumbe, 2020). Vocational and Entrepreneurial Education (VEE) is the part of education that plays a very vital role in skills acquisition, youth empowerment, employment creation and economic development of any nation. In the landscape of modern education, the fusion of vocational training with entrepreneurial acumen stands as a transformative force, equipping individuals with not only the technical skills pertinent to their fields but also the business savvy necessary to navigate and succeed in today's dynamic market environments. Establishing accessible, equitable, quality and functional system of VEE system is essential to foster attitudes that steer individuals away from negativity (Emeka, Nwamaka & Manasseh, 2024). This type of education equips citizens with knowledge, understanding and freedom to recognize their capabilities and innate potential. It empowers individuals to think creatively about ideas and issues across various disciplines. VEE empowers students with the right attitudes, skills and knowledge to set up their own businesses and become employers of labor contributing to the socio-economic wellbeing of the country. Nigeria faces significant security challenges, including Boko Haram insurgency in the Northeast, banditry in the Northwest, and communal clashes in other regions. These crises have disrupted education, particularly Vocational and Entrepreneurial Education (VEE), which is vital for youth employability and poverty reduction. Despite governmental efforts and commitments to combat these issues, the trend persists and intensifies, leading to high unemployment rates, food insecurity, soaring living costs, rampant inflation, and widespread loss of life (CBN, 2022; FAO, 2022). Insecurity severely limits access and quality of vocational and entrepreneurial education in Nigeria particularly in rural and conflict affected areas. Recognizing these challenges, there is a growing acknowledgment of the need for holistic and contextually relevant approaches to leverage education as a catalyst for peace and security in Nigeria. By addressing systemic barriers



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to quality education and promoting inclusive and equitable access to learning opportunities, policymakers can empower individuals and communities to become agents of positive change, fostering a more peaceful and prosperous society (Oluwatobi & Ige, 2021). This paper aim to analyze the impact of insecurity on access and quality of VEE and proffer ways forward as strategies for improving access, equity and quality in the sector.

## **Conceptual Clarifications**

### **Concept of Educational Access and Equity**

Nigeria's philosophy of education is based on "equal educational opportunities for all citizens of the nation at the primary, secondary and tertiary levels, both inside and outside the formal school system (NPE, 2013). This means that in order to attain a free, just and egalitarian society, Nigeria requires an atmosphere that is conducive enough to accommodate equal educational opportunities for all citizens at all levels. Access refers to the availability and affordability of education opportunities. Insecurity has led to school closures, displacement of learners, and destruction of infrastructure, disproportionately affecting vulnerable groups (Eze, 2020). Equity ensures fair distribution of educational resources. Insecurity exacerbates disparities, as marginalized groups (women, rural dwellers, and the poor) face greater barriers to VEE participation (UNESCO, 2020). In the opinion of Astumbe (2020), the principle of equity in education has the following features:

- i. Education should be free, universal and compulsory to some extent.
- ii. No one should be left out for one reason or the other from opportunities of education and of funding in public education
- iii. Equal social benefits – benefits of access to higher education, finance, influence, position, amenities and other social needs.
- iv. Equal educational benefits – learning outcomes, knowledge, and skills-knowledge and skill achievable in private schools should also be available in public schools.
- v. Equal educational treatment – procedure and practices should be equal in all educational institutions, be it private or public and at all levels.
- vi. Equal distribution of resources and facilities – particularly teaching and learning facilities such as chairs, desks, classrooms, machines, tools, workshops, laboratories, equipment libraries, books, etc.
- vii. Equal opportunity to a large number of people for earnings through education – job opportunity for a large number of educated people.

### **Quality Education**

Many definitions of quality in education exist, testifying to the complexity and multifaceted nature of the concept. The terms efficiency, effectiveness, equity and quality have often been used synonymously (Ogona & Anele, 2021). Quality education should be considered as a holistic concept that goes beyond basic literacy and numeracy. It encompasses a learner-centered approach, focusing on the overall development of the individual, including cognitive, social, emotional, and physical well-being (Oluwatobi & Ige, 2021). This includes a safe and supportive learning environment, qualified and engaged teachers, relevant and inclusive curriculum, and positive learning outcomes that prepare individuals for life and active participation in society. According to the World Bank (2019), quality entails relevant curricula, qualified instructors, and adequate facilities. Insecurity disrupts teacher availability, practical training, and accreditation processes, diminishing learning outcomes. Considerable consensus exists around the basic dimensions of quality education today, however. Quality education includes: Learners who are healthy, well-nourished and ready to participate and learn, and supported in learning by their families and communities; Environments that are healthy, safe, protective and gender-sensitive, and provide adequate resources and facilities; Content that is reflected in relevant curricula and materials for the acquisition of basic skills, especially in the areas of literacy, numeracy and skills for life, and knowledge in such areas as gender, health, nutrition, HIV/AIDS prevention and peace; Processes through which trained teachers use child-centered teaching approaches in well-managed classrooms and schools and skillful assessment to facilitate learning and reduce disparities; Outcomes that encompass knowledge, skills and attitudes, and are linked to national goals for education and positive participation in society (Humphrey & Crawford, 2015).



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## **Insecurity**

Security is defined as a situation in which citizens of any country are at liberty to go about their normal daily activities without threat to their lives and means of livelihood, safety from bodily harm, disease and human rights violation wherever they may find themselves (Nwoku & Ogayi, 2021). Chris (2021) describes insecurity as lack of stability and continuity of livelihood (unstable and unsteady income), unpredictability of daily life (not knowing what to expect), lack of protection from crime (not feeling safe), and lack of freedom from psychological harm (lack of safety or protection from emotional stress which results from the lack of assurance of knowing that one is wanted, accepted, loved and protected in one's community or neighborhood and by people around.

## **Theoretical Underpinnings**

The following theories are relevant to this study:

### **Human Capital Theory (Becker, 1964)**

Human capital theory, advanced by economists such as Theodore Schultz and Gary Becker, posits that education enhances economic potential and productivity, benefiting society as a whole (Becker, 1964; Schultz, 1961). The theory posits that education enhances productivity and economic growth while insecurity undermines human capital development by limiting skill acquisition, reducing workforce readiness, and stifling entrepreneurship. It serves as a framework that examines the knowledge and experiences of business owners, positing that the human capital of a founder enhances the likelihood of small firms' survival. Investment in human capital via accessible, equitable and quality VEE can drive economic growth and development. High quality VEE can equip individuals with the right skills for entrepreneurship enabling these individuals to become self-employers and also employ others. This will in turn reduce unemployment and poverty which are the primary drivers of insecurity in Nigeria often leading individuals to engage in illegal activities such as theft, kidnapping, and radicalism (Eze, 2020).

### **Social Justice Theory**

The concept of social justice emerged during the Industrial Revolution, as people became aware of the vast inequalities between the wealthy and the working class. Early efforts focused on issues like wealth distribution and the exploitation of labor. The theory was further articulated by scholars such as Bourdieu (1986), Coleman (1988), and Putnam (2000), with emphasis on the importance of social networks, trust, and cooperation in addressing insecurity. Social justice theory focuses on the fair and equitable distribution of resources, opportunities, and privileges within society. It aims to address issues like inequality, discrimination, and injustice, promoting policies and practices that uphold human dignity and equality for all individuals and groups, especially those who have been historically marginalized or oppressed (Emeka, et al, 2024). Social justice emphasizes the importance of ensuring that everyone has access to the resources and opportunities they need to thrive, regardless of their background. By promoting educational strategies that enhance community engagement, cooperation, and trust, accessible, equitable and quality VEE can significantly reduce insecurity in Nigeria.

### **Impact of Insecurity on Access to Vocational and Entrepreneurial Education**

As mentioned earlier, access refers to the availability and affordability of education opportunities (Eze, 2020). Insecurity has affected access to VEE in several ways:

- i. Led to school closures particularly in the banditry affected areas.
- ii. Displacement of learners, teachers and destruction of infrastructure, disproportionately affecting vulnerable groups.
- iii. Destruction of educational infrastructure (e.g., training centers, equipment) leading to Infrastructure and Resource Constraints for human development
- iv. Access to resources needed for supplies and equipment are extremely poor.
- v. Access to new technologies is virtually non-existent.
- vi. Aggravate the number of out-of-school to 15 million children roaming about on the streets of cities in Northern Nigeria (UNICEF, 2020)

### **Impact of Insecurity on Equity in Vocational and Entrepreneurial Education**

Nigeria faces a significant north-south educational imbalance stemming from colonial legacies, religious differences, economic disparities, and geographic factors, with the south historically receiving more resources and engagement with western education (Umar, Ismail & Abdul-Hakim, 2014). This imbalance is evident in lower educational attainment,



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particularly for girls in the north, and contributes to socioeconomic disparities and challenges, such as the high number of out-of-school children in the northern regions. Insecurity has also caused rural vs. urban disparities in access to occasional and entrepreneurial training by causing inequalities in enrollment and between urban and rural settlements. In addition, gender disparities are also exacerbated by insecurity (e.g., girls' education disproportionately affected as it reflects in the enrollment patterns between boys and girls (UNICEF, 2020).

### **Impact of Insecurity on Quality of Vocational and Entrepreneurial Education**

There has been a growing concern about the decline in the quality of the Nigerian education system (Atsumbe, 2020). Earlier literature indicates that the quality of education in some Nigerian institutions in the 1970s was comparable to high quality education offered by top world universities. As a result, there is high unemployment amongst graduates, especially in fields such as engineering (Uzuka & Igwe, 2015). There is also concern about the lack of recognition of Nigerian degrees by overseas universities (Atsumbe, 2020).

Other factors contributing to the decline in quality are:

- i. The unstable environment due to frequent communal clashes and banditry.
- ii. Inadequate funding has resulted in problems such as the breakdown and deterioration of facilities
- iii. Problems of high turnover and difficulties in recruitment and retention particularly in the troubled area
- iv. The teaching and learning materials were inadequate to support the delivery of qualitative education
- v. Lack of adequate facilities to encourage entrepreneurial skills acquisition
- vi. Dominance of theory in the delivery method of teaching entrepreneurship in place of practical and behavior simulation
- vii. Lack of synergy between academia and business/private sector to create a strong link and collaboration.
- viii. Outdated curricula and teaching methods that do not meet the needs of today's job market.
- ix. Skills mismatch, where graduates lack the skills that employers are looking for.

These factors need to be taken into consideration in rethinking promotion of quality education.

### **Challenges posed by Insecurity on Vocational and Entrepreneurial Education**

Insecurity has posed enormous challenges which generally exacerbated inequalities in access to education. Insecurity undermines the quality of educational programs particularly VEE which has suffered enormous setback in Nigeria because of its capital-intensive nature and the need for costly instructional materials and facilities. Other Challenges include:

- i. The disruption and closure of institutions- Insecurity leads to the frequent closure of vocational and entrepreneurial institutions. This forces the internal displacement of students and teachers, making it impossible to maintain a consistent educational process (Jacob, Ndubuisi & Constance, 2021). These issues are linked to the frequent closure of vocational institutions and the internal displacement of students.
- ii. Infrastructure Damage: Attacks and conflicts can result in the destruction of essential infrastructure, including workshops and equipment, further debilitating the learning environment (Umar, et al., 2014).
- iii. Loss of qualified personnel through brain drain scarcity of experts. Teachers and qualified personnel are often forced to leave areas affected by insecurity, leading to a loss of expertise in vocational and entrepreneurial fields.
- iv. Insecurity creates economic uncertainty and instability, which deters private investment and reduces overall funding for educational initiatives, including vocational and entrepreneurial education programs.
- v. Without a stable and safe environment, students cannot effectively learn the practical skills needed to become self-reliant and employable, undermining the core objectives of vocational and entrepreneurial education. This results in low learner outcomes and poor skill acquisition due to disruptions.
- vi. Unemployment-Ultimately, the challenges posed by insecurity exacerbate unemployment and poverty by preventing the cultivation of a skilled workforce ready to meet the demands of the job market.

### **Strategies for Improving Access and Quality of Vocational and Entrepreneurial Education**

Increase funding for vocational education in insecure regions.

- i. Strengthening partnerships between government, private sector, NGOs and Community
- ii. Curriculum Reform: Integration of digital skills, conflict resolution, and peacebuilding into vocational training.
- iii. Capacity-building programs for instructors in insecure regions and Incentives to retain skilled teachers in conflict zones
- iv. Infrastructural provision and rehabilitation of existing buildings.



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v. Safety on campuses and creation of conducive learning environment

Examples of successful vocational training programs in conflict-affected regions (e.g., Nigeria: Northeast Nigeria, other African countries e.g. Rwanda)

1. Northeast Nigeria-The training of 800 youth including women provided under a UNDP project to support early recovery of the conflict-affected community in the North-East Nigeria. The area of the skill provided include farming, tailoring, furniture making, livestock production, computer craft, electrical installation, and maintenance, among others. The training sessions will last for 2 months and trainees who complete the targeted courses and meet the key requirements on various vocational skills will be provided with cash grants to be used to start or enlarge their own businesses UNDP, 2020)
2. Kenya- Kenya Youth Employment Opportunities (KYEOP); A Kenyan government initiative designed to improve young people's well-being and economic prospects by providing them with training, internships, and business grants. The project equips youth with necessary skills for employment and entrepreneurship, addressing the mismatch between training and market demands and ultimately aiming to create sustainable livelihoods and reduce unemployment. Key aspects include empowerment, skills development and employment and entrepreneurship (The National Youth Opportunities Towards Advancement <http://mis.kyeop.go.ke/>)
3. Sierra Leone: A Business Development (BD) program was implemented as part of the nation's Technical and Vocational Education and Training (TVET) strategy. While initially successful, the program faced challenges like donor funding decreases and the need to address social inequality and youth unemployment, which contributed to renewed instability.
4. Morocco: Morocco is a case study of adoption of good skills acquisition programme that suits modern technology-derived work practices. It has established over 300 vocational training centres with the capacity to enroll 500,000 trainees to be trained in 87 different trades in the areas of technical, vocational, entrepreneurial, agricultural, creative, entertainment etc. The Moroccan model has the potential for meaningful skills acquisition by trainees.

## Conclusion

Major educational transformations are required in the Nigerian education system. The tasks ahead are numerous and daunting but with focus and good educational policies, planning, implementation, motoring and supervision, the problems can be tackled. It is important to note that Government alone cannot surmount all the identified issues of concern. As such it will be impossible for these tasks to be tackled without the support of the private sector and community development efforts. Therefore, addressing the challenges requires a holistic and inclusive approach

## Recommendations

Based on the issues raised by the study as pertains to access, equity and quality of vocational entrepreneurship education (VEE), the following recommendations are proffered:

- i. Enhance the safety of campuses and creation of conducive learning environment
- ii. Increase funding for vocational education in insecure regions.
- iii. Strengthen partnerships between government, private sector, NGOs and Community and for infrastructural provision, rehabilitation of existing buildings and enhance synergy between academia and business/private sector to create a strong link and collaboration.
- iv. Curriculum reform to reduce dominance of theory in the delivery method of teaching entrepreneurship in place of practical and behavior simulation and integrate conflict resolution and peace building. These measures will help to reform the outdated curricula and teaching methods that do not meet the needs of today's job market.
- v. Improve access to resources needed especially new technologies that are virtually non-existent and other supplies and equipment are extremely poor.
- vi. Improve incentives to retain skilled teachers in conflict zones to reduce the problems of high turnover and difficulties in recruitment and retention particularly in the troubled areas.



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*Impact of Vigilante Service Group on ... Abdulsalam, O. S., Et. al. (2025)*

## Impact of Vigilante Service Group on Crime Control for Sustainable Development in Ilorin West Local Government Area of Kwara State, Nigeria

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### Abstract

*This study assesses the impact of vigilante service group on crime control for sustainable development in Ilorin West Local Government, Kwara State. The Population of the study comprised of all community members and vigilante in Ilorin West Local Government. The sample for this study comprised of 120 respondents selected through a dip-hat sampling technique. Descriptive survey design was employed in the study and a questionnaire titled "Impact of Vigilante Service Group on Crime Control for Sustainable Development Questionnaire (IVESGCCSDQ)" with a reliability of 1.9. Four research questions were raised and answered using mean and standard deviation. The results shows that crime constitutes to social problem in the aspect that crime has led to disruption of business activities and crime has led some to marriage divorce in Ilorin West local government area. The following recommendations were suggested: that government should encourage the vigilante group service by allocating adequate fund to execute their duties couple with the provision of ammunition to protect the populace of a community. The community members should not obstruct the vigilante group during the course of executing their duties in the community like controlling crime.*

**Keywords:** Vigilante Service group, Crime Control, Sustainable Development, Policing, Community, Livelihood.

### Introduction

The importance of law and order to orderly development and growth of a society, both in the physical and economic sense, cannot be over emphasized. It is only a mind that is secured and at peace that can rationally address the issues of procreation, economic development and societal growth. A disturbed mind is a restless and distraught personality. It is therefore imperative to have peace and order in the society to assure its growth and development (Balami, Ahmed & Yusuf, 2016) Crime is like other concepts in social sciences, which have no generally accepted definition. At first sight, it seems easy to define crime as doing something wrong or relating crime to immorality. Is there any agreement over what is morally wrong or right? Should all moral wrongs be crimes? It could also be asked whether all crimes are moral wrongs. In a strict legal sense, crime is the breaking of rules or laws for which some governing authority (via mechanisms such as legal systems) can ultimately prescribe a conviction (Ritzer, 2021). Crime in the social and legal framework is the set of facts or assumptions that are part of a case in which there were committed acts punishable under criminal law, and the application of which depends on the agent of a sentence or security measure criminal. In criminal law, crime is an act of omission which attracts sanctions such as fines, imprisonment or even death.

Peace, safety and security are both necessary and indispensable requirements for development and the attainment of good quality of life for any human society. They provide the requisite enabling environment for citizens to live and work towards social, economic and political development of the society (Groenewald & Peake, 2020). By the same token, their absence develops and heavily compromises the dignity and quality of life of both individuals and society. Furthermore, insecurity impacts negatively on all citizens through losses of property, life and limb, or through loss of confidence from fear and violence. It is against this backdrop that the delivery of safety and security is considered a justifiable public good and the very essence of the state (Lubuva, 2019). Human safety and security are indeed human rights having a value of their own and serving an instrumental function in the construction of human contentment and prosperity (Odinkalu, 2018). Unfortunately, social life in Nigeria has remained largely characterized by fear and insecurity (Odekunle, 2018; Alemika & Chukuma, 2018) in a manner that suggests that the country lacks the capacity to discharge its security functions



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especially that of policing. The Kwara vigilante service groups may not have a cordial and mutual relationship with the formal policing structure. The reasons for this may include the feeling by the police that they are arrogating their constitutional powers to themselves. Another reason may be the fact that the police are benefiting from the high and unabated crime rate in the country (Amuka, (2018). The vigilante group is a non-governmental organization founded about 20 years ago it was registered by cooperate affairs commission, with the headquarter in Kaduna and zonal offices across the entire country, the aim of the group maintains outmost security in the country, the organization pullout all stop to curb up crime must specially in this current security upsurge, the group are out to protect people's, property and maintain law and order, breed peace and prosperity in our dear country. Sustainable development is the organizing principle for meeting human development goals while at the same time sustaining the ability of natural systems to provide the natural resources and ecosystem services upon which the economy and society depend. The desired result is a state of society where living conditions and resource use continue to meet human needs without undermining the integrity and stability of the natural system. Sustainable development can be classified as development that meets the needs of the present without compromising the ability of future generations.

### **Statement of the problem**

In recent years, many communities in Nigeria have witnessed crimes of various descriptions and Ilorin West Local Government Area of kwara State is not an exception. Many factors contribute to inappropriate crime control or prevention in Ilorin West such as ineffective of police which their ineffectiveness may be as a result of the fact that they are under-staffed, under-equipped, corrupt and lacked public cooperation. These have created problem of under policing in Nigeria including Ilorin West Local Government Area of Kwara State. Thus, violence and property crimes are committed on daily basis without detection and prosecution. The issue of insecurity and lawlessness where every member tagged as hoodlums in a certain community like Oja-Oba, Oja Tuntun, commit atrocities with late intervention of security agencies after much damages might have been done to properties even extent to the bodily endangering of common men or women in the community. This evident in the unknown acclaimed political thugs clashed at the middle of January 2019, where properties were damaged and even recorded victims. Despite the clash of these thugs for about hours, there is no security agencies to abate their atrocities not alone apprehend any thugs for prosecution which expose the people around this place to danger of insecurity. Inability of the police to protect the lives and properties of members of the society has given rise to community efforts at ensuring their own security. Okoro (2017) identified corruption, brutality, oppressive and repressive postures, high level of extortion, high cost of assessment to police services, poverty, non-personal relationships, as some of the factors that made the people lose faith in the police and their consequent preference for informal policing structures. Furthermore, the emergence of vigilante in crime control couple with their roles in the society should be well stated in a written document to legally binding them to some certain specified roles and strengthen their relationship with other security agencies especially police. It is also essential that, whenever the region police as well as the Nigerian Police Force draw their plan for community policing, consultation with the community should be made to fish out some certain obstacles that may obstruct their work in time of action.

### **Objectives of the Study**

The broad objective of this study is to examine the contributions of vigilante groups in crime control in Ilorin West Local Government Area of kwara State. The specific purposes are:

1. identify crime rate and its types in Ilorin West Local Government
2. to find out the extent to which crime constitutes a social problem in Ilorin West Local Government
3. to determine the extent vigilante groups' capacity in controlling crime in Ilorin West Local Government

### **Research Questions**

1. What are the influences of vigilante service group on the eradication of crime in Ilorin West Local Government Area
2. Does vigilante service group reduce crime rate in Ilorin West Local Government Area
3. To what extent does crime constitute a social problem in Ilorin West Local Government?

### **Methodology**

Descriptive survey design was used for the study. Descriptive survey design is concerned with collecting data from a sample of a population in order to describe conditions or relationships that exist, opinions that are held, processes that are going on, effects that are evident or trends that are developing. This research design was considered appropriate for the



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study because it helped the researcher to obtain relevant information from the respondents on the impact of vigilante service groups on crime control for sustainable development. The total population for this study comprises of selected community members in Ilorin West Local Government, Kwara State. Community members was purposively selected for this study because they are familiar with the roles vigilante groups plays in controlling crime. Thus, hundred and twenty (120) members from various communities within Ilorin West, Kwara State were purposively selected for the study. A well-structured questionnaire with both face and content validity established by selected experts and a reliability index of 0.79 was used to gather appropriate data for the study, while the data collected was analysed with the use of descriptive statistic

### **Presentation of Results**

The results of the data analysis are represented in such a way to highlight the background variables, research question, and test of hypothesis and summary of findings. The hypothesis was tested at 0.05 level of significance.

### **Demographic Representation of Participants**

Participants were asked to indicate their religion as shown in Table 1.

**Table 1: Distribution of Participants by Religion**

Religion	Frequency	Percent
Islam	75	62.5
Christianity	45	37.5
Total	120	100.0

Table 1 reveals that (62.5%) with 75 frequency represents the population of respondent by religion of Islam while 37.5% the result represent respondent of Christianity religion. Base on this, it was indicated that respondents with Islamic faith participate more than Christianity religion.

Participants were asked to indicate their gender as shown in Table 2.

**Table 2: Distribution of Participants by Gender**

Gender	Frequency	Percentage (%)
Male	54	45.0
Female	66	55.0
Total	120	100.0

As shown in Table 2, 54(45.0%) of the respondents were males while 66(55.0%) were females. This shows that more females participated in the study than males. Participants were asked to indicate their marital status as shown in Table 3.

**Table 3: Distribution of Participants by Marital Status**

Marital Status	Frequency	Percent (%)
Single	68	56.7
Married	44	36.7
Divorced	6	5.0
Widow	2	1.7
Total	120	100.0

As shown in Table 3, 68(56.7%) of the respondents were single, while married status of the respondents were represented by 44(36.7%), 6(5.0%) indicate respondents divorced marital status, while 2(1.7%) were widow. This shows that most of the respondents that participate in this study were single.

**Research Questions One:** *What are the influences of vigilante service group on the eradication of crime in Ilorin West local government area?*

To answer research question one, responses were analyzed using descriptive statistics of Mean, Standard Deviation and Rank. Responses on a 4-point scale. A mean response of 1.5 and below was indicative of influences of vigilante group on eradication of crime as shown on Table 5. The mean value indicated the most agreed statement by the respondents while the mean that beyond this benchmark set is determined as disagreed statement and they shall be less considered respectively.



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**Table 5:** Mean Response on Influences of Vigilante Group on Eradication of Crime

	N	Min.	Max.	Mean	SD	Rank
Youth has stopped engaging in criminal behavior because of vigilante group in my community	120	1	4	1.42	.588	1 <sup>st</sup>
Vandalism acts has been in control as a result of vigilante groups in my areas	120	1	4	1.62	.688	3 <sup>rd</sup>
Vigilante groups have been able to curb armed robbery in my community	120	1	4	1.61	.714	2 <sup>nd</sup>
There is no night party in my community due to the formation of vigilante groups	120	1	4	1.79	.766	5 <sup>th</sup>
There is no thief in my community because of vigilante	120	1	4	1.66	.772	4 <sup>th</sup>
Valid N (listwise)	120					

As shown on the table 5, with a mean response of 1.42 which is below the cut score of 1.5 and is rank 1<sup>st</sup>, the item asserted that youth has stopped engaging in criminal behavior because of vigilante group in the community as the influence of vigilante group on the eradication of in Ilorin West Local Government Area of Kwara state.

**Research Questions Two:** *Does vigilante service group eradicate crime in Ilorin West local government area?*

To answer research question two, responses were analyzed using descriptive statistics of Mean, Standard Deviation and Rank. Responses on a 4-point scale. A mean response of 1.5 and below was indicative of level of crime eradication as shown on Table 6. The mean value indicated the most agreed statement by the respondents while the mean that beyond this benchmark set is determined as disagreed statement and they shall be less considered respectively.

**Table 6:** Mean Response on Relevance of Level of Crime Reduction

	N	Min	Max	Mean	SD	Rank
Criminal behaviours have been reduced in my community	120	1	4	1.46	.607	1 <sup>st</sup>
The rate of crime before the formation of vigilante is high	120	1	4	1.65	.669	2 <sup>nd</sup>
Increase in crime rate has been reduced due to the formation of vigilante groups	120	1	4	1.69	.708	4 <sup>th</sup>
The level of sexual abuse crime is low in my community as a result of vigilante groups	120	1	4	1.97	.840	5 <sup>th</sup>
The level of cultism in my area has been reduced because of vigilante groups	120	1	4	1.65	.741	2 <sup>nd</sup>
Valid N (list wise)	120					

As shown on the table 6, with 1<sup>st</sup> rank and a mean response of 1.46 which is below the benchmark of 1.5, there is reduction of criminal behavior in the community as a result of crime eradication level in Ilorin West Local Government Area of Kwara state. Other ranks were considered less importance in crime eradication in Ilorin West Local Government Area.

**Research Questions Three:** *To what extent does crime constitute a social problem in Ilorin West Local Government?*

To answer research question two, responses were analyzed using descriptive statistics of Mean, Standard Deviation and Rank. Responses on a 4-point scale. A mean response of 1.9 and above was indicative of extent crime constitutes to social problems as shown on Table 7. The mean value indicated the most agreed statement by the respondents while the mean that below this benchmark set is determined as disagreed statement and they shall be less considered respectively.

**Table 7:** Mean Response on Relevance of Extent Crime Constitutes to Social Problem

	N	Min	Max	Mean	S. D	Rank
Increasing crime rate led to loss of property in my community	120	1	4	1.72	.852	4 <sup>th</sup>
Crime has led to disruption of business activities	120	1	4	1.94	.910	1 <sup>st</sup>
Increase in crime has contributed to social problems	120	1	4	1.68	.811	5 <sup>th</sup>



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	N	Min	Max	Mean	S. D	Rank
Increasing crime rate led to loss of property in my community	120	1	4	1.72	.852	4 <sup>th</sup>
Crime has ruined some families in my community	120	1	4	1.88	.927	3 <sup>rd</sup>
Crime has led some to marriage divorce in my community	120	1	4	1.90	.854	2 <sup>nd</sup>
Valid N (list wise)	120					

As shown on the table 6, with a mean response of 1.94 and 1.90 which are above the set score of 1.90 with 1<sup>st</sup> and 2<sup>nd</sup> rank respectively holds, have the statement that the extent in which crime constitutes to social problem in the aspect that crime has led to disruption of business activities and crime has led some to marriage divorce in my community (i.e Ilorin West Local Government Area of Kwara state).

### Discussion of Findings

The study focused on the impact of vigilante service group on crime control for sustainable development in Ilorin West local government area. The findings revealed based on the first table which gave information about demographic distribution by religion where it indicates that respondents that practice Islam participated more than the Christianity faith with 62.5 to 37.5 percentage. Also, table two provides information on respondents based on 54 (45.0%) of the respondents were males while 66 (55.0%) were females. This shows that more females participated in the study than males. On final note on demographic information on the ground of marital status 68 (56.7%) of the respondents were single, while married status of the respondents were represented by 44 (36.7%), 6 (5.0%) indicate respondents divorced marital status, while 2 (1.7%) were widow. This shows that most of the respondents that participate in this study were single. Table 3, 38 (31.7%) of the respondents were civil servant, 62 (51.7%) represent the respondents that are student, 18 (15.0%) indicate respondents' occupation of trading, while 2 (1.7%) were professional. This shows that most of the respondents that participate in this study were student as it has high percentage in the frequency counts.

Findings from the study revealed that, with a mean response of 1.42 which is below the cut score of 1.5, the item asserted that youth has stopped engaging in criminal behavior because of vigilante group in the community as the influence of vigilante group on the eradication of in Ilorin West Local Government Area of Kwara state. This result is in line with the study of Adegbusi (2019) in a study conducted in Ondo state of Nigeria on 'Vigilante groups and the task of policing' with 500 respondents found that vigilante service groups are important in crime prevention and control as majority of the respondents indicated that vigilante service groups can partner with the police to control and prevent crime in the state. More also, the finding discovered that there is reduction of criminal behavior in the community as a result of crime eradication level in Ilorin West Local Government area. It was further indicated in the study that crime has led to disruption of business activities and crime has led some to marriage divorce as the extent in which crime constitutes to social problem. This finding agrees with the study of Dönmez ((2018)) who observed that in such societies, the culture of violence is ingrained in the practices of different groups to such an extent that it goes out of control.

### Conclusions

This study investigated the impact of vigilante service group on crime control for sustainable development in Ilorin West Local Government Area. The findings revealed that that youth has stopped engaging in criminal behavior because of vigilante group in the community as the influence of vigilante group on the eradication of in Ilorin West Local Government Area of Kwara state. Also, there is reduction of criminal behavior in the community as a result of crime eradication level in Ilorin West Local Government Area of Kwara state. The study furthered indicated that the extent in which crime constitutes to social problem in the aspect that crime has led to disruption of business activities and crime has led some to marriage divorce in Ilorin West local government area. The community perception of vigilante groups held that the existence of vigilante groups to promotes peace and unity in my community in Ilorin West Local Government Area of Kwara state.

### Recommendations

In the view of this study, the following recommendations were made:



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1. The government should encourage the vigilante group of service by allocating adequate fund to execute their duties couple with the provision of ammunitions to protect the populace of a community.
2. Police should mitigate the level of checking the extent in which vigilante group execute their duties in curbing and controlling crime in the community especially in Ilorin West local government.
3. The community members should not obstruct the vigilante group during the course of executing their duties in the community like controlling crime.
4. There should be prior recognition of the existence of vigilante group and formulated regulations that will oversee their practices in curbing crime in the society.

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*Comparative Analysis Between ... Fatusi, O. A. (2025)*

## Comparative Analysis between Textbooks Availability and Utilisation on Achievement in Chemistry among Secondary School Students in Abuja Municipal Area Council, Abuja, Nigeria

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### Abstract

*This study investigated correlation among availability, utilisation of textbooks and students' achievement in chemistry in Senior Secondary Schools in AMAC, Abuja. The study adopted the descriptive research design of the correlational type. Ten public secondary schools were randomly selected from public secondary schools in AMAC, Abuja. Simple random sampling technique was used to select 30 SS II students from each school, making a total of 300 SS II students. In all, 300 SS II students participated in the study. Three research instruments were used for data collection: Questionnaire on Text Availability ( $r=.76$ ), Questionnaire on Text Utilisation ( $r=.78$ ) and Achievement Test in Chemistry ( $r=.87$ ). Data collected were analysed using Pearson Product Moment Correlation and Multiple Regression Analysis. Findings of the study revealed that text availability had a negative relationship with students' achievement in chemistry ( $r = -.065$ ), text utilisation had a positive relationship with students' achievement in chemistry ( $r = .091$ ). The joint contribution of text availability and utilisation to students' achievement in chemistry was not significant ( $F_{(2; 297)} = 2.469$ ; Adj.  $R^2 = .010$ ;  $p>0.05$ ). Also, text utilisation ( $\beta = .114$ ) had more relative contribution to students' achievement in chemistry than text availability ( $\beta = -.093$ ). Based on the findings, it was recommended that students who wish to excel in chemistry, must be ready to utilise all the recommended texts. Ministry of Education and external examination bodies should try to always recommend chemistry textbooks whose approach is simple and that can easily be understood by students. Teachers of chemistry should encourage students to read the prescribed textbooks and ensure that students read all the recommended textbooks.*

**Keywords:** Availability, Utilisation, Textbooks, achievement, Chemistry

### Introduction

Chemistry is a basic area of study which is concerned with the composition, structure, characteristics, and changes of matter. Standing in the center of scientific research, it is frequently referred to as the "central science" because to the vital link it creates between the biological and physical sciences, which supports and enhances disciplines like biology, physics, medicine, engineering, environmental science, and materials science. Therefore, having a solid foundation in chemical principles offers a strong basis for scientific literacy, creativity, and technological advancement. Chemistry is essential for young students, especially those who want to work in science, engineering, health sciences, and technology-related fields, because it develops critical thinking, problem-solving skills, and creativity in scientific research (Omoifo, 2012; Kasper, 2024).

Chemistry is relevant in many aspects of daily life, not just theoretical research. Common family habits, interactions in the marketplace, agricultural pursuits, health care routines, and even technical applications seen in social media material all incorporate its themes. Even when people are not aware that they are participating in chemical processes, many everyday activities depend on chemical reactions and principles. For instance, heat-induced chemical reactions during cooking cause molecules to break down and recombine, improving the food's flavor, texture, and nutritional content. The process of washing garments with detergents demonstrates how surfactants work by emulsifying and dissolving oil and grime. By changing the pH levels and changing the chemical connections in plant fibers, adding limestone (calcium compounds) to beans or unripe plantains softens the food and increases nutritional availability and cooking efficiency. Chemistry is ubiquitous, as seen by other everyday activities. Using a stainless-steel spoon to help transfer heat while boiling meat might also affect the cooking process by interacting with trace minerals. Kerosene or gasoline can be separated from water to show that liquids are immiscible due to variations in density and polarity. The fermentation process, a biological process in which microorganisms break down carbs to produce flavor and enhanced digestibility, is used to prepare pap (ogi) from ground maize. The same is true for the ripening of fruits, the browning of bread, the corrosion of metals, the purification of water, the manufacture of cosmetics, and the use of batteries. Essentially, chemistry is a fundamental aspect of everyday life and is not limited to labs or scholarly debates. A greater understanding of these common chemical processes fosters



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scientific curiosity, informed decision-making, and an improved capacity for students to relate what they learn in the classroom to practical applications. Chemistry continues to be essential to human advancement and sustainable development as civilisations innovate in fields including agriculture, nanotechnology, pharmaceuticals, renewable energy, and environmental management. Similarly, the application of pesticides to eradicate pests is an example of environmental chemistry and applied toxicology, showing how chemical compounds are designed to interfere with insect biological processes. Ice blocks melting to produce drinking water highlights physical processes controlled by heat energy and represents a basic phase transition from solid to liquid. The traditional method of making African fufu from cassava demonstrates both biochemical and physical processes, including starch gelatinisation, enzymatic hydrolysis, and mechanical transformation. Combustion and oxidation reactions, which release energy and create new chemicals, are analogous to the burning of materials in air. One common illustration of oxidation and corrosion is the rusting of an iron nail in the presence of oxygen and moisture. These commonplace observations support the idea that chemistry is not a separate field but rather a fundamental aspect of human life, permeating everyday activities, cultural customs, agriculture, technology, and interactions with the environment (Forrester, 2012; Tatiana, 2023). Chemistry plays a fundamental role in everyday life and the advancement of the country, however students' performance in the subject at all educational levels continues to be a source of concern. Research has repeatedly connected this difficulty to a number of causes, such as a lack of access to up-to-date and pertinent textbooks, a lack of lab space and teaching resources, and the persistence of teacher-centered and ineffectual teaching methods (Eya & Ezeh, 2020; Iyiola & Ezeh, 2024). Additionally, it has been determined that demographic and affective factors, such as gender differences and learners' interest, are important indicators of chemical performance. It is often known that interest in particular is a strong motivating factor that affects students' engagement, perseverance, curiosity, and general academic success. Additionally, empirical research shows that gender accounts for a small but significant percentage of the variation in chemistry achievement, indicating that attitude and gender dynamics are significant factors in determining students' cognitive and affective outcomes in the subject (Eya & Ezeh, 2020; Iyiola & Ezeh, 2024). In an effort to address the persistent problem of students' poor performance in chemistry, a considerable body of scholarly research has focused on identifying effective instructional approaches, strategies, and pedagogical innovations. While these studies have contributed meaningfully to improving the teaching and learning of chemistry, a notable research gap remains in determining the relationship among the availability, utilisation of textbooks and students' achievement in chemistry, particularly in senior secondary schools in Abuja Municipal Area Council (AMAC). This gap highlights the need to broaden the scope of inquiry beyond pedagogical methods alone. As Obemeata (1995) rightly observes, enhancing teaching methods and instructional strategies, though valuable, cannot solely resolve the persistent challenge of poor academic performance. The implication is that systemic and resource-related factors, including the provision and use of quality instructional materials, must also be carefully examined.

A textbook, often known as a text-based instructional resource, is one of the most widely used and acknowledged teaching and learning aids (Rahmad, 2016). According to Ogunsiji (2015), textbooks are an essential component of educational resources and the main means of efficiently disseminating knowledge within the educational system. In addition to providing teachers and students with instructional structure and security, textbooks offer a thorough, well-organized source of content and make information retrieval easier. They also assist with lesson planning, direct the implementation of the curriculum, and broaden the scope and structure of the material in ways that improve understanding. The value of textbooks is further highlighted by Garinger (2010), who points out that they greatly lessen the workload for teachers by reducing preparation time, providing pre-made learning activities, and offering a clear record of classroom progress to meet the needs of both internal and external stakeholders. The core of the educational process, according to Chambliss and Calfee (1998), is the textbook, which provides students with a multitude of factual knowledge while also providing them with opportunities to encounter new ideas, thoughts, and experiences. The same is true for textbooks, which Mohammad and Kumari (2007) contend are essential to educational reform and quality improvement. Textbooks that are well-designed benefit teachers and students in their learning process by acting as organized teaching guides and useful learning aids (Frederick, 2007). However, the effectiveness with which textbooks are used determines their actual educational worth. A textbook without an active reader, according to Giorgi and Nancy (2003), is just printed material; it only acquires academic significance when students interact with its content through curiosity, interpretation, and past experiences. Selden and Widdowson (1993) support this viewpoint by underlining the learner's role in meaning construction and emphasizing that



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interacting with text is a dynamic cognitive process that involves interpretation, critical thinking, and reflection. This supports the notion that textbook availability and intentional use are crucial elements of successful learning, especially in a topic as conceptually complex as chemistry. Student outcomes are impacted by textbook availability and use, according to recent empirical studies. In quantitative research of recently released textbooks, Li & Wang (2024), for instance, discovered a strong positive impact of high school chemistry textbook use on students' interest, attitudes, and achievement in chemistry. Their results show a relationship between achievement and the frequency, purpose, belief, and willingness with which students use textbooks. The efficient use of textbooks had a significant impact on students' academic performance in public secondary schools in Kenya, as Mwikali, Kiende, and Ogeta (2024) revealed. Furthermore, a study conducted in Southwest Nigeria by Ajiboye and Tunde (2022) discovered a favorable and statistically significant correlation between students' academic performance in teacher-education colleges and the availability of material resources, including textbooks. The significance of textbook availability and use in promoting academic success is reaffirmed by these recent studies.

In line with these findings, many key propositions emerge. First, in resource-constrained settings like AMAC, it is not enough simply to procure textbooks; schools must ensure that textbooks are available to students when needed, in sufficient quantity, and that they are of appropriate quality (updated editions, readable language, aligned with curriculum). For instance, Fatoba (2020) found that poor readability of recommended chemistry textbooks in Nigerian schools was a limiting factor in student achievement. Second, the utilisation of textbooks by students should be monitored and encouraged: frequent use of textbooks for reading, homework, self-study, revision and reference fosters better learning outcomes. Studies show that merely owning textbooks is insufficient if students do not engage with them. Third, there should be a conceptual shift in research and practice to examine correlations and mediating mechanisms; for example, how availability leads to utilisation, how teacher encouragement affects the extent of textbook use, how student attitude mediates the relationship between textbook use and achievement. Given this context, the proposed study focusing on chemistry in senior secondary schools in AMAC is timely and necessary. It moves the focus beyond pedagogy into the domain of instructional resources. Specifically, the study investigates: (a) the extent of availability of chemistry textbooks in senior secondary schools in AMAC; (b) the extent to which those textbooks are utilised by both teachers and students; and (c) the relationship between availability, utilisation of textbooks and students' achievement in chemistry. By doing so, the study complements previous research on teaching strategies by highlighting the resource-factor dimension of chemistry learning.

In summary, while improvements in teaching methods and strategies remain vital, they are not sufficient in isolation. Textbooks, when available in adequate number, of suitable quality, and actively utilised by learners, can play a significant role in improving students' achievement in chemistry. As the recent literature suggests, the presence and effective use of textbooks are correlated with better learning outcomes (Li & Wang, 2024; Mwikali et al., 2024; Ajiboye & Tunde, 2022). Thus, to enhance chemistry education in senior secondary schools especially in contexts such as AMAC, teachers, curriculum planners and policymakers must give due attention to ensuring textbook availability and fostering active utilisation as part of a broader strategy to raise achievement in chemistry. Many studies have shown that text availability and utilisation are strong determinants of students' achievement in English language, Mathematics, Economics and Biology but to the best knowledge of the researcher, these factors have not been significantly linked to chemistry at senior secondary school level especially in AMAC, Abuja. Therefore, this study investigated correlation among availability, utilisation of textbooks and students' achievement in chemistry in senior secondary schools in AMAC, Abuja.

### **Statement of the Problem**

Chemistry is a fundamental branch of science that focuses on the structure, composition, properties, and transformations of matter. Positioned at the heart of scientific inquiry, it is often described as the central science because it forms a critical bridge between the physical and life sciences, supporting and enriching fields such as physics, biology, medicine, engineering, environmental science, and materials science. Despite the importance attached to chemistry in the senior secondary school curriculum in Nigeria, students' performance in the subject yearly is below average. Reports from WAEC and NECO have shown that students' persistent poor performance in chemistry is as a result of so many factors. As a way of addressing this problem, numerous studies have been carried on methods and strategies of teaching chemistry with less emphasis on correlation among availability, utilisation of textbooks and students' achievement in chemistry in senior



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secondary schools in AMAC, Abuja. Therefore, this study investigated correlation among availability, utilisation of textbooks and students' achievement in chemistry in senior secondary schools in AMAC, Abuja.

### Research Questions

1. What relationship exists among text availability, utilisation and students' achievement in chemistry?
2. What is the relative contribution of text availability, utilisation and students' achievement in chemistry?
3. What is the joint contribution of text availability, utilisation and students' achievement in chemistry?

### Methodology

The study adopted the descriptive research design of the correlational type. Ten public secondary schools were randomly selected from public secondary schools in AMAC, Abuja. Simple random sampling technique was used to select 30 SS II students from each school, making a total of 300 SS II students. In all, 300 SS II students participated in the study. Three research instruments were used for data collection: Questionnaire on Text Availability ( $r=.76$ ), Questionnaire on Text Utilisation ( $r=.78$ ) and Achievement Test in Chemistry ( $r=.87$ ). Data collected were analysed using Pearson Product Moment Correlation and Multiple Regression Analysis.

### Presentation of Results

**Research Question 1:** What relationship exists among text availability, utilisation and students' achievement in chemistry?

**Table 1: Correlation Matrix of the Independent Variables (text availability and utilisation of textbooks) and Students' Achievement in Chemistry**

Variables	Students' Achievement in Chemistry	Text Availability	Text Utilisation
Students' Achievement in Chemistry	1		
Text Availability	-.065 (.264)	1	
Text Utilisation	.091 (.117)	.249 (.000)	1
N	300	300	300
Mean	15.49	14.20	39.96
Standard Dev.	4.40	1.10	4.11

Table 1 shows the relationship that exists between the independent variables (text availability and utilisation) and students' achievement in chemistry. The result indicates that text availability had a negative relationship with students' achievement in chemistry ( $r = -.065$ ). This implies that the more text availability, the less students' achievement in chemistry. However, text utilisation had a positive relationship with students' achievement in chemistry ( $r = .091$ ). This implies that the more of the students utilised the available texts, the more their achievement in chemistry increased. Hence, text utilisation correlated directly with students' achievement in chemistry.

**Research Question 2:** What is the relative contribution of text availability, utilisation and students' achievement in chemistry?

**Table 2: Summary of the Regression Analysis of the Joint Contribution of the Independent Variables to Students' Achievement in Chemistry**

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	94.804	2	47.402	2.469	.086 <sup>b</sup>
	Residual	5702.192	297	19.199		
	Total	5796.997	299			

$R = .128^a$ ;  $R \text{ Square} = .016$ ;  $\text{Adjusted } R \text{ Square} = .010$ ;  $\text{Std. Error of the Estimate} = 4.38170$

Table 2 shows the joint contribution of the independent variables (text availability and utilisation) to students' achievement in chemistry. The result indicates that the joint contribution of text availability and utilisation to students' achievement in chemistry was not significant ( $F_{(2; 297)} = 2.469$ ;  $\text{Adj. } R^2 = .010$ ;  $p > 0.05$ ). This implies that the two independent variables, when taken together, did not significantly contribute to students' achievement in chemistry. However, the result also shows that  $\text{Adj. } R^2 = .010$ , which implies that 10% of the variance in students' achievement in chemistry was accounted for by



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the joint contribution of the two independent variables, while other variables not included in this model may have accounted for the remaining 90% variance.

**Research Question 3:** What is the joint contribution of text availability, utilisation and students' achievement in chemistry?

**Table 3: Summary of the Regression Analysis of the Relative Contribution of the Independent Variables to Students' Achievement in Chemistry**

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
			Std. Error	Beta		
1	(Constant)	15.912	3.696		4.305	.000
	Text Availability	-.372	.238	-.093	-1.566	.118
	Text Utilisation	.122	.064	.114	1.916	.056

Table 3 shows the relative contribution of each of the independent variables (text availability and utilization) to students' achievement in chemistry as expressed in standardized coefficient of beta weight. The result indicates that text utilisation ( $\beta = .114$ ) had more relative contribution to students' achievement in chemistry than text availability ( $\beta = -.093$ ). This implies that text utilisation is the variable that would predict students' achievement in chemistry.

### Discussion of Findings

Table I showed that students' achievement in chemistry had a positive low and non-significant relationship with text availability and text utilisation. However, text availability and utilisation had a positive high significant relationship. This implies that the more text availability increased, the more the text utilisation also increased. This is in line with the study of Oduwale (2011) who revealed that text availability and utilisation had a positive high significant relationship. This is against the finding of Christopher (2010) who revealed in his study that text availability and utilisation had no positive significant relationship. Table II showed that text availability and utilisation had not significant joint contribution to students' achievement in chemistry. This implies that the joint contribution of text availability and text utilisation did not bring about a significant variance in students' achievement in chemistry. This is in line with the study of Christopher (2010) who revealed in his study that text availability and utilisation did not predict students' achievement. This is against the finding of Heyneman, Farrell and Sepulveda-Stuardo (1978) who revealed that text availability and utilisation would jointly predict students' academic achievement. Table III indicated that text utilisation had a more relative contribution to students' achievement in chemistry. However, the relative contribution of each of both variables was not significant. This is in line with the study of Christopher (2010) who revealed in his study that text availability and utilisation did not predict students' achievement. This is against the finding of Heyneman, Farrell and Sepulveda-Stuardo (1978) who revealed that text availability and utilisation would jointly predict students' academic achievement.

### Conclusion

It can be concluded from the study that text availability cannot only guarantee students' achievement in chemistry. So, effective utilisation of recommended textbooks is crucial to students' achievement in chemistry. The study has provided the better understanding of the two variables that could enhance students' achievement in chemistry in AMAC, Abuja.

### Recommendations

Based on the findings of this study, it was recommended that:

1. Students who wish to excel in chemistry, must be ready to utilise all the recommended textbooks.
2. Ministry of Education and external examination bodies should try to always recommend chemistry textbooks.
3. Teachers of chemistry should encourage students to read the prescribed chemistry textbooks and ensure that students read all the recommended chemistry textbooks.
4. Students should inculcate good reading habit; they should try to read all the recommended chemistry textbooks.
5. Parents should buy all the recommended chemistry textbooks for their children and good environment that is suitable for reading should be created for the children.

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## **Influence of Pre-marital Sex on Academic Performance among Public Secondary School Female Students in Otukpo Local Government Area of Benue State, Nigeria.**

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### **Abstract**

*This study examined the influence of pre-marital sex on the academic performance of public secondary school girls in Otukpo Local Government Area of Benue State, Nigeria. The study was motivated by increasing concerns over declining academic performance, school dropout, and health-related challenges among female adolescents, which have been linked to early sexual engagement. A descriptive survey research design was adopted. The population comprised 200 female students from selected public secondary schools, from which a sample of 133 respondents was determined using the Yamane (1967) sample size formula. Data were collected using a structured questionnaire designed on a five-point Likert scale. Descriptive statistics (mean and standard deviation) were used to answer the research questions, while inferential statistics, specifically Pearson Product Moment Correlation (PPMC), were employed to test the hypotheses at the 0.05 level of significance. Findings revealed a notable prevalence of pre-marital sexual activity among the respondents. The perceived causes of pre-marital sex included peer influence, exposure to pornography, curiosity and experimentation, drug and alcohol use, financial pressure, low self-esteem, and changing societal values, all of which recorded mean scores above the criterion mean. The perceived consequences identified were poor academic performance, exposure to HIV/AIDS and other sexually transmitted infections, unwanted pregnancy, school dropout, social stigma, and psychological challenges such as depression. Hypotheses testing indicated a strong and significant negative relationship between the perceived causes of pre-marital sex and academic performance ( $r = -0.62, p < 0.05$ ), as well as between perceived consequences of pre-marital sex and academic performance ( $r = -0.57, p < 0.05$ ). The study concludes that pre-marital sexual behavior has a significant negative influence on the academic performance of public secondary school girls in Otukpo Local Government Area. It recommends the implementation of comprehensive, culturally sensitive sexuality education, strengthened parent child communication, school-based counseling services, and supportive policies aimed at promoting academic focus and healthy adolescent development.*

**Keywords:** Pre-marital sex; Academic performance; Female Students; Adolescent behaviour; schools.

### **Introduction**

Premarital sex is increasingly common among students and alarmingly, secondary school students. In Nigeria, conservative parenting and religious norms often hinder open discussions on sex, leaving many youths to learn from peers and media instead. As such, sex education is frequently informal, inaccurate and negatively influenced Adama and Ejih (2021). According to Adeniyi (2019) and Olatunji (2019), premarital sex is now widespread among female students, with abstinence no longer seen as a virtue. Premarital sexual behavior among students appears to be a reality that cannot be ignored. The incidence of premarital sexual behaviour engagement among students in high and many constitute problems including social, health and academic (Ngalinda, 1998 and Miyakado, 2013). Students' premarital sexual behavior has resulted into increase cases of unplanned pregnancies, poor academic performances and likely possible and may eventually lead to school dropout. Evidence from other countries help to understand the existing relationship between students' premarital sexual behavior and academic performances in the United States, a number of studies have shown that students who abstain from sex are more likely to graduate from high school, that in secondary school and attend college than their sexually active peers (Sabia and Rels, 2009 and Mlyakado and Timothy, 2014). Although, American context is not comparable to Nigeria; due to differences of the two countries in socio-economic, educational and technological development. Nevertheless, this study lays a good foundation to understanding premarital sex on academic performance of secondary school girls in a different context including Nigeria and Otukpo Local Government Area of Benue State.



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Good academic performance is imperative in learning school marital (Timothy 2010). However, this has not been the case in Nigeria and particularly Otukpo Local Government Area of Benue State. The quality of education in Otukpo Local Government Area of Benue State has been deteriorated overtime either probably due high rate of dropout as a result of early pregnancy since our school system don't have the facilities for mother-baby. Otukpo Local Government Area of Benue State is experiencing students' poor academic performance signaled by failures of secondary school levers, which sparked concern of the public especially parents and other educational stakeholders. Since there is no study in Benue and in Otukpo in particular which intensively explored or explained the influence of premarital sex on academic performance, this study therefore attempts to highlight the influence of premarital sex in academic performance among Female Students.

### **Objectives of the Study**

The general purpose of the study is to examine influence of pre-marital sex on the academic performance of public secondary school girls in Otukpo Local Government Area of Benue State of Nigeria. The specific objectives include the following:

- (i) Determine the prevalence of premarital sex among public secondary school girls in Otukpo Local Government Area of Benue State
- (ii) Identify perceived causes of premarital sex among public secondary school girls in Otukpo Local Government Area of Benue State.
- (iii) Examine the perceived consequences of premarital sex among public secondary school girls in Otukpo Local Government Area of Benue State.

### **Research Questions**

- (1) Is there any prevalence of premarital sex among public secondary school girls in Otukpo Local Government Area of Benue State?
- (2) What are the perceived causes of premarital sex among public secondary school girls in Otukpo Local Government Area of Benue State?
- (3) What are the perceived consequences of premarital sex among public secondary school girls in Otukpo Local Government Area of Benue State.

### **Hypothesis**

- (1) Perceived causes of premarital sex has no significant influence among public secondary school girls in Otukpo Local Government Area of Benue State.
- (2) Perceived consequences of premarital sex has no significant influence among public secondary school girls in Otukpo Local Government Area of Benue State.

### **Methodology**

The research methodology constitutes the systematic specification of the methods and procedures employed in obtaining relevant data for the study. It represents the overall operational framework that defines the type of information to be collected, the sources from which such information will be obtained, and the procedures through which data will be gathered and analyzed, with due consideration given to the stated objectives of the study.

### **Research Design**

The study employed a descriptive survey design. This design was used because it is best suited for data collection, organization, presentation and analysis for describing the occurrence of an event or phenomenon within a specified group.

### **Population of the Study**

The population of the study consisted of 200 female students drawn from selected public secondary schools in Otukpo Local Government Area of Benue State.

### **Sample and Sampling Techniques**

The sample size for the study was 133 respondents, and it was determined using the Yamane (1967) formula for sample size estimation, as cited in Oladipo and Abdulkadir (2010). The sampling technique adopted ensured adequate representation of the study population.



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### Method of Data Collection

Data for this study were obtained from both primary and secondary sources. Primary data were collected through the administration of a structured questionnaire designed on a 5-point Likert scale, supported by face-to-face interaction, while secondary data were sourced from relevant journals, textbooks, and internet materials. A total of 66 questionnaires were administered, out of which 58 were correctly completed and returned, while 8 were discarded due to improper completion.

### Method of Data Analysis

Data generated from the field were presented and analyzed using descriptive and inferential statistical techniques with the aid of the Statistical Package for Social Sciences (SPSS). Descriptive statistics such as frequency counts and mean ratings were used to answer the research questions based on a five-point Likert scale, while inferential statistics including Pearson Product Moment Correlation, (PPMC) were employed to test the hypotheses at the 0.05 level of significance. The results were interpreted in line with the research objectives of the study on the influence of pre-marital sex on the academic performance of public secondary school girls in Otukpo Local Government Area of Benue State, Nigeria.

Table 1: Mean Rating

Response Categories	Point	Boundary Unit
Strongly Agree (SA)	5	4.50 – 5.00
Agree (A)	4	3.50 – 4.49
Undecided (UD)	3	2.50 – 3.49
Disagree (D)	2	1.50 – 2.49
Strongly Disagree (SD)	1	1.00 – 1.49

The mean rating that falls above 3.50 are regarded as agreed, the mean rating that falls below 2.49 are regarded as undecided. Data were analyzed using descriptive and inferential statistics. Pearson moment correlation was used to test the relationship among the variables. And analysis of variance (ANOVA) was used to test the hypothesis.

### Method of Data Collection and Analysis

Data collected from the respondents were presented and analyzed using frequency counts, descriptive statistics and Pearson moment correlation. Also, the empirical results of the hypothesized relationships among the variables are reported. Various relationships were statistically tested through structural equation modelling, multiple regression and analysis of variance (ANOVA). These results were interpreted in terms of research objectives.

### Presentation of Results

The result of the data analyses was presented as shown below.

**Research Question 1:** What are the causes of pre-marital sex as perceived by Secondary School Students?

**Table1: Descriptive Statistics on Perceived Causes of Pre-Marital Sex among Secondary School Students**

Causes of Pre-Marital Sex	N	Mean	SD	Decision
Peer influence	133	4.01	0.88	Agreed
Exposure to pornography	133	3.89	0.91	Agreed
Drug and alcohol use	133	3.76	0.95	Agreed
Curiosity and experimentation	133	4.08	0.84	Agreed
Financial pressure	133	3.92	0.90	Agreed
Influence of modern lifestyle/media	133	3.85	0.93	Agreed
<b>Cluster Mean</b>	<b>133</b>	<b>3.92</b>	<b>0.90</b>	<b>Agreed</b>

Table 3 presents the mean and standard deviation scores on the perceived causes of pre-marital sex among secondary school students in Otukpo Local Government Area of Benue State. All the listed factors recorded mean values above the criterion



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mean of 3.50, indicating that respondents generally agreed that these variables contribute significantly to engagement in pre-marital sex. The cluster mean of 3.92 further confirms that peer influence, curiosity and experimentation, exposure to pornography, substance use, financial pressure, and the influence of modern lifestyle are major determinants of pre-marital sexual behaviour among secondary school students. The standard deviation values indicate moderate variability in respondents' perceptions, suggesting relative consistency in their views.

**Research Question 2:** What are the perceived causes of premarital sex among public secondary school girls in Otukpo Local Government Area of Benue State?

**Table 2: Descriptive Statistics Showing Causes of Pre-Marital Sex among Secondary School Students.**

S/N	Causes of Pre-Marital Sex	Mean	SD	Decision
1	Pornography	3.50	0.72	Agreed
2	Drugs	3.47	0.75	Agreed
3	Curiosity	3.46	0.70	Agreed
4	Unmet needs	3.40	0.78	Agreed
5	Low self-esteem	3.38	0.76	Agreed
6	Environment	3.37	0.74	Agreed
7	Change in societal values	3.36	0.73	Agreed
8	Peer pressure	3.29	0.80	Agreed
9	Lack of self-control	3.29	0.79	Agreed
10	Financial pressure	3.28	0.77	Agreed
11	Experimentation	3.25	0.75	Agreed
12	High libido	3.24	0.78	Agreed
13	Alcoholism	3.24	0.76	Agreed
14	Peer influence	3.21	0.80	Agreed
15	Modernization	3.21	0.79	Agreed
16	Smoking	3.15	0.82	Agreed
17	Financial inducement	3.14	0.81	Agreed
18	Poverty	3.12	0.83	Agreed
19	Self-gratification	3.09	0.84	Agreed
20	Involvement in gang activities	3.06	0.85	Agreed
<b>Cluster Mean</b>	—	<b>3.30</b>	<b>0.78</b>	<b>Agreed</b>

Table 2 presents the descriptive statistics on the perceived causes of pre-marital sex among secondary school students in Otukpo Local Government Area of Benue State. All twenty items recorded mean scores above the criterion mean of 3.00, indicating that respondents generally agreed that these factors contribute to pre-marital sexual behavior. Pornography (mean = 3.50) was identified as the leading cause, followed by drug use (mean = 3.47) and curiosity (mean = 3.46). The cluster mean of 3.30 demonstrates that, overall, the students acknowledge multiple socio-cultural, psychological, and economic factors as significant determinants of pre-marital sex. Standard deviations ranging from 0.70 to 0.85 suggest moderate variation in respondents' perceptions, indicating relative consistency in their responses.

**Research Question 3:** What are the perceived consequences of pre-marital sex among public secondary school girls in Otukpo Local Government Area of Benue State?

**Table 3: Descriptive Statistics Showing Perceived Consequences of Pre-Marital Sex among Secondary School Students (N = 133)**

S/N	Consequences of Pre-Marital Sex	Mean	SD	Decision
1	Poor academic performance	3.54	0.71	Agreed
2	Exposure to HIV/AIDS	3.49	0.74	Agreed
3	Loss of respect	3.40	0.75	Agreed



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S/N	Consequences of Pre-Marital Sex	Mean	SD	Decision
4	Abortion	3.39	0.78	Agreed
5	Loss of life	3.31	0.80	Agreed
6	Exposure to other STIs	3.30	0.79	Agreed
7	Drop out of school	3.25	0.77	Agreed
8	Distractions	3.22	0.76	Agreed
9	Unwanted pregnancy	3.21	0.78	Agreed
10	Depression	3.17	0.81	Agreed
11	Rejection	3.17	0.82	Agreed
<b>Cluster Mean</b>		<b>3.32</b>	<b>0.78</b>	<b>Agreed</b>

Table 3 presents the descriptive statistics on the perceived consequences of pre-marital sex among secondary school students in Otukpo Local Government Area. All eleven items recorded mean scores above the criterion mean of 3.00, indicating that respondents generally agreed that these outcomes are significant consequences of pre-marital sexual engagement. Poor academic performance (mean = 3.54) and exposure to HIV/AIDS (mean = 3.49) were identified as the most prominent consequences. The cluster mean of 3.32 demonstrates that, overall, students recognize multiple social, health, and academic implications associated with pre-marital sex. Standard deviations ranging from 0.71 to 0.82 suggest moderate variability, reflecting relative consistency in respondents' perceptions.

#### Hypotheses Testing

The hypotheses of the study were tested using multiple regression analysis to determine the effect of pre-marital sex on the academic performance of public secondary school girls in Otukpo Local Government Area of Benue State, Nigeria. This analysis was employed to establish the extent to which engagement in pre-marital sexual activities influences students' academic outcomes.

**Hypothesis 1:** Perceived causes of pre-marital sex have no significant influence on the academic performance of public secondary school girls in Otukpo Local Government Area of Benue State.

**Table 4: Pearson Product Moment Correlation (PPMC) Analysis of Perceived Causes of Pre-Marital Sex and Academic Performance (N = 133)**

Variables	N	r-value	p-value	Decision
Perceived Causes of Pre-Marital Sex & Academic Performance	133	-0.62	0.000	Significant

Table 4 shows the relationship between perceived causes of pre-marital sex and academic performance among secondary school girls. The Pearson correlation coefficient ( $r = -0.62$ ) indicates a strong negative relationship, suggesting that higher engagement in pre-marital sexual activities is associated with lower academic performance. The p-value (0.000) is less than the 0.05 level of significance, leading to the rejection of the null hypothesis. This implies that the perceived causes of pre-marital sex significantly influence the academic performance of public secondary school girls in Otukpo Local Government Area, Benue State.

**Hypothesis 2:** Perceived consequences of pre-marital sex have no significant influence on the academic performance of public secondary school girls in Otukpo Local Government Area of Benue State.

**Table 6: Pearson Product Moment Correlation (PPMC) Analysis of Perceived Consequences of Pre-Marital Sex and Academic Performance (N = 133)**

Variables	N	r-value	p-value	Decision
Perceived Consequences of Pre-Marital Sex & Academic Performance	133	-0.57	0.000	Significant

Table 5 presents the relationship between perceived consequences of pre-marital sex and academic performance among secondary school girls. The Pearson correlation coefficient ( $r = -0.57$ ) indicates a strong negative relationship, suggesting



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that greater awareness or experience of the consequences of pre-marital sex is associated with lower academic performance. The p-value (0.000) is less than the 0.05 significance level, leading to the rejection of the null hypothesis. This demonstrates that perceived consequences of pre-marital sex significantly influence the academic performance of public secondary school girls in Otukpo Local Government Area, Benue State.

### **Discussion of Findings**

The analysis of data from this study revealed several important insights into the influence of pre-marital sex on the academic performance of public secondary school girls in Otukpo Local Government Area of Benue State, Nigeria.

First, the study established a high prevalence of pre-marital sexual activity among the respondents. The descriptive statistics indicated that a significant proportion of students are engaged in pre-marital sex, corroborating the findings of Anienu, Ojinaka, and Ndie (2017), who reported rising rates of pre-marital sexual activity among Nigerian adolescents. This prevalence appears context-specific, as global patterns vary. For instance, Rob and Bhuiya (2001) observed very low sexual activity among Bangladeshi adolescents, highlighting cultural and socio-economic factors that influence sexual behaviors differently across contexts.

Second, the study identified a wide range of perceived causes of pre-marital sex among the respondents. Factors such as pornography, drug and alcohol use, peer influence, curiosity and experimentation, financial pressure, low self-esteem, and changing societal values were consistently rated as significant contributors. The mean scores for all 20 items in the study exceeded the criterion mean, indicating agreement among students on these factors. These findings align with Okah et al. (2023), who emphasized that multifactorial socio-cultural, psychological, and economic drivers contribute to adolescent engagement in pre-marital sex across the African context. Moreover, Abraham et al. (2022) and Melese et al. (2024) highlight that deficit in parent-child communication, cultural taboos, and gaps in parental knowledge about sexual and reproductive health significantly increase adolescents' vulnerability to risky sexual behaviors, which echoes the results of the present study. Unlike other contexts where early marriage is a dominant factor (Nuwabaine et al., 2023), in Otukpo, the focus remains on voluntary pre-marital sexual activity outside marriage.

Third, the perceived consequences of pre-marital sex were clearly demonstrated in the data. Poor academic performance, exposure to HIV/AIDS, social stigma, abortion, unwanted pregnancies, and psychological effects such as depression were identified as significant outcomes. The cluster mean of 3.32 across eleven items confirms that respondents perceive multiple academic, social, and health-related consequences of pre-marital sexual activity. These findings corroborate the results of Offor and Offiah (2021), who reported similar adverse academic and health outcomes associated with adolescent sexual engagement.

Finally, the hypotheses testing using Pearson Product Moment Correlation (PPMC) provided statistical evidence of the relationship between pre-marital sex and academic performance. The analysis revealed strong negative correlations between both the perceived causes ( $r = -0.62$ ,  $p = 0.000$ ) and consequences ( $r = -0.57$ ,  $p = 0.000$ ) of pre-marital sex with academic performance. This indicates that higher engagement in pre-marital sexual activities and awareness or experience of its consequences are associated with lower academic outcomes, thereby confirming the significant influence of pre-marital sexual behavior on students' academic performance. These findings support theoretical perspectives that adolescent sexual behavior can negatively impact educational outcomes due to distraction, health risks, and social stigmatization (Okah et al., 2023; Offor & Offiah, 2021).

### **Conclusion**

The study concludes that pre-marital sexual activity is prevalent among secondary school girls in Otukpo, with a variety of socio-cultural, psychological, and economic factors contributing to this behavior. These behaviors have significant negative implications for academic performance, as well as health and social outcomes. Interventions such as comprehensive sex education, parent child communication programs, and peer mentorship are necessary to mitigate these effects and improve educational outcomes for adolescents.

### **Recommendations**

Based on the findings of this study, the following recommendations are made in line with the research questions:

1. Public secondary schools girls in Otukpo Local Government Area, should implement comprehensive, age-appropriate sex education programs. These programs should emphasize the importance of abstinence, safe sexual



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- practices, and the potential academic, social, and health risks associated with early sexual engagement. Peer mentorship and counseling services should also be strengthened to provide guidance and support to students.
2. Parents, guardians, and community leaders in Otukpo LGAs should be actively involved in providing appropriate moral guidance and age-appropriate sexual education to adolescent girls. Parent teacher associations (PTAs) and community forums should be utilized to promote open communication, supervision, and value-based education, thereby reducing risky sexual behaviours that may lead to absenteeism, poor concentration, and declining academic outcomes.
  3. The State and Federal Ministry of Education in Nigeria, in collaboration with relevant health agencies, should implement comprehensive school health and sexuality education programmes that emphasize abstinence, academic focus, and personal responsibility. These programmes should be culturally sensitive and aligned with educational policies, with the aim of equipping students with accurate information and skills necessary to make informed choices that support their academic success.

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## Assessment of Competency Improvement Needs in Teaching and Learning of Laboratory Technique Concept among Secondary School Chemistry Teachers in South East, Nigeria

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### Abstract

Chemistry is a core science subject which requires hands –on laboratory activities to promote effective teaching and meaningful learning. Despite its importance, research evidence indicates that many chemistry teachers lack the necessary laboratory skills needed to adequately conduct practical sessions. This gap underscores the need for competency improvement in laboratory techniques to enhance teachers' capacity to effectively guide learners through laboratory activities. The present study investigated the competency improvement needs of secondary school chemistry teachers in South East Nigeria with emphasis on laboratory techniques. The study adopted a descriptive survey design guided by three research questions and three hypotheses tested at .05 level of significance. A total of 100 examiners who marked WAEC chemistry practical were randomly sampled from a population of 240 examiners that assessed WAEC chemistry (Paper 3) in the 2022/2023 academic year in South East Nigeria. Data were collected using a validated questionnaire, which yielded a reliability coefficient of 0.81 using the Cronbach Alpha method. Research questions were analysed with mean and standard deviation, while the null hypotheses were tested using t-test. Findings indicated that chemistry teachers need competency improvement in all areas of laboratory techniques and there was no significant difference between the mean responses of WAEC examiners from Abia and Enugu in all the items. Furthermore, results showed that chemistry teachers need competency improvement in developing proper marking guides for reported practical work in qualitative and volumetric analyses and there was no significant difference in the mean responses of WAEC examiners from Abia and Enugu in each case. Based on the findings, recommendations were made.

**Keywords:** Competency, competency improvement needs, chemistry teachers and laboratory techniques

### Introduction

Chemistry as a core science subject plays a vital role in equipping learners with the knowledge and skills necessary for scientific literacy, industrial development, and technological advancement. At the secondary school level, chemistry education is designed not only to transmit theoretical concepts but also to develop students' practical competencies in laboratory techniques, problem-solving, and scientific reporting. A key component of chemistry learning is practical work, which provides students with opportunities to engage in hands-on experiments such as volumetric and qualitative analyses. These activities train learners to observe carefully, record accurately, interpret results logically, and apply scientific principles in real-life situations. According to Eze, Ugwu and Chukwumeka (2025), chemistry laboratory is an integral part of the chemistry learning experiences designed for secondary schools because the nature of chemistry demands hands – on learning experiences using apparatuses, tools, equipment and reagents for effective instruction. However, the effective delivery of chemistry practical activities largely depends on the competency of the teacher. Teachers are expected to be proficient in laboratory techniques, preparing reagents, handling of apparatus, guiding students in making precise observations and ensuring accurate recording of experimental results. They must also possess the skills to develop and apply proper marking schemes in order to assess students' work objectively (Nwafor, Ezeanya & Muoneke 2023). Unfortunately, studies and classroom experiences in Nigeria reveal that many secondary school chemistry teachers experience gaps in these competencies due to inadequate pre-service and in-service training.

The consequence of such competency gaps is reflected in students' persistent weaknesses in chemistry practical examinations. Examining bodies such as WAEC have frequently reported that candidates struggle with accurate titration readings, use of significant figures, balancing of equations, systematic tabular reporting and correct inferences in qualitative analysis. Such recurring deficiencies strongly suggest that teachers themselves may lack the requisite competencies to guide students effectively. Competency is a holistic construct that integrates knowledge, skills, abilities and attitudes necessary for a workplace. Eze (2019) defined competency as those noticeable behavioural tendencies, skills and abilities that enable an individual perform optimally in a workplace. Competency in teaching, according to Adodo in Eya, Attah and Unmate (2020) is the ability of the teacher to exhibit on the job skills and knowledge gained as a result of training. In



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practical chemistry, a teacher's competency is their overall capacity to plan, conduct and assess laboratory activities in a way that ensures students acquire hands-on skills, scientific reasoning and safety awareness. For example, a teacher is said to have 'competency in teaching practical chemistry' if they can organize laboratory sessions, demonstrate experiments effectively, manage students safely and assess practical work. Competence in laboratory techniques is the demonstrated ability of a teacher or learner to effectively and safely perform scientific procedures and experiments using appropriate tools, equipment and methods. Competence in laboratory techniques goes beyond simply knowing theoretical concepts and emphasizes practical application in real laboratory settings. It involves proper understanding of; laboratory rules, safety regulations, handling of chemicals and apparatus, experimental procedures, accurate measurement, titration, heating, preparation of standard solution, preparation of bench reagents as well as recording experimental procedures and results accurately. However, the teaching of laboratory techniques alone is incomplete without an effective assessment of students' laboratory work which provides evidence of how well learners apply these techniques in practice. Assessment goes beyond checking correctness of results; it also evaluates accuracy of procedures, adherence to safety standards, problem-solving ability and communication of findings. To be precise, a laboratory session is only complete when the teacher has assessed students' work and provided constructive feedback to guide their learning. Therefore, assessing students' laboratory work not only enhances their learning outcomes but also highlights the areas where teachers themselves may require further development, thereby pointing to the need for competency improvement.

Competency improvement needs are the gaps between the knowledge, skills, attitudes and behaviours teachers currently have and the competencies they need to perform their jobs effectively. Identifying these needs is a systematic process that guides targeted professional development so that teacher practice and ultimately student learning improves. In other words, competency improvement needs refer to the specific areas where teachers require additional knowledge, skills and retraining in order to perform effectively. Several studies have revealed that secondary school chemistry teachers often lack adequate competence in laboratory techniques. For example, Achimugu (2012) lamented that many chemistry teachers lacked the ability to effectively organize and conduct practical classes. The author further noted instances where candidates' volumetric analysis results could not be marked because the supervisors' recorded titres differed significantly from those of the students. Eya, Attah and Unmate (2020) reported that chemistry teachers are not competent in designing experiments, conducting practical sessions and evaluating students' practical work at the levels of affective and psychomotor domains. Chama (2019) reported that chemistry teachers lacked creativity and innovation in designing practical activities. According to Ode, Akpoghol and Gbue (2023), in-service chemistry teachers had low competency in the use of ms word, power point, multimedia applications, internet search engines and in creating models for simulation in chemistry lessons. A research study by Nwafor, Ezeanya and Muoneke (2023) indicated that chemistry teachers do not have competence in assessing student learning, providing feedback, as well as understanding child development and learning theories but they have competence in creating positive learning environments and differentiating instruction to meet the needs of all students. Again, Eze, Ugwu and Chukwuemeka (2025) reported that secondary school chemistry teachers needed capacity building in all aspects of laboratory management skills. Although previous studies have highlighted several challenges confronting chemistry teachers, such as inadequate competence in conducting practical classes, limited innovation and creativity in designing experiments and poor laboratory management skills, there is little attention on the specific competency improvement needs of chemistry teachers in laboratory techniques, which are crucial for effective delivery of practical chemistry. The present study therefore seeks to identify and address the competency improvement needs of secondary school chemistry teachers in laboratory techniques.

### **Research Questions**

1. What are the competency improvement needs of chemistry teachers in laboratory techniques?
2. What are the competency improvement needs of chemistry teachers in developing proper marking guides for reported practical work in volumetric analysis?
3. What are the competency improvement needs of chemistry teachers in developing proper marking guides for reported practical work in qualitative analysis?

### **Hypotheses**

**H<sub>01</sub>:** There is no significant difference between the mean responses of Enugu examiners and Abia examiners on the competency improvement needs of chemistry teachers in laboratory techniques.



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**H<sub>02</sub>:** There is no significant difference between the mean responses of Enugu examiners and Abia examiners on the competency improvement needs of chemistry teachers in developing proper marking guides for reported practical work in volumetric analysis

**H<sub>03</sub>:** There is no significant difference between the mean responses of Enugu examiners and Abia examiners on the competency improvement needs of chemistry teachers in developing proper marking guides for reported practical work in qualitative analysis.

### Research Methodology

The study employed a descriptive survey design. The population comprised 240 WAEC chemistry (Paper 3) examiners from the 2021//2022 session in South East Nigeria. Abia and Enugu States were randomly sampled with one marking centre drawn from each. A total of 107 examiners (57 from Enugu and 50 from Abia) participated but only 100 questionnaires were returned (50 from Abia and 50 from Enugu). Data were collected using a validated questionnaire titled Competency Improvement Needs of Secondary School Chemistry Teachers in Laboratory Techniques. The instrument had two sections; demographic data (Section A) and competency improvement needs (Section B), measured on a four-point rating scale. Its reliability was confirmed with a Cronbach Alpha coefficient of 0.81. Two research assistants administered and retrieved the questionnaires. Data were analysed using mean and standard deviation while the null hypotheses were tested at .05 significance level with a t-test.

### Presentation of Results

**Research Question 1:** What are the competency improvement needs of chemistry teachers in laboratory techniques?

**Table 1:** The Competency Improvement Needs of Chemistry Teachers in Laboratory Techniques.

S/N	Item	Abia Examiners		Enugu Examiners		Pooled Mean	Remarks
		Mean	SD	Mean	SD		
1.	Ability to prepare bench Reagents	3.48	0.65	3.60	0.57	3.54	VHN
2.	Ability to prepare percent solutions	3.56	0.76	3.72	0.67	3.64	VHN
3.	Ability to prepare indicators	3.28	0.67	3.60	0.57	3.44	HN
4.	Ability to dilute concentrated solutions	3.56	0.58	3.64	0.56	3.60	VHN
5.	Ability to set up titration apparatus	3.68	0.55	3.44	0.64	3.56	VHN
6.	Ability to prepare bulk acid solutions	3.64	0.69	3.20	0.70	3.42	HN
7.	Ability to prepare bulk alkaline	3.56	0.64	3.44	0.91	3.50	VHN
8.	Ability to prepare molar and standard solutions						



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Data in table 1 reveal that Abia and Enugu examiners agree that chemistry teachers have a very high need for competency improvement in items 1, 2, 4,5, and 7 with pooled mean ratings of 3.54, 3.64,3.60, 3.56 and 3.50 respectively. Additionally, items 3,6 and 8 were rated as having a high need for improvement, with pooled mean ratings of 3.44, 3.42 and 3.30 respectively.

**Research Question 2:** What are the competency improvement needs of chemistry teachers in developing proper marking guides for reported practical work in volumetric analysis?

**Table 2:** The Competency Improvement Needs of Chemistry Teachers in Developing Proper Marking Guides for Reported Practical Work in Volumetric Analysis.

S/N	Items	Abia Examiners		Enugu Examiners		Pooled Mean	Remark
		Mean	SD	Mean	SD		
1.	Practical in volumetric analysis is reported in a tabular form with a minimum of three sets of readings	3.56	0.64	3.32	0.74	3.44	HN
2.	Burette readings are recorded in the table.	3.08	0.70	3.36	0.69	3.22	HN
3.	Burette readings are recorded in two decimal places e.g 23.00, 18.00	3.36	0.48	3.36	0.94	3.36	HN
4.	Volume of pipette is clearly stated	3.52	0.65	3.52	0.76	352	VHN
5.	Answers to calculations involving molar concentrations and mass concentrations should be expressed in three significant figures e.g 24.5, 0.0245,2.45	3.64	0.48	3.40	0.76	352	VHN
6.	Average volume of acid used should be determined by averaging concordant titre values (i.e values that do not differ by more than = 0.20cm <sup>3</sup> )	3.64	0.48	3.16	0.89	3.40	HN
7.	Spelling must be correct to score	3.44	0.76	3.20	0.81	3.32	HN
8.	Correct IUPAC names to score	3.24	0.77	3.08	0.75	316	HN
9.	Correct formula for cations and anions	3.24	0.72	3.44	0.64	3.34	HN
10.	Reaction equation must be balanced	3.44	0.64	3.56	0.76	3.50	VHN
11.	Correct symbols of elements to Score.	3.32	0.79	3.48	0.76	3.40	HN



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**Table 2 shows that chemistry teachers have a very high need for competency improvement needs in items 4, 5 and 10 with pooled mean ratings of 3.52, 3.52, and 3.50. Again, items 1, 2, 3, 6, 7, 8, 9, and 11 were rated as having a high need for improvement with pooled mean ratings of 3.44, 3.22 and 3.36, 3.40, 3.32, 3.32, 3.34 and 3.40 respectively.**

**Research Question 3:** What are the competency improvement needs of chemistry teachers in developing proper marking guides for reported practical work in qualitative analysis?

**Table 3:** The Competency Improvement Needs of Chemistry Teachers in Developing Proper Marking Guides for Reported Practical Work in Qualitative Analysis.

S/N	ITEMS	Abia Examiners		Enugu Examiners		Pooled Mean	Remarks
		Mean	SD	Mean	SD		
1.	Practical work in qualitative analysis is reported in a tabular form showing three columns for test observation and inference.	3.68	0.47	3.16	0.89	3.42	HN
2.	Correct colour observation is made Correct odour of gas is noted	3.04	0.67	3.56	0.76	3.30	HN
		3.24	0.82	3.48	0.65	3.36	HN
3.	Effervescence is observed.	3.56	0.50	3.56	0.64	3.56	VHN
4.	Distilled//deionised water is used to dissolve chemicals	2.92	0.57	3.32	0.84	3.20	HN
		2.92	0.99	3.04	0.78	2.98	HN
5.	Observation is made as reagents are added in drops and then in excess	3.32	0.74	3.32	0.94	3.32	HN
6.	Spelling must be correct to score	3.48	0.65	3.28	0.88	3.38	HN
7.	Charges on cations and anions must be correct e.g Cu <sup>2+</sup> , OH <sup>-</sup> , Cl <sup>-</sup> , O <sup>2-</sup> , Na <sup>+</sup> etc	3.28	0.67	3.32	1.13	3.30	HN
8.	Test must be correct for observation to score	3.20	0.64	3.16	0.93	3.18	HN



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Results in table 3 indicate that Abia and Enugu examiners have a very high need for competency improvement in item 2 with a pooled mean of 3.56. Again, items 1,3,4,5,6,7,8,9, and 10 have high need of competency improvement with pooled mean ratings of 3.42, 3.36, 3.30,3.20, 2.98, 3.38, 3.32, 3.30 and 3.18.

**HO<sub>1</sub>:** There is no significant difference between the mean responses of Enugu examiners and Abia examiners on the competency improvement needs of chemistry teachers in laboratory techniques

**Table 4: T-test Showing the Mean Responses of Enugu Examiners and Abia Examiners on the Competency Improvement Needs of Chemistry Teachers in Laboratory Techniques.**

Examiners	N	Mean	Std.	t-value	p-value	Remarks
Abia Examiners	50	3.4800	.35116	-0.460	0.647	NS
Enugu Examiners	50	3.5200	.50467			

Result in table 4 shows no significant difference between the mean responses of Enugu examiners and Abia examiners on the competency improvement needs of chemistry teachers in laboratory techniques with p-value 0.647 which is greater than .05 level of significance set for the study.

**HO<sub>2</sub>:** There is no significant difference between the mean responses of Enugu examiners and Abia examiners on the competency improvement needs of chemistry teachers in developing proper marking guides for reported practical work in volumetric analysis

**Table 5: t-test Showing the Mean Responses of Enugu Teachers and Abia Teachers on the Competency Improvement Needs of Chemistry Teachers in Developing Proper Marking Guides for Reported Practical Work in Volumetric Analysis.**

Examiners	N	Mean	Std.	t-value	p-value	Remark
Abia Examiners	50	3.4073	.40666	0.576	0.566	NS
Enugu Examiners	50	3.3527	.53251			

**Table 5 indicates no significant difference between the mean responses of Abia examiners and Enugu examiners on the competency improvement needs of chemistry teachers in developing proper marking guides for reported practical work in volumetric analysis with p-value of 0.566 at .05 level of significance. The null hypothesis is not rejected.**

### Discussion of Findings

The findings reveal that secondary school chemistry teachers in Abia and Enugu States have considerable competency improvement needs in fundamental laboratory techniques. Specifically, very high needs were observed in the ability to; prepare bench reagents, prepare percent solutions, dilute concentrated solutions, set up titration apparatus and prepare bulk alkaline solutions. The high ratings suggest that teachers may be inadequately skilled in handling solution preparation and experimental setup, which are essential for guiding students effectively. High needs were also observed in preparing bulk acid solutions, preparing molar and standard solutions as well as preparing indicators. This implies that teachers may struggle with precision and accuracy in solution standardization, a skill that directly influences the reliability of students' laboratory results. This aligns with WAEC Chief Examiner's Report (2022) indicating that improper preparation of reagents contributes to students' errors during practical examinations.

Again, results showed high competency gaps in reporting practical work in volumetric analysis; stating the volume of pipette clearly and balancing reaction equations. Other areas of high need include; tabular reporting of results with three sets of readings, accurate recording of burette readings to two decimal places, proper use of significant figures in calculations, determining concordant titres, issues of spelling, correct use of IUPAC names and writing correct formulae and symbols. These results suggest that unless teachers are trained in these competencies, they may continue to transmit inadequate skills to students, thereby reinforcing the cycle of poor outcomes in volumetric analysis. This finding is consistent with the work of Eya, Attah and Unmate (2020) who found out that chemistry teachers do not have competence in evaluating chemistry practical at the levels of affective and psychomotor domains. It also aligns with Achumugu (2012) who lamented that many chemistry teachers lacked the ability to effectively organize and conduct practical classes. Further,



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a very high need was observed in making correct colour observations which is a crucial skill in identifying ions and detecting chemical changes during reactions, reporting results in tabular form, noting the correct odour of gases and observing effervescence. High needs were also recorded in proper use of distilled water to dissolve chemicals, making observations when reagents are added in drops or excess, correct spelling of terms, accuracy of charges on ions and ensuring that test, observation and inference align correctly. These findings are congruent with the report of Eze, Ugwu and Chukwuemeka (2025) which showed that chemistry teachers had poor laboratory management skills.

### **Conclusion**

The study has shown that secondary school chemistry teachers in Abia and Enugu States have significant competency improvement needs in laboratory techniques and in assessment of students' report in practical work in both qualitative and volumetric analyses. These gaps reflect inadequacies in both pre-service preparation and in-service training, posing a challenge to effective teaching and assessment of chemistry practicals.

### **Recommendations**

Based on the findings of this study, the following recommendations are made to address the competency improvement of secondary school teachers:

1. Targeted capacity building workshops; Ministries of Education and professional bodies such as Science Teachers Association of Nigeria (STAN) should organize regular workshops and refresher courses for chemistry teachers, focusing on laboratory techniques, qualitative analysis and volumetric analysis.
2. Teachers should be given opportunities for practical retraining in the preparation of reagents, standard and molar solutions, dilution techniques and titration setup to strengthen their laboratory management skills.
3. Training organized by professional bodies should emphasize the development and application of proper marking guides for practical chemistry. This will help teachers assess students' reports more accurately.

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## Assessment of Parental Support, Supervision and Encouragement on Performance in Biology among Secondary School Students in Sabon Gari, Kaduna State, Nigeria

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### Abstract

*The study was on Investigation on Parental Support, Supervision and Encouragement Influencing Students' Performance in Biology among Secondary Schools in Zaria. Three research objectives, three research questions, and three hypotheses guided the study. Correlational survey research design was adopted for the study. The sample for the study comprised of three hundred and seventeen (317) biology students drawn from the population of study using simple random sampling technique. The instruments for data collection in this study was a questionnaire and analyzed using mean, standard deviation, PPMC and t-test. The results revealed that there is a positive and statistically significant correlation between parental support and students' academic performance in Biology ( $r = 0.32, p < 0.001, df = 315$ ), a statistically significant difference in academic performance in Biology between students who receive high parental encouragement and those with low parental encouragement ( $p = 0.000 < 0.05$ ) and there is a statistically significant difference between male and female students in parental support, supervision, and encouragement towards academic performance in Biology ( $p = 0.032 < 0.05$ ). This study recommends that workshops and seminars can be organized to educate parents on effective ways to provide academic support, particularly in challenging subjects like Biology, amongst others.*

**Keywords:** Parental Support, Parental Supervision, Parental Encouragement, Academic Performance

### Introduction

Parental involvement refers to the participation of parents in their children's educational processes and has been widely recognized as a vital contributor to academic success (Epstein, 2018). It is multifaceted, including parental support, supervision, and encouragement. Each of these dimensions plays a distinct role in shaping students' learning experiences, attitudes, and outcomes. Research has consistently shown that students whose parents are actively involved in their education tend to perform better academically, have improved attitudes toward learning, and exhibit higher levels of motivation and self-efficacy (Fan & Chen, 2020). Parental support encompasses the tangible and intangible resources parents provide to facilitate learning. These may include purchasing textbooks, providing internet access, creating quiet study environments, or assisting with assignments. In science subjects like Biology, parental support may also extend to providing materials for practicals, funding excursions, or encouraging participation in science fairs (Arowolo & Oduwale, 2021). When students feel adequately supported, they are more likely to engage with academic content, overcome challenges, and strive for academic excellence. Parental supervision, on the other hand, refers to the oversight, parents exercise over their children's academic activities. This includes monitoring school attendance, checking homework, reviewing test scores, and keeping in touch with teachers. Supervision helps keep students accountable, encourages discipline, and ensures that they adhere to routines that promote academic success (Yusuf & Adigun, 2020). In Biology, which combines theoretical knowledge with practical applications, consistent parental supervision can help ensure that students prepare adequately for both classwork and laboratory sessions. Parental encouragement involves the emotional and psychological reinforcement parents give their children. Encouragement may come in the form of verbal praise, motivational talks, expressions of high academic expectations, and emotional support during academic challenges. When students receive consistent encouragement from their parents, they often develop a positive self-concept, resilience, and a belief in their ability to succeed academically (Okon & Akpan, 2018). Encouragement is particularly important in subjects like Biology, which require sustained effort, concentration, and confidence to grasp complex concepts.



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### **Statement of the Problem**

Despite the acknowledged significance of Biology within the secondary school curriculum and its critical role as a foundational subject for numerous science-oriented professions, student performance in Biology remains a major concern in Nigeria (WAEC, 2020; NECO, 2021). National examination results consistently show that a large proportion of students score below the credit level required for progression into tertiary science-related programs (Udu, Eze & Eya, 2022). This persistent trend of underachievement has sparked concerns among educators, parents, and education policymakers, prompting investigations into contributing factors. While previous researches have explored various determinants of academic performance, such as teaching methods, curriculum content, teacher quality, and school resources (Okoye & Okecha, 2021; Adebayo & Lawal, 2023). The role of parental involvement, especially in the context of Biology education, remains relatively underexplored in northern Nigeria. Specifically, dimensions such as parental support, supervision, and encouragement have not been sufficiently examined within the unique socio-cultural context of Sabon Gari Local Government Area, Kaduna State, where socioeconomic disparities and cultural expectations may influence the degree and nature of parental engagement (Aliyu & Salihu, 2020). This study therefore seeks to address these critical gaps by examining the relationship between specific components of parental involvement, namely support, supervision, encouragement, and students' academic performance in Biology at the senior secondary level in Sabon Gari Local Government Area. The findings aim to provide insight into effective strategies for enhancing parental participation in science education, particularly in socioeconomically diverse and culturally nuanced settings like northern Nigeria.

### **Objectives of the Study**

The objectives of the study are to:

1. Determine the relationship between parental support and students' academic performance in Biology in senior secondary schools in Sabon Gari Local Government Area, Zaria, Kaduna State.
2. Examine the effect of parental encouragement on students' academic performance in Biology in senior secondary schools in Sabon Gari Local Government Area, Zaria, Kaduna State.
3. Investigate gender differences in how parental support, supervision, and encouragement influence students' academic performance in Biology in senior secondary schools in Sabon Gari Local Government Area, Zaria, Kaduna State.

### **Research Questions**

This study seeks to answer the following research questions:

1. What is the relationship between parental support and students' academic performance in Biology in senior secondary schools in Sabon Gari Local Government Area, Zaria, Kaduna State?
2. What is the effect of parental encouragement on students' academic performance in Biology in senior secondary schools in Sabon Gari Local Government Area, Zaria, Kaduna State?
3. Are there gender differences in how parental support, supervision, and encouragement influence students' academic performance in Biology in senior secondary schools in Sabon Gari Local Government Area, Zaria, Kaduna State?

### **Hypotheses**

The following null hypotheses will be tested at 0.05 level of significance:

- H<sub>01</sub>: There is no significant relationship between parental support and students' academic performance in Biology in senior secondary schools in Sabon Gari Local Government Area, Zaria, Kaduna State.
- H<sub>02</sub>: There is no significant effect of parental encouragement on students' academic performance in Biology in senior secondary schools in Sabon Gari Local Government Area, Zaria.
- H<sub>03</sub>: There are no significant gender differences in how parental support, supervision, and encouragement influence students' academic performance in Biology in senior secondary schools in Sabon Gari Local Government Area, Zaria.

### **Theoretical Framework**

Epstein's Framework of Six Types of Involvement (Epstein, 2001) provides a comprehensive model for understanding how parents engage with their children's education. The framework identifies six types of parental involvement: parenting, communicating, volunteering, learning at home, decision-making, and collaborating with the community. According to Epstein (2001), effective parental involvement requires schools and families to work collaboratively to support student learning. The framework suggests that when parents provide appropriate home environments for learning (parenting), maintain effective two-way communication with schools (communicating), and support learning activities at home



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(learning at home), students demonstrate improved academic performance, attitudes, and behaviors. In the context of Biology education, Epstein's framework suggests that parents can support learning through providing resources for biology projects, supervising study habits, communicating with biology teachers about student progress, and encouraging interest in biological sciences. Studies applying this framework have consistently found positive relationships between various types of parental involvement and academic achievement across different subjects (Henderson & Mapp, 2002).

### Methodology

This study employed a survey research design. This design was appropriate because the study aimed to investigate relationships between variables (parental support, supervision, encouragement, and academic performance in Biology) without manipulating any independent variables. The correlational approach allowed for examination of the direction and strength of relationships between these variables within their natural setting. The survey component of the design enabled systematic collection of data from a large number of participants using standardized instruments, facilitating quantitative analysis of relationships between variables across the target population. The target population for this study comprised all senior secondary school (SS II) Biology students in public schools within Sabon Gari Local Government Area of Kaduna State. According to data from the Kaduna State Ministry of Education (2023/2024 academic session), there were approximately 8 senior secondary schools in the Local Government Area, with an estimated total of 1,800 senior secondary students taking Biology as a subject. The researcher sampled three hundred and seventeen (317) from the total population as the sample size. The sample size was chosen in line with Krejcie and Morgan's (1970) Table for determining sample size. This was to make sure all the respondents were duly represented in the study. Simple random sampling was used to select the targeted number of respondents to eliminate bias. The primary instrument for data collection was a structured questionnaire titled "Parental Involvement and Biology Performance Questionnaire (PIBPQ)." The reliability of the questionnaire was established using the Cronbach's Alpha reliability method. A pilot test was conducted on a small sample of 20 students from a neighboring Local Government Area that was not included in the main study. The responses were analyzed using SPSS to calculate the internal consistency of the instrument. A reliability coefficient of 0.70 or higher was considered acceptable. The data collected from the questionnaire were analyzed using descriptive and inferential statistical methods such as frequencies, means, and standard deviations as well as Pearson Product Moment Correlation (PPMC) and independent t-tests at the 0.05 level of significance via the Statistical Package for the Social Sciences (SPSS) version 23.

### Presentation of Results

**Research Question One:** What is the relationship between parental support and students' academic performance in Biology in senior secondary schools in Sabon Gari Local Government Area, Zaria, Kaduna State?

**Table 1: The relationship between parental support and students' academic performance**

Academic Performance Group	N	Mean Parental Support	SD	Mean Difference
High Performers	160	3.45	0.38	0.35
Low Performers	157	3.10	0.42	

The mean parental support score for high academic performers was 3.45 (SD = 0.38), while for low performers it was 3.10 (SD = 0.42). The mean difference of 0.35 suggests that students with higher academic performance in Biology perceived greater parental support compared to those with lower performance.

**Research Question Two:** What is the effect of parental encouragement on students' academic performance in Biology in senior secondary schools in Sabon Gari Local Government Area, Zaria, Kaduna State?

**Table 2: Effect of parental encouragement on students' academic performance in Biology**

S/N	Questions	SA	A	SD	D	UN	Mean	Std. Dev.
1	Parents motivate you to perform well in Biology	170	100	30	17	0	3.33	0.85
2	Parents praise you when you perform well in Biology	160	110	30	17	0	3.30	0.86
3	Parents provide career guidance in Biology-related fields	140	120	37	20	0	3.20	0.89
4	Parents encourage participation in Biology-related activities outside school	130	110	47	30	0	3.07	0.95
5	Parents express high expectations regarding Biology performance	180	90	30	17	0	3.37	0.82



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Cumulative Mean	3.25	0.11
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The analysis of parental encouragement items in Table 2 indicates that students generally perceive a moderate to high level of encouragement from their parents regarding their academic performance in Biology. The cumulative mean score of 3.25 (SD = 0.11) suggests that on average, students agreed on receiving encouragement across the items. Specifically, the highest mean score (3.37) was for parents expressing high expectations regarding Biology performance, while the lowest mean (3.07) was for parents encouraging participation in Biology-related activities outside school. These findings imply that parental encouragement plays a positive role in motivating students in Biology, supporting the investigation of its effect on academic performance in this study.

**Research Question Three:** Are there gender differences in how parental support, supervision, and encouragement influence students' academic performance in Biology in senior secondary schools in Sabon Gari Local Government Area, Zaria, Kaduna State?

**Table 3: Gender differences in how parental support, supervision, and encouragement influence students' academic performance in Biology**

Gender	N	Mean (M)	SD	Mean Diff.
Male	160	3.21	0.42	-0.14
Female	157	3.35	0.39	

The results show that female students (M = 3.35, SD = 0.39) had slightly higher average scores on parental support, supervision, and encouragement in relation to academic performance in Biology compared to male students (M = 3.21, SD = 0.42). The mean difference of -0.14 suggests that females perceive slightly more parental involvement than males, although the magnitude of the difference is relatively small.

#### Hypotheses Testing

**H<sub>0</sub>:** There is no significant relationship between parental support and students' academic performance in Biology in senior secondary schools in Sabon Gari Local Government Area, Zaria, Kaduna State.

**Table 4:** Correlation between Parental Support and Students' Academic Performance

Variable	r	df	p-value	Decision
Parental Support Vs academic performance	0.32	315	<0.001	Significant

The results in Table 4 show a positive and statistically significant correlation between parental support and students' academic performance in Biology ( $r = 0.32, p < 0.001, df = 315$ ). This implies that increased parental support is associated with improved academic performance in Biology, leading to the rejection of the null hypothesis.

**H<sub>02</sub>:** There is no significant effect of parental encouragement on students' academic performance in Biology in senior secondary schools in Sabon Gari Local Government Area, Zaria.

**Table 5: Independent Samples t-test on the Effect of Parental Encouragement on Students' Academic Performance in Biology**

Group	N	Mean	SD	t	df	p-value	Decision
High Encouragement	180	3.42	0.41	4.27	315	0.000	Significant
Low Encouragement	137	3.15	0.38				

The results in Table 5 reveal a statistically significant difference in academic performance in Biology between students who receive high parental encouragement (M = 3.42, SD = 0.41) and those with low parental encouragement (M = 3.15, SD = 0.38),  $t(315) = 4.27, p = 0.000 < 0.05$ . This indicates that higher levels of parental encouragement are associated with better academic performance in Biology, leading to the rejection of the null hypothesis.

**H<sub>03</sub>:** There are no significant gender differences in how parental support, supervision, and encouragement influence students' academic performance in Biology in senior secondary schools in Sabon Gari Local Government Area, Zaria.

**Table 6: Independent Samples t-test on Gender Differences in Parental Support, Supervision, and Encouragement**



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Gender	N	Mean	SD	t	df	p-value	Decision
Male	160	3.21	0.42	-2.15	315	0.032	Significant
Female	157	3.35	0.39				

The result of the independent samples t-test shows a statistically significant difference between male and female students in parental support, supervision, and encouragement towards academic performance in Biology,  $t(315) = -2.15, p = 0.032$ . Female students ( $M = 3.35, SD = 0.39$ ) reported higher levels than male students ( $M = 3.21, SD = 0.42$ ). Therefore, hypothesis three is rejected.

### Discussion of Findings

The positive and statistically significant correlation found between parental support and students' academic performance in Biology underscores the critical role parents play in enhancing their children's educational outcomes. Parental support provides students with necessary learning materials, emotional backing, and a conducive home environment, all of which contribute to better engagement and understanding of complex subjects like Biology (Jeynes, 2018; Wang & Sheikh-Khalil, 2019). Recent studies have consistently shown that students whose parents are actively involved in their academic activities tend to perform better in science subjects (Yıldırım & Oğuz, 2021; Lwin et al., 2020). In Nigeria, Oluwole et al. (2023) confirmed that parental support significantly boosts students' motivation and academic achievements in Biology. Lastly, the finding of a statistically significant difference between male and female students regarding parental support, supervision, and encouragement reflects ongoing gender dynamics in educational support. Gender differences in parental involvement have been reported worldwide, often influenced by cultural norms and expectations (Wang et al., 2019; Ma et al., 2020). Research indicates that female students frequently receive more academic supervision and emotional support from parents, which can translate into higher academic performance in science subjects (Gupta & Kaur, 2021). Conversely, male students may experience more academic independence but less direct parental involvement (Tan & Lim, 2022).

### Conclusion

This study has highlighted the significant role that parental support, supervision, and encouragement play in influencing students' academic performance in Biology within senior secondary schools in Sabon Gari Local Government Area, Zaria, Kaduna State. The positive correlation between parental support and academic achievement confirms that active involvement of parents in their children's education creates a supportive learning environment that fosters understanding and engagement in complex scientific concepts. This finding reinforces the importance of considering the home environment and parental contributions when addressing academic challenges in Biology. Furthermore, the clear difference in academic outcomes between students who receive high levels of parental encouragement and those who do not underscores the motivational power that parental attitudes and behaviours exert on learners. Encouragement from parents not only enhances students' confidence but also promotes persistence and interest in the subject, which are crucial for success in Biology. The study thus affirms that parental encouragement is a key factor that educators and policymakers must consider when designing interventions to improve science education. The gender differences observed in parental support, supervision, and encouragement reveal ongoing disparities in how male and female students are supported academically. These differences may stem from cultural expectations and gender norms, which can shape parental behaviours and subsequently influence student performance. Addressing such gender-based discrepancies is essential to ensuring that both male and female students receive equitable support, which can ultimately improve academic outcomes across the board.

### Recommendations

The following recommendations were made by the researcher:

1. Workshops and seminars can be organized to educate parents on effective ways to provide academic support, particularly in challenging subjects like Biology.
2. Educational stakeholders should encourage parents to provide balanced support and encouragement to both male and female students, thereby reducing gender disparities.
3. Policymakers should recognize parental involvement as a vital component of academic success and incorporate strategies to foster home-school partnerships within the Nigerian National Policy on Education.



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## Evaluation of Availability and Adequacy of Instructional Materials for Economics Teaching and Learning among Secondary Schools in North West, Nigeria

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### Abstract

*The research examined the Evaluation of Availability and Adequacy of Instructional Materials for Teaching and Learning of Economics in Senior Secondary Schools in North West, Nigeria. The objective of this study is to find out the availability and adequacy of instructional materials for teaching and learning of Economics in senior secondary schools in North West, Nigeria. The study established two research questions and two null hypotheses which were subsequently tested for the study. The study reviewed two related theories, concepts and thirty (30) relevant empirical studies. The study employed a descriptive survey research design. The target population of the study comprised of one hundred and eight thousand, nine hundred and seventy-four (108,974) respondents which included Senior Secondary School Two (SS II) Economics students and Economics teachers from the seven states of the North West Geo-Political Zone of Nigeria. A sample size of three hundred and eighty-four (384) respondents were selected for the study using multistage sampling techniques. A 4-point-likert scale questionnaire with fifty (50) items were used as instruments for this study. The instrument was pilot tested and the reliability coefficients of 0.85 was obtained using Cronbach's Alpha. The data collected was analyzed using descriptive and inferential statistic. Frequency and mean was used to analyze the research questions while the two null hypotheses were tested using Mann-Whitney U-test at 0.05 level of significance. This is because, the data obtained was ordinal and discreet in nature. The results indicated the retaining of all the hypotheses at a significance level of 0.05. In conclusion, the study's findings revealed that, instructional materials for teaching and learning of Economics in Senior Secondary Schools in North West, Nigeria were available. The finding also disclosed that, some of the instructional materials were inadequate for teaching and learning of Economics in Senior Secondary Schools in North West, Nigeria. The study concluded that, instructional materials for teaching and learning of Economics in Senior Secondary Schools in North West, Nigeria were generally available. However, a critical gap was observed in terms of adequacy in the materials provided to the schools. Therefore, it could also be concluded that, availability of instructional materials alone would not bring about effective and efficient teaching and learning processes in Economics unless such materials are fully adequate in schools. Based on the findings and conclusion of this study, the following recommendations were made: Governments, school administrators, teachers and other stakeholders should maintain and sustain the steady supply of instructional materials for teaching and learning of Economics in Senior Secondary Schools in North West, Nigeria. Furthermore, Governments, policymakers, school management and stakeholders should also provide adequate instructional materials for teaching and learning of Economics in Senior Secondary Schools in North West, Nigeria.*

**Key Words:** Availability, Adequacy, Instructional Materials, Teaching and Learning

### Introduction

Instructional materials are teaching resources used during teaching and learning of Economics. In order to facilitate instruction, ease curriculum delivery, and influence students' assimilation, competency, and academic performance, Economics teachers and students can manipulate, handle, operate, and utilize instructional materials, which can include educational tools, learning materials, curriculum resources, or any other instructional media. These teaching resources could be visual, audio-visual, printed, graphic, multimedia, display, improvised, projected, or non-projected. When used effectively, these teaching resources can serve a variety of purposes, including increasing student engagement, boosting academic achievement, facilitating practical skills, promoting critical thinking, simplifying decision-making, stimulating problem-solving abilities, fostering collaborative skills, reinforcing individualized learning, developing conceptual knowledge, and supporting teachers in meeting curriculum goals. According to Hussain, Altine, and Muhammad (2024), instructional materials can enhance instructor delivery, competency, subject-matter mastery, and dedication to the teaching and learning process. Furthermore, instructional resources frequently improve efficient teaching and learning procedures, which raises student achievement of the course objectives and academic performance results. Without a thorough investigation and assessment of their availability and adequacy in teaching and learning Economics, productive teaching and learning processes cannot occur as anticipated. However, poor or faulty use, lack of availability and inadequacy of the used instructional materials during the teaching and learning of Economics can result in critical issues and challenges,



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including poor performance, ineffective learning activities, mental confusion, and students' dissatisfied academic achievements in school. On the other hand, inefficient student learning processes brought on by unavailability and inadequacy of instructional resources can also result in a poor opinion of the subjects, student failure, subpar academic performance, and lower achievement in the majority of schools. However, ineffective teacher instruction, poor academic performance syndromes, misuse, inaccessibility, inadequacy, students' severe failures in internal and external exams in the majority of Nigerian North Western Secondary Schools, were the driving forces behind this study. Therefore, it was necessary to conduct an investigation to assess their availability and adequacy for Economics instruction in Nigeria's North Western Secondary Schools.

### **Statement of the Problem**

The critical issues of Economics ineffective lesson delivery, poor students' academic performance, slow rate of learning, defective classroom management, poor Economics curriculum implementation, non-achievement of the lesson objectives, massive failure in teacher made tests as well as external examinations, according to Agene (2021), are likely to be attributable to unavailability, inaccessibility, and inadequacy, of instructional materials used in teaching and learning of Economics as well as teachers' inability to utilize and avail themselves with the appropriate instructional materials required for effective teaching and learning processes. However, these problems could also be linked to lack of improvisational skills, poor teaching skills, teachers' attitude and inexperience in teaching and learning processes and above all, teachers' unpreparedness, lack of practical skills, and expertise require to operate and utilize the appropriate instructional materials in any classroom instructions. However, these shocking and scary problems made teachers' teaching efforts abortive and unsuccessful, which could make learning less effective and might affect the Economics students' learning abilities and academic performance. According to Yusuf (2018), Economics students continue to perform lamentably poor in their external and internal examinations which resulted in ineffective educational delivery and poor academic achievements due to the unskilled utilization or unavailability of the relevant instructional materials in North Western secondary schools. This made Economics teaching and learning processes more challenging, strenuous and reduction of O-level achievements. These problems necessitated the conduct of this research in order to evaluate the availability and adequacy of these instructional materials for teaching and learning of Economics in Nigerian North Western Senior Secondary Schools.

### **Objectives of the Study**

The objectives of the study were to:

1. examine the extent of availability of instructional materials for teaching and learning of Economics in Senior Secondary Schools in North West, Nigeria;
2. ascertain the level of adequacy of instructional materials for teaching and learning of Economics in Senior Secondary Schools in North West, Nigeria;

### **Research Questions**

The study answered the following research questions:

1. What is the extent of availability of instructional materials for teaching and learning of Economics in Senior Secondary Schools in North West, Nigeria?
2. What is the level of adequacy of instructional materials for teaching and learning of Economics in Senior Secondary Schools in North West, Nigeria?

### **Hypotheses**

The study was guided by the following research hypotheses:

**H<sub>01</sub>:** There is no significant difference in the extent of the availability of instructional materials for teaching and learning of Economics in Senior Secondary Schools in North West, Nigeria

**H<sub>02</sub>:** There is no significant difference in the level of adequacy of instructional materials for teaching and learning of Economics in Senior Secondary Schools in North West, Nigeria.

### **Concept of Instructional Materials**

Instructional materials are powerful educational tools, curriculum or learning resources that are utilized by Economics teachers to concretized lessons, simplify difficult Economics concepts and ease teaching and learning processes. They are handled by teachers to facilitate instructions, make lesson explicit to the learners, encourage collaborative, cooperative and interactive learning. When properly utilized by Economics teachers, these learning materials can facilitate teaching and



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learning processes which could lead to the excellent students' academic performance. According to Samuel (2025), instructional materials refer to those alternative channels of communication, which a classroom teacher can use to concretize concepts during teaching and learning processes. These instructional materials, used to help students meet the state of learning standards, may be printed, digital, technology-based materials, educational media, and assessments, (Washington Office of Superintendent of Public Instruction, 2025). In the words of Anabel (2025), instructional materials are teaching or curriculum materials that a teacher may use in teaching and learning situations to help him achieve desired learning objectives and to facilitate the teaching and learning process. However, Instructional materials can be grouped, classified or categorized into different types and sub-groups to serve multifarious purposes and functions in classroom instructions as followed: Audio instructional materials, visual instructional materials, audio-visual instructional materials, display instructional materials, multimedia instructional materials, printed instructional materials, graphic instructional materials, human instructional materials, infrastructural instructional materials, financial instructional materials, time instructional materials and community instructional materials.

### **Availability of Instructional Materials**

The availability of instructional materials refers to the state of instructional materials of being obtainable, available, present, supplied and ready to be utilized by Economics teachers at any given time in classrooms. Ikpesu and Nkem (2021), opined that, the availability of instructional materials means access to instructional materials needed for teaching Economics. The availability of these materials reduces students' poor academic performance, defective learning activities and improves teaching and learning processes. They can also help teachers make difficult aspects of Economics easy, abstract, concrete, or complex, simple. The importance of instructional materials in any Economics lesson can also make teachers put extra efforts into having access and availability of these materials from different sources or engage in improvising the unavailable ones to achieve consistent and coherent instructions in classrooms. Governments at all levels and some private organisations are struggling to provide schools with the appropriate and adequate proportions of these instructional materials to enhance teaching and learning processes in schools. Nonetheless, the availability of these instructional materials for teaching and learning of Economics can help Economics teachers and students to simplify instructions, improve students' retention rate, influence students' learning activities, improve academic performance, resolve several educational issues and problems. However, Bright and Jonathan (2019), observed that, despite their importance, there have been reports on either the non-utilization or unavailability of instructional materials in Economics, which have become a source of concern to stakeholders in today's educational sectors. This is because "they can give secondary school teachers a vision of how to successfully integrate disciplinary concepts, crosscutting concepts, and practices as well as relate instruction to standards and assessment, (Kanno, Obasi and Solomon 2016)." Their unavailability can cause inefficient learning activities and poor academic performance among Economics students in most Nigerian senior secondary schools in the North West, Nigeria. Therefore, there is a need to evaluate the availability of these instructional materials for teaching and learning of Economics in Nigerian senior secondary.

### **Concept of Adequacy of Instructional Materials**

The adequacy of instructional materials means the state of instructional materials of being enough, adequate, sufficient or satisfactory for use and manipulation by teachers and their students during classroom instructions. Albarico et'al (2024), opined that, adequacy of instructional materials is the sufficiency of learning resources in numbers as well as the number of the tools and equipment in relation to the number of students enrolled and must be adequate, appropriate and updated. However, adequacy and availability of instructional materials are two concepts with different meaning and interpretation. Availability of instructional materials refers to the obtainability, readiness, presence or supply of these materials for use in classrooms. It is not necessary that, when instructional materials are available, they must be adequately sufficient to go round to both teachers and students during delivery. It was discovered that, instructional materials can be available but not necessarily enough for use during lesson instructions. This showed that, availability of instructional materials has only one concept of being available while adequacy of instructional materials has two meanings or concepts of being available and adequate or sufficient to both teachers and their students for utilization in Economics teacher delivery. Mohammed (2023), stated that, instructional materials are considered adequate when the teaching tools used to teach a subject can meet the students' expectations regarding effectiveness and efficiency. It is considered inadequate when the number or quantity of instructional materials available does not correspond to the intended number of students. Kaizer and Okoli (2021), added that, adequacy means when the instructional materials available for teaching are available in enough quantity and quality



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when compared to the students' population. When instructional materials needed for teaching a particular subject can measure up to the expectation of the students in terms of quantity and quality, it said to be adequate. Adequacy of instructional materials can facilitate Economics teacher delivery and learning activities which in turn improve students' academic performance. Mohammed (2023), stated that, adequacy means the degree to which the instructional materials or resources for teaching are adequate for the student population. The necessary instructional materials should be readily available in sufficient quantities and capable of providing the intended value. It is imperative to equip schools with suffice instructional materials for teaching Economics in most schools. These materials like charts, graphs, diagram, maps, workbooks, graph sheets etc. can simplify the most difficult aspects of Economics. There is no way someone will be good in Economics without graphical and manipulative skills. Therefore, the adequacy of instructional materials enhances teacher delivery, facilitates students' learning activities and improve academic performance in Economics in the study areas.

### **Methodology**

The research employed a descriptive survey research design. Specifically, in this design, the researcher used a survey method. The population of this study was one hundred and eight thousand, nine hundred and seventy-four (108,974) respondents comprising all Economics teachers and students in Senior Secondary Schools in North West, Nigeria. It also included one hundred and five thousand, seven hundred and nineteen (105,719) Senior Secondary School Two (SSII) Economics students and three thousand, two hundred and fifty-five (3,255) Economics teachers from the seven states of the North West Geo-Political Zone of Nigeria. The study's respondents were spread across one thousand, six hundred and twenty-four (1,624) Senior Secondary Schools that were offering Economics in the seven (7) states of the North West Geo-Political Zone of Nigeria, namely Jigawa, Kaduna, Kano, Katsina, Kebbi, Sokoto and Zamfara states. The total sample size of this study comprised three hundred and eighty-four (384) respondents sampled from Economics teachers and students in the study area. This was based on the recommendation of Research Advisor 2006 under 95% confidence, (Dada, 2016). Multistage sampling techniques were employed in the selection of sampled teachers, students and schools. Firstly, the simple random sampling procedure was used in selecting fifty-eight (58) Economics teachers from one thousand, eight hundred and sixty-five (1,865) Economics teachers from the three sampled states. Secondly, the three hundred and twenty-six (326) sampled students were selected using proportionate sampling procedure whereby each sampled state contributed a proportion to the sample size based on their population strength. However, proportionate sampling procedure was also used in selecting fifty (50) schools out of eight hundred and seventy-six (876) schools as the school sample size. Thirdly, three (3) sampled states were chosen by assigning numbers to all the seven states; then, all the even numbers were systematically taken as the sample size. The instrument used for this study was the researcher self-designed questionnaire for both teachers and students using a four (4) modified Points Likert Scale. It was divided into sections A - E which contained fifty (50) items that required respondents' responses. The instrument used for this study was validated by some experts from Department of Educational Foundations and Curriculum, Faculty of Education Ahmadu Bello University, Zaria. The researcher carried out a pilot test at Alhudahuda College Zaria, Kaduna State, Nigeria in order to assess the effectiveness of the instrument to be used. The test was conducted in the school which was not part of the sample size where twenty (20) copies of the instrument were administered to three (3) teachers and seventeen (17) students in the pilot school. The results were computed while the Cronbach's Alpha was employed to determine the Reliability Coefficient of the pilot test. The reliability coefficient of the instrument was assessed following a successful pilot test conducted with twenty (20) copies of the instrument from the pilot school. The test-retest reliability method was employed and the results were analyzed using Cronbach's Alpha. The obtained Cronbach's Alpha value was 0.85 which was in proximity to one (1). However, Aliyu (2023), opined that, any reliability index ranging from 0.5 and above can be deemed high enough for use in real research. Therefore, the instrument used demonstrated high reliability and consistency for the intended study, as the results was close to one (1). This justified the use of the instrument and made it reliable for the study proper. The research was set by taking an introductory letter obtained from the Department of Educational Foundations and Curriculum, Faculty of Education, Ahmadu Bello University, Zaria to all the Principals of the sampled schools which solicited permission to use their Economics teachers and students in the collection of data for the study. The data collected were analysed using descriptive and inferential statistics. The research questions were analysed using frequency and mean while non-parametric statistics, specifically the Mann-Whitney U-Test was employed to test all the five null hypotheses formulated for the study at 0.5 level of significance.



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## Presentation of Results

This section presented the results of data analysis, discussion and interpretations of the findings based on the data gathered during the course of this study. Essentially, the analysis involved analyzing of the research questions using descriptive statistics of frequency and mean and statistical testing of the hypotheses formulated for the study using inferential statistics of Mann-Whitney test at 0.05 level of significance.

## Analysis of Research Questions

This section presented the analysis of research questions raised during the course of this study which were analysed using descriptive statistics of frequency and mean. The bench mark for acceptance was 2.5. All the research questions and their analysis were presented in Tables 1 and 2 as follow:

**Research Question One:** What is the extent of availability of instructional materials for teaching and learning of Economics in Senior Secondary Schools in North West, Nigeria?

In order to answer this research question, the data collected on the extent of availability of instructional materials for teaching and learning of Economics in Senior Secondary Schools in North West, Nigeria were analysed using frequency and mean. The outcomes of this analysis were succinctly summarized in Table 1 as follows:

**Table 1:** Frequency and Mean on the Extent of Availability of Instructional Materials for Teaching and Learning of Economics in Senior Secondary Schools in North West, Nigeria.

S/N	Item statements	N	FA	A	RA	NA	Mean
1	Radios, public address system, audio books, cassette players, audio CD players, podcasts, audio tapes, microphones, recordings, tape recorder and loudspeaker are available for teaching and learning of Economics in my school.	384	61	154	108	61	2.6
2	Blackboards, whiteboards, magnetic boards, bulletin boards, flashcards, slides, e-books, e-journals, drawings, pictures and photographs are available for teaching and learning of Economics in my school.	384	117	201	38	28	3.1
3	Educational television, videos, documented films, filmstrips, projector, films projectors, sound slide, videotapes and interactive video are available for teaching and learning of Economics in my school.	384	39	100	148	97	2.2
4	Posters, models, specimen, display board, felt board display, realia, real objects, cartoons, cartograms, photographic print and local currency are available for teaching and learning of Economics in my school.	384	116	153	78	37	2.9
5	Computers, mobile phones, iPad, tablet device, smart boards, internet, internet facilities, multimedia board are available for teaching and learning of Economics in my school.	384	130	135	56	63	2.8
6	Charts, graphs, graph sheets, diagrams, tables, maps, globe, atlas, flow charts and pie charts are available for teaching and learning of Economics in my school.	384	170	165	31	18	3.3
7	Digital charts, digital graphs, digital diagrams, digital tables, info graphics, PowerPoint presentation and projected maps are available for teaching and learning of Economics in my school.	384	50	151	123	60	2.5
8	Newspapers, magazines, periodicals, pamphlets, journals, articles, gazettes, wall newspapers and workbooks are available for teaching and learning of Economics in my school.	384	187	129	43	25	3.2
9	Textbooks, handouts, structured notes, assignment sheets, fact sheets, wall charts, flip charts, dictionaries, encyclopedia, course and study guide are available for teaching and learning of Economics in my school.	384	178	145	42	19	3.3
10	Interactive whiteboard, multimedia projector, DVD, VCD, CD, slide projector, Economics simulators, printers and	384	188	171	20	5	3.4



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scanners are available for teaching and learning of Economics in my school.

**Cumulative Mean**

**2.9**

*Source: Field work, 2025/Bench Mark 2.5*

Table 1 presented the analysis of responses on the extent of availability of instructional materials for teaching and learning of Economics in Senior Secondary Schools in North West, Nigeria. The cumulative mean was 2.9 which is greater than the 2.5 benchmark. This implied that, instructional materials were available for teaching and learning of Economics in Senior Secondary Schools in North West, Nigeria.

**Research Question Two:** What is the level of adequacy of instructional materials for teaching and learning of Economics in Senior Secondary Schools in North West, Nigeria?

In order to answer this research question, the data collected on the level of adequacy of instructional materials for teaching and learning of Economics in Senior Secondary Schools in North West, Nigeria were analysed using frequency and mean. The outcomes of this analysis were succinctly summarized in Table 2 as follows

**Table 2:** Frequency and Mean on the Level of Adequacy of Instructional Materials for Teaching and Learning of Economics in Senior Secondary Schools in North West, Nigeria.

S/N	Item statements	N	VA	A	SA	NA	Mean
11	Radios, public address system, audio books, cassette players, audio CD players, podcasts, audio tapes, microphones, recordings, tape recorder and loudspeaker are adequate for teaching and learning of Economics in my school.	384	1	9	107	247	1.3
12	Blackboards, whiteboards, magnetic boards, bulletin boards, flashcards, slides, e-books, e-journals, drawings, pictures and photographs are adequate for teaching and learning of Economics in my school.	384	85	77	90	132	2.3
13	Educational television, videos, documented films, filmstrips, projector, films projectors, sound slide, videotapes and interactive video are adequate for teaching and learning of Economics in my school.	384	16	105	157	106	2.1
14	Posters, models, specimen, display board, felt board display, realia, real objects, cartoons, cartograms, photographic print and local currency are adequate for teaching and learning of Economics in my school.	384	50	138	142	54	2.4
15	Computers, mobile phones, ipads, tablet device, smart boards, internet, internet facilities and multimedia board are adequate for teaching and learning of Economics in my school.	384	75	112	120	77	2.4
16	Charts, graphs, graph sheets, diagrams, tables, maps, globes, atlases, flow charts and pie charts are adequate for teaching and learning of Economics in my school.	384	63	60	130	131	2.1
17	Digital charts, digital graphs, digital diagrams, digital tables, infographics, PowerPoint presentation and projected maps are adequate for teaching and learning of Economics in my school.	384	70	114	113	87	2.4
18	Newspapers, magazines, periodicals, pamphlets, journals, articles, gazettes, wall newspapers and workbooks are adequate for teaching and learning of Economics in my school.	384	89	103	97	95	2.4
19	Textbooks, handouts, structured notes, assignment sheets, fact sheets, wall charts, flip charts, dictionaries, course and study guide are adequate for teaching and learning of Economics in my school.	384	62	66	154	102	2.2
20	Interactive whiteboard, multimedia projector, DVD, VCD, CD, slide projector, Economics simulators, printers and scanners are adequate for teaching and learning of Economics in my school.	384	73	77	146	88	2.4
	<b>Cumulative Mean</b>						<b>2.2</b>

*Source: Field work, 2025/Bench Mark 2.5*



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Table 2 presented the analysis of responses on the level of adequacy of instructional materials for teaching and learning of Economics in Senior Secondary Schools in North West, Nigeria. The cumulative mean was 2.2 which is less than the 2.5 benchmark. This implied that, instructional materials for teaching and learning Economics in Senior Secondary Schools in North West, Nigeria were inadequate.

### Test of Hypotheses

This section presented the analysis of two (2) null hypotheses formulated during the course of this study which were tested using the inferential statistical tool of Mann Whitney Test at 0.05 level of significance. The summaries of the test analysis were presented in Table 3 & 4 as follow:

**Hypothesis One:** There is no significant difference in the extent of the availability of instructional materials for teaching and learning of Economics in Senior Secondary Schools in North West, Nigeria. To test the null hypothesis one (1), Mann Whitney (U-test) statistic was used. The summary of the analysis was presented in Table 3 as follows:

**Table 3: Summary of Mann Whitney Test Analysis on the extent of the Availability of Instructional Materials for Teaching and Learning of Economics in Senior Secondary Schools in North West, Nigeria.**

Variables	N	df	H-cal.	p-value	Decision
Teachers	384	382	509.000	.753	Retained
Students					

P-Value = 0.753 >  $\alpha = 0.05$

Table 3 presented the Mann Whitney Test analysis result which revealed H.cal value equal to 509.00 and the P-value equal to 0.753. The calculated P-value of 0.753 is greater than the alpha value of 0.05 ( $P = 0.753 > 0.05$ ). This implied that, there is no significant difference in the extent of the availability of instructional materials for teaching and learning of Economics in Senior Secondary Schools in North West, Nigeria. Based on this evidence, the null hypothesis that said, there is no significant difference in the extent of the availability of instructional materials for teaching and learning of Economics in Senior Secondary Schools in North West, Nigeria was retained. Moreover, the result also indicated that, no significant difference between teachers and students regarding availability of instructional materials for teaching and learning of Economics in Senior Secondary Schools in North West, Nigeria.

**Hypothesis Two:** There is no significant difference in the level of adequacy of instructional materials for teaching and learning of Economics in Senior Secondary Schools in North West, Nigeria. To test the null hypothesis two (2), Mann Whitney (U-test) statistic was used. The summary of the analysis is presented in Table 4 as follows:

**Table 4: Summary of Mann Whitney Test Analysis on the level of Adequacy of Instructional Materials for Teaching and Learning of Economics in Senior Secondary Schools in North West, Nigeria.**

Variables	N	df	H-cal.	P-Value	Decision
Teachers	384	382	11.500	.924	Retained
Students					

P-Value = 0.924 >  $\alpha = 0.05$

Table 4 presented the Mann Whitney Test analysis result which revealed H- Cal value equal to 11.500 and the P-value equal to 0.924. The calculated P-value of 0.924 is greater than the alpha value of 0.05 ( $P = 0.924 > 0.05$ ). This implied that, there is no significant difference in the level of adequacy of instructional materials for teaching and learning of Economics in Senior Secondary Schools in North West, Nigeria. Based on this evidence, the null hypothesis that said, there is no significant difference in the level of adequacy of instructional materials for teaching and learning of Economics in Senior Secondary Schools in North West, Nigeria was retained. Furthermore, the result also indicated that, no significant difference between teachers and students regarding adequacy of instructional materials for teaching and learning of Economics in Senior Secondary Schools in North West, Nigeria.

### Summary of Findings

1. The findings of this study revealed that, instructional materials for teaching and learning of Economics in Senior Secondary Schools in North West, Nigeria were available (P-value 0.753)
2. The finding also disclosed that, instructional materials for teaching and learning of Economics in Senior Secondary Schools in North West, Nigeria were inadequate (P-value 0.924)



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### **Discussion of Findings**

The finding number one revealed that, instructional materials for teaching and learning of Economics in Senior Secondary Schools in North West, Nigeria were available. This finding was in agreement with the findings of Chikendu and Ekoyo (2024), which revealed that, instructional materials are highly available for teaching computer studies in senior secondary schools in Idemili North Local Government Area. The finding was also supported by the findings of Ali, Kura, Abdul and Aliyu's (2020), which revealed that, the instructional materials for teaching and learning are available. It was also found that, the availability of instructional materials improves students' academic performance in secondary schools. This implied that, if teaching materials are available to various subjects' requirements it will result in better academic performance. Additionally, Ehirim, Iwuchukwu and Okenyi's (2020), findings also revealed that, many instructional materials were available but they are not adequately utilized and chemistry teachers failed to effectively improvise instructional materials when none were accessible for use in chemistry lessons. This finding was not in line with the findings of Zubar (2023), who found that, necessary materials for teaching social studies are not available in schools. It was also revealed that, effective teaching and learning of social studies is dependent on the availability, accessibility and utilization of teaching resources. The finding was also supported by the finding of Augustine (2022), which revealed that, audio, visual and audio-visual resources for teaching Christian religious studies were not adequately available and utilized in both public and private senior secondary schools in Taraba State. Moreover, this finding also aligned with the research findings conducted by Ndu and Aminu (2016), who reported that, multimedia facilities were available but they are not adequate in the study area. It was also found that, teachers and students have limited access to multimedia facilities in the study area. This discovery aligned with the observations of Ameen, Abdullahi and Gbadamosi (2024), who reported that, 57.1% of the sampled instructional materials are available, emphasizing a notable scarcity. The finding was also consistent with Ifeakor's study in 2019 which revealed that, visual instructional materials such as real objects/specimen, models, posters, charts, maps, pictures/photograph, chalkboard and chalks, marker-board and marker, handouts, journals, magazines, textbooks and e-books as well as audio-visual instructional materials such as slides, projectors and computers were available in Federal Colleges of Education in North-central, Nigeria. In addition, Ehirim, Iwuchukwu and Okenyi (2020), revealed that, many instructional materials were available, but they were not adequately utilized and chemistry teachers do not appropriately improvised instructional materials when not available in the teaching and learning of chemistry. The finding number two disclosed that, instructional materials for teaching and learning of Economics in Senior Secondary Schools in North West, Nigeria were inadequate. This finding was supported by the finding of Dahiru, Akinpade and Aluko's (2021), which revealed that, instructional facilities were inadequate and the available instructional facilities were not fully utilized in teachings Agricultural Science. The finding was also supported by the findings of Tety (2016), who disclosed that, instructional materials are not adequate in the study area and most community secondary schools in Rombo District suffer shortage of essential teaching and learning materials. This implied that, the schools with inadequacy of instructional materials; their instructors are likely to perform low whereas schools with adequate instructional materials; their instructors are likely to perform high. In contrast, the discovery of the present study did not align with the research conducted by Yusuf (2018), who reported that, instructional materials for teaching Economics are adequate but the extent of their utilization is low. That is to say, Economics teachers neglected the use of instructional materials despite their relevance, which cannot be separated from teaching and learning process. Nonetheless, the current study's outcomes did not also align with the research conducted by Usman (2016) who reported that, availability and utilization of instructional materials have influence in teaching Economics in senior secondary schools in Kwara State.

### **Conclusion**

Based on the findings of this study, it was concluded that, instructional materials for teaching and learning of Economics in Senior Secondary Schools in North West, Nigeria are generally available. However, a critical gap was observed in terms of adequacy in the materials provided to the schools. Therefore, it could also be concluded that, availability of instructional materials alone would not bring about effective and efficient teaching and learning processes in Economics unless such materials are fully adequate in schools. Statistical analysis further confirmed that, there were no significant differences in availability, and adequacy of Instructional Materials across the studied schools ( $P$ -values  $> \alpha$ ). This suggested that while schools may possess the relevant instructional materials, the effectiveness of these materials in enhancing meaningful learning was constrained by their inadequacy.



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## Recommendations

Based on the findings and conclusion of this study, it was recommended that:

1. Governments, school administrators, teachers and other stakeholders should maintain and sustain the steady supply of instructional materials for teaching and learning of Economics in Senior Secondary Schools in North West, Nigeria. This could be done through continuous supply of instructional materials by the educational resource centre and provision of effective storage facilities by the school heads.
2. Governments, policymakers, school management and stakeholders should provide adequate instructional materials for teaching and learning of Economics in Senior Secondary Schools in North West, Nigeria. However, this could be done through government supply of the materials, provision of funds to purchase the materials needed by individual schools as well as seeking donations from private organizations. School heads should also encourage and train Economics teachers and students to produce, design, source or improvise the unavailable ones. Parents should also be encouraged by the schools to donate or provide cash for continuous supply of the instructional materials for enhancing teaching and learning in schools.

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## Design, Development and Evaluation of web-based Virtual Laboratory for Integrated Science Education Program among Selected Colleges of Educations in Osun State, Nigeria

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### Abstract

*The effective training of science student-teachers is critical for the advancement of science-based education. Traditional laboratory instruction still faces challenges related to high cost, safety issues, and accessibility. This study focuses on the design, development and evaluation of a web-based Virtual Laboratory (VL) designed to enhance the training of student-teachers in integrated science teachers. The study uses a quantitative approach, where 120 student-teachers were assessed before and after a four-week intervention with the developed Virtual Laboratory. Quantitative analysis showed a statistically significant increase in competency scores from pre-test ( $M = 64.5$ ,  $SD = 8.2$ ) to post-test ( $M = 85.3$ ,  $SD = 7.5$ ),  $t(149) = 21.8$ ,  $p < .001$ . The study implemented a System Usability Scale (SUS) which showed a mean score of 88.5, indicating excellent student satisfaction with the Laboratory. The study findings shows that the VL is an effective and usable tool that significantly improves student-teachers' practical knowledge and teaching confidence.*

**Keywords:** Virtual Laboratory, Integrated Science Education, Teacher Training, Educational Technology, Usability.

### Introduction

Science education for student teachers relies on laboratory experimentation, where students observe scientific concept, verify theoretical principles, and also develop the necessary practical skills (Kurtz et al., 2025). Laboratory experimentations provides opportunities for students to develop knowledge through the direct use of laboratory equipment's and observation of results (Bitar et al., 2024). In the field of Integrated Science Education in Colleges of Education in Nigeria, laboratory work is indispensable for developing practical skills and conceptual understanding. Traditional physical laboratories often face constraints such as high operational costs, safety issues, and limited access. Studies have shown that there is increase need for virtual laboratories not merely as a supplementary tool but as a critical infrastructure needed to ensure pedagogical continuity (Oun et al., 2025). By leveraging Virtual Laboratories, it would provide a risk-free environment where students can iterate experiments, visualize molecular interactions, and reduce the gap between theory and practical observation. In many institutions, particularly in developing countries like Nigeria, the lack of adequate resources and infrastructure for practical science education is a significant challenge. The absence of well-equipped science laboratories in schools often limits the effectiveness of science teaching and learning (Efendi & Jayanti, 2024). This gap is even more pronounced in teacher training programs, where Nigeria Certificate in Education (NCE) students may not have access to hands-on practical experience in science education (Babalola & Fakoyede, 2022). Even with adequate equipment, effective science teaching requires teachers to be well-trained in designing and implementing engaging laboratory activities (Remperas et al., 2025; Zhang et al., 2024). This study therefore aims to design and develop a Virtual Laboratory (VL) that will serve as a simulation tool for science experiments and activities, for student teachers in colleges of education in Nigeria to gain practical knowledge and experience in conducting integrated science experiments.

### Objectives of the Study

The objectives of the study are to:

1. Design a Virtual Laboratory for NCE students in Integrated Science Education
2. Develop the designed Virtual Laboratory for NCE students in Integrated Science Education
3. Assess the usability and accessibility of the VL in different educational settings



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## Research Questions

The following research questions guided the study:

1. How effective is the Virtual Laboratory in enhancing NCE students' practical skills in integrated science education?
2. What are the perceptions of student-teachers regarding the usability and accessibility of the Virtual Laboratory?
3. How does the use of the Virtual Laboratory influence the teaching competency of NCE Students?

## Literature Review

Research has indicated that the VL teacher training programs may have a positive effect on the perceptions, attitudes and learning outcomes of participants in the VL use (Achuthan et al., 2023). The teachers who were exposed to VLs prior to teaching show better knowledge of various educational practices and are more participatory in the physical lab work (Alhashem & Alfaiakawi, 2023). VL are considered to be efficient as supplementary devices in the development of skills and knowledge transfer of laboratories in blended classrooms (Radhamani et al., 2018).

### Virtual Laboratories in Education

Virtual laboratories tools play a crucial role in modern education by enhancing the learning process, promoting interactive understanding, and developing essential skills (Vascan, 2024). Previous studies has shown that virtual laboratories support both individual and collaborative learning environments thereby allowing students to actively participate in social communities. By incorporating virtual labs in place of traditional laboratories, educators can improve student engagement, retention, and transfer of learning across various scientific disciplines (Vascan, 2024).

### Teacher Training and Integrated Science Education

Previous studies have shown that a large percentage secondary science teachers lack the ability to develop integrated science practical lessons, as a result of their specialized backgrounds in individual science disciplines (Rubini et al., 2018). To address this, various approaches have been explored, including Laboratory-based training courses for preservice teachers (Valls-Bautista et al., 2021), professional development programs focusing on practical syllabus, pedagogical content knowledge, and STEM instructional materials (Lertdechapat & Faikhanta, 2021).

### Related Work

Tuysuz (2010) used quasi-experimental designs to prove that VLs were capable of overcoming time, cost, and safety limitations in traditional chemistry laboratories, but in the case of the study was confined to one subject. Likewise, Dela Cruz and Mendoza (2018) addressed the issue of inadequate facilities and equipment of engineering courses by creating an immersive Virtual Reality (VR) setting, which is limited by the high cost of the special equipment and the simplicity of the experiment introduced. More recently, the problem of resources to serve large student populations in Nankai University was solved by Zhang and Liu (2023) through the high-scale implementation of a platform of 41 simulation projects, and this method has difficulties in ensuring uniformity among various projects. The other problem as emphasized in the past research is the pedagogical and design dilemma of VL implementation. In cases Coutinho et al. (2023) found the absence of a systematic process of development, the author suggested a conceptual model that would join backward design and software engineering, but this methodology needs to be empirically tested. Miyamoto et al. (2019) were interested in enhancing the students in their background knowledge on the basic biology procedures using 3D interactive animation, but had to be constrained by the fact that the virtual setting was based on errors in the underlying lab manuals. Reginald (2023) applied a systematic review to evaluate the influences of VLs on self-regulated learning (SRL) in the COVID-19 transition, but the weaknesses included the fact that the conclusions were drawn by secondary data. Within the framework of collaborative learning, Kurtz et al. (2025) identifies the necessity of enhanced integration of learning analytics, while Elmoazen et al. (2023) emphasized and identified the fact that at present, the situation is disjointed and standardized protocols are missing, which can be used to track the progress of students on different platforms.

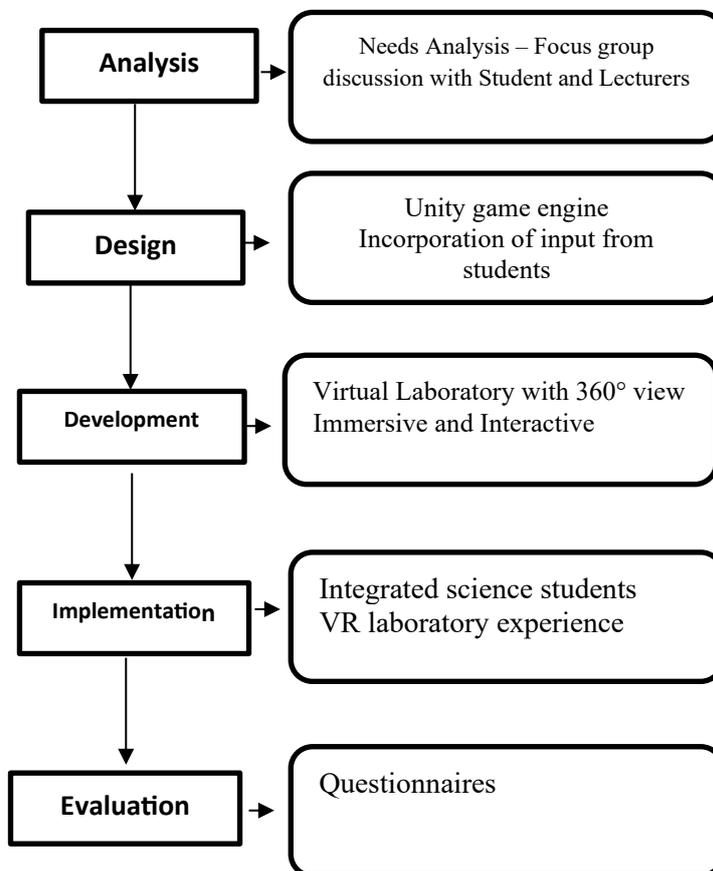
### Methodology

The virtual lab was developed as a web-based program based on Flask (python 3.14). The logic of chemical reactions and user session management were implemented with the help of the backend, while the frontend uses HTML5, CSS3, and JavaScript to display the interactive interface. Application architecture is a Model-View-Controller (MVC) type, which is scalable and easy to modify various modules of chemicals. In order to measure the efficacy of the virtual lab, quasi-experimental design was used involving a sample of Nigeria Certificate in Education Students in the department of integrated science Education. The respondents were separated into an Experimental Group (Virtual Lab) and Control Group (Traditional).

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## Design and Development

### Phase 2: Design and Development



**Figure 1:** Phases of the Virtual laboratory for NCE Integrated Science Student

This stage consists of the design and the development of the virtual laboratory through iterative prototyping. The scalability and the flexibility was ensured in a modular architecture. The logic was written in Python programming language and web interface written in JavaScript scripting language and HTML and CSS. The developmental tool was utilized as the Unity to simulate on 3D and WebGL to make it compatible on the browser. The characteristics of the Virtual Laboratory were Interactive Simulations where core experiments in the teacher training programme on integrated science subjects are physics, chemistry, as well as biology, though the emphasis in the initial phase of the implementation activity was the use inclusion of certain Chemistry laboratory practicals as contained in the National Commission of Colleges of Education minimum standard. A completed web application containing six interactive chemistry experiments (Acid-Base Titration, Stoichiometric Calculations, Buffer Solutions, Precipitation Reactions, Redox Reactions, Gas Laws) as shown on table 1 with real time parameter manipulation, live visualization of data represented on Figure 3, 4 and 5.

**Table 1**

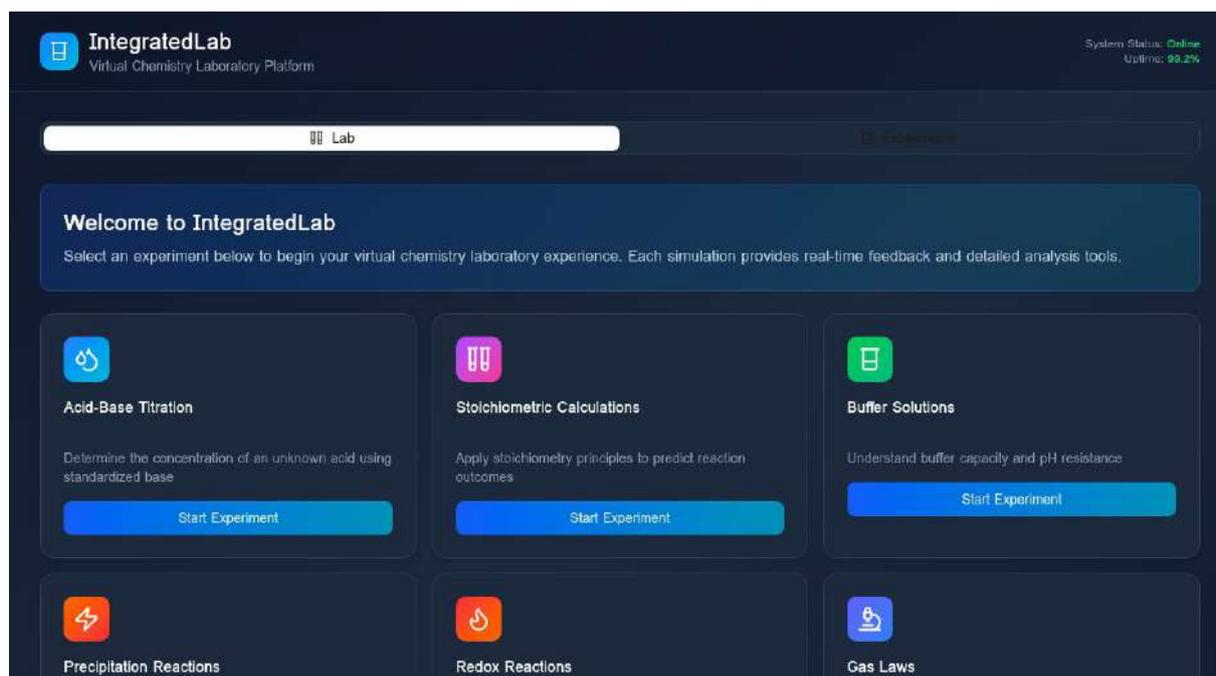
Summary of Implemented Virtual Lab Experiments, Learning Objectives, and Key Features

Experiment	Learning Objectives	Key Features
Acid-Base Titration	Understand titration principles and calculate molarity	Real-time pH monitoring; indicator color changes
Stoichiometric Calculations	Apply stoichiometry to chemical reactions	Molar ratio visualization; limiting reagent identification
Buffer Solutions	Understand buffer capacity and pH	pH monitoring; buffer component adjustment



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Precipitation Reactions	Predict and observe precipitation reactions	Ionic equation visualization; solubility rules
Redox Reactions	Understand electron transfer processes	Oxidation state visualization; half-reaction balancing
Gas Laws	Apply the ideal gas law	Pressure–volume–temperature relationships



**Figure 2.** Flask application interface for Integrated Laboratory Interface simulation.

## Evaluation of Virtual Laboratory

### Study Area/Site/Subjects:

The evaluation was conducted at selected Colleges of Education in Osun state, Nigeria. Using purposive sampling, one federal owned college (Federal College of Education, Iwo), one state-owned college (Osun State College of Education, Ila-Orangun) and a private college of education (Assanusiyah College of Education Ode-Omu) were selected for the evaluation of the developed virtual laboratory. The primary subjects of the study were NCE students enrolled in the Integrated Science Education programs. The developed Virtual Laboratory was tested with a group of student-teachers who are currently enrolled in integrated science. A total sample size of 120 students was selected using random sampling techniques from the chosen institutions. The students were divided into two groups: a Experimental Group (N=60) and a Control Group (N=60).

### Data Collection:

Data was collected using a quantitative method with a questionnaire instrument. Additionally, a set of tests (Pre-Test and Post-Test) were administered before and after the use of the VL to assess changes in students' practical skills, scientific knowledge, and teaching competency.

### Data Analysis:

Quantitative data was analyzed using statistical methods to compare pre- and post-test results specifically, T-tests to compare pre-test and post-test scores.



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## Presentation of Results

The evaluation of the Virtual Laboratory (VL) showed significant quantitative and qualitative data. This section presents the findings from the pre- and post-test assessments, usability surveys, and classroom observations, providing a comprehensive picture of the VL's impact on student-teachers.

## Student Learning and Competency Outcomes

In order to determine the effect of the VL on the learning of the students, pre-test and post-test were conducted in 120 student-teachers. The different tests were intended to test three major areas: Practical Skills Knowledge, Scientific Conceptual Knowledge and Teaching Competency. Paired-samples t-test, showed statistically significant increase in the overall scores after the four weeks of intervention period. The means became 85.30 (SD = 7.50) against 64.50 (SD = 8.20) in the post-test and pre-test respectively,  $t(149) = 21.8, p < .001$ . This difference is significant (mean difference = 20.8 percentage points) and demonstrates a significant and positive change in the performance of students. In order to get more insight, the scores were segregated by the area of competency. As Table 2 indicates, there were considerable improvements in all the three areas. The greatest improvement was observed in Practical Skills Knowledge where it improved by 24.5 percentage points.

Table 2

*Descriptive Statistics for Pre-Test and Post-Test Scores by Competency Area (N=120)*

Competency Area	Test	Mean (%)	Std. Deviation	Mean Difference (%)
Practical Skills Knowledge	Pre-Test	61.2	9.5	24.5
	Post-Test	85.7	7.8	
Scientific Conceptual Knowledge	Pre-Test	68.1	8.9	18.9
	Post-Test	87.0	7.1	
Teaching Competency	Pre-Test	64.2	9.1	19.0
	Post-Test	83.2	8.0	
Overall Score	Pre-Test	64.5	8.2	20.8
	Post-Test	85.3	7.5	

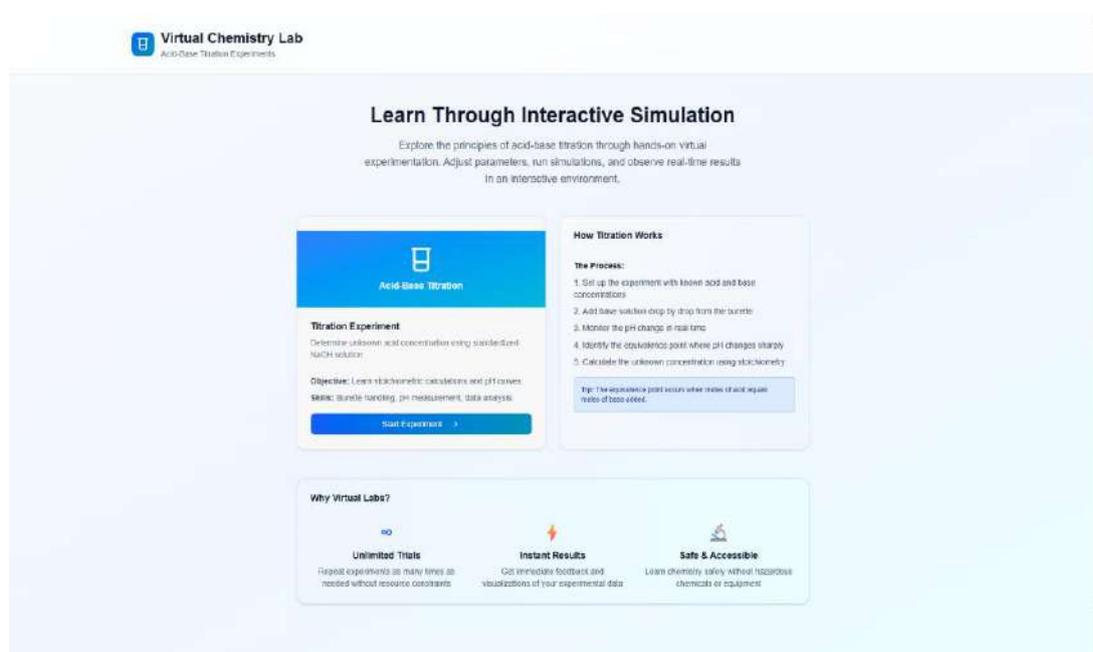


Figure 3: Home page with experiment selection and educational overview

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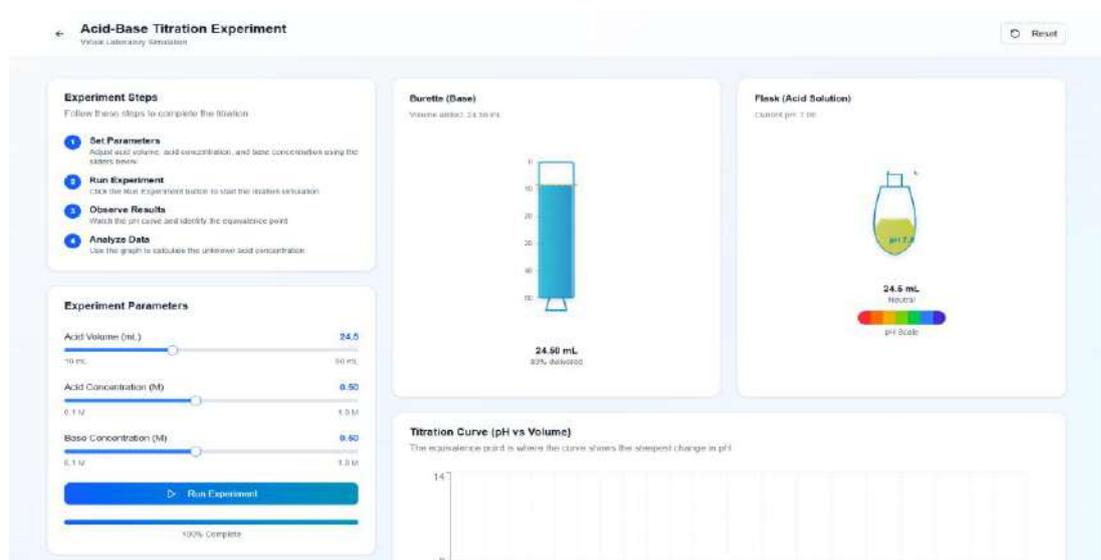
**User Experience and Perceived Effectiveness**

The mean System Usability Scale (SUS) score was 88.5 (SD = 6.2), indicating an Excellent level of usability. Feedback from the questionnaire, as shown in Table 3, was positive, with 96.0% of student teachers feeling more confident in their teaching abilities after using the platform.

**Table 3**

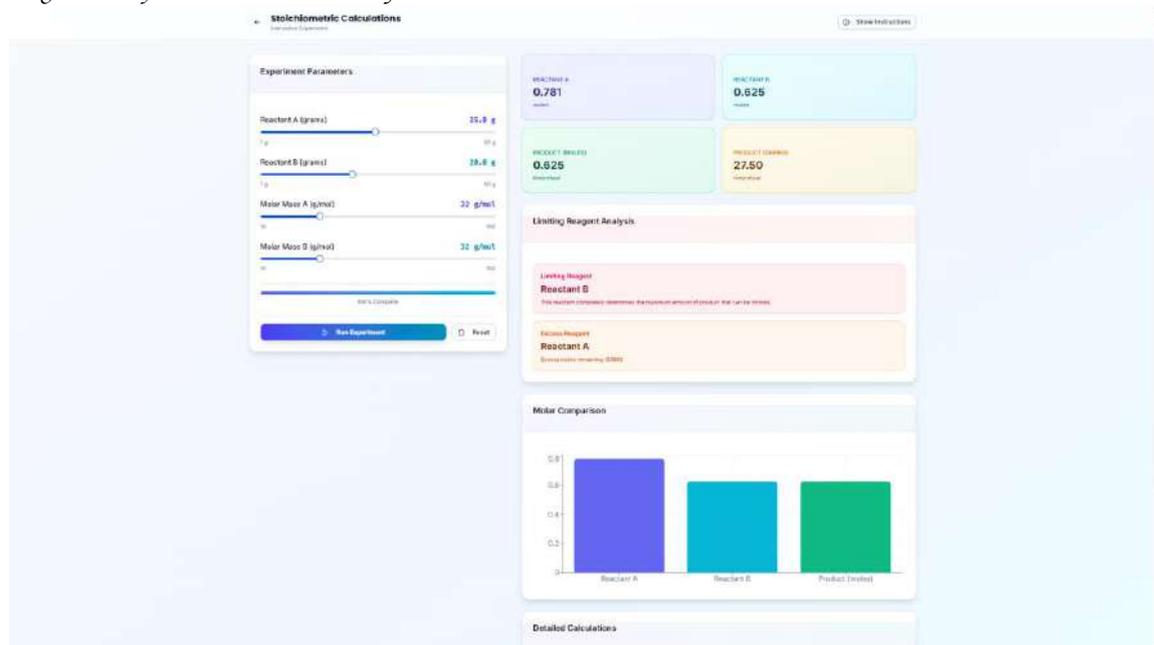
*Student-Teacher Feedback on the Virtual Laboratory (N=120)*

Survey Item	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)
The VL was easy to use and navigate.	72.0	24.0	4.0	0.0	0.0
The VL was an effective tool for my learning.	68.0	26.7	5.3	0.0	0.0
I feel more confident in my teaching abilities.	70.7	25.3	4.0	0.0	0.0
The accessibility of the VL was beneficial.	81.3	16.7	2.0	0.0	0.0



**Figure 4:** Animated burette visualization showing liquid delivery

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**Figure 5:** Simulated Accurate pH curve generation using stoichiometric calculations

## Discussion of Findings

The results indicate that the Virtual Laboratory is a very productive tool to use in training integrated student-teachers. The dramatic rise in test scores is consistent with the studies that VLS have the potential to generate learning outcomes that are similar or even better than those generated by conventional labs. Practical Skills Knowledge was the most improved and this implies that the risk-free environment of the VL is the best place to learn the logic behind the procedure. The Scientific Conceptual Knowledge and Teaching Competency gains can be attributed to the fact that the VL brings abstract concepts to life and that it can be easily integrated into the teaching practice. The high usability measure proves that the user-centered design was effective and reduced the cognitive load and enabled learners to concentrate on the content. The results indicate that the VL is a potent complement to the conventional labs, which fosters equity to offer high-quality experiences to every learner and aid in the creation of modern educators who can effectively operate with technology. A randomized controlled trial should be used in future studies to compare the VL with the traditional instruction per se and carry longitudinal studies to determine long-term knowledge retention.

## Conclusion

This research paper can prove that a web-based Virtual Laboratory (VL) has a remarkable positive influence on the training of pre-service teachers of integrated science. The study aimed at assessing how effective the VL is in practical skills, scientific knowledge, and teaching competence development. The results verify that VL is an effective educational instrument and, the results obtained are significant and statistically significant in terms of improvement of students-teacher performance. The main conclusions drawn from this study are:

1. The Virtual Laboratory has significant accelerating effects on learning: The intervention led to increasing assessment scores on overall, with significant improvement of knowledge in practical skills, conceptual knowledge, and teaching competency. This proves that a properly drawn virtual environment may be an effective means of teaching.
2. A positive user experience is critical to success: The high usability rating (SUS M = 88.5) and the vast majority of positive user experience feedbacks confirm the need to focus on user-driven design. The user-friendly and intuitive design of the VL also enabled student-teachers to concentrate on learning and not using a complicated tool.
3. The VL fosters confidence and innovative teaching: Qualitative data showed the importance of the risk-free environment of the VL, which enabled student-teachers to rehearse and learn complex procedures and developed more confidence. Such confidence, in its turn, carried into more creative and efficient pedagogical activities in their practicums as teachers.



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### **Acknowledgement**

This study was funded by TETFUND Institution Based Research (IBR) Grant

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## Effects of Indoor and Outdoor Learning Strategies on Performance and Retention in Biology Concepts among Secondary School Students in Adamawa State, Nigeria

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### Abstract

*This study investigated comparative effects of indoor and outdoor learning strategies on biology student's academic performance and retention in senior secondary schools of Adamawa State, Nigeria. Three research questions were raised and three null hypotheses were formulated and tested at 0.05 level of significance guided the study. The study adopted quasi-experimental design, which involves a pretest-posttest, post-posttest, non-equivalent, control group, design. The population of the study was 48,760 SSII biology students across five education zones of Adamawa State. A sample of 514 SSII biology students from four intact classes were purposively selected for the study. The instruments for data collection were adapted Biology Academic Performance Test (BAPT) which were subjected to face and content validation. The BAPT scores were subjected to K-R 21 to determine the reliability of the instrument. The reliability index of 0.78 was obtained. Data were analyzed using mean and standard deviation to answer the research questions, while ANCOVA and Independent sample t – test were used to test the hypotheses. The findings of the study revealed that: there is significant differences in the mean achievement scores of Biology students taught using indoor and outdoor learning strategies,  $F_{(1, 191)} = 14.314, p < 0.00$ , there is significant differences in the mean retention scores of Biology students taught using indoor and outdoor learning strategies,  $F_{(1, 191)} = 8.513, p < 0.00$ , there is significant gender difference on students' academic achievement in biology when taught with indoor and outdoor learning strategy. There is a significant difference in the mean retention scores of Biology students using the same learning strategies based on gender  $F_{(1, 191)} = 0.000, p > 0.05$  Based on the findings it was recommended that, School administrators should encourage biology teachers to use teacher-students based activities such as indoor and outdoor learning strategies during teaching and learning of biology content.*

**Key words:** Indoor, Outdoor, Gender, Learning Strategy, Students' Academic Achievement, Biology,

### Introduction

Education is primarily concerned with the strategies and practices used to facilitate learning in schools. It serves as the channel through which a society passes on its accumulated knowledge, beliefs, and values to future generations (Amae, 2020). In essence, education equips learners to play meaningful roles in shaping and improving their communities. In today's world marked by rapid technological progress and continual innovation strengthening science education has become essential for any nation seeking to achieve or maintain advanced status (Aliyu & Mustapha, 2018). At the secondary level, one key role of science education is to help learners develop an organized scientific understanding that may support them in everyday problem-solving through subjects such as Biology, Chemistry, and Physics. Biology, in particular, focuses on the study of living organisms, exploring their features, structures, functions, interactions within their environments, genetic relationships, and patterns of distribution across different regions (Joda, 2018; Joda & Mohammed, 2017). The aim is to develop a thorough grasp of biological ideas that can lead to effective and meaningful instruction in



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Biology. Both indoor and outdoor learning experiences require attention to biological and environmental related factors that shape students' educational achievement. Indoor settings provide controlled environmental and physical conditions such as managed temperature, lighting, biology resources and adaphic factors that are designed to promote concentration and organized teaching (Okon, 2015; Joda, 2018).

Indoor Learning strategy refers to situations where students are taught using laboratory method within the four corners of a classroom (Reid, 2018). This approach relies on teacher led instruction, predetermined curricula, organized schedules, and a variety of teaching materials, including books and digital technologies. Indoor settings are stocked with numerous learning resources such as classrooms and that support high-quality teaching (Yaşın, 2016; Priest, 2024). As a result, the structured nature of indoor learning often helps students meet their academic performance. Such environments can also ease student anxiety and promote a sense of inclusion, thereby enriching the overall learning experience. On the other hand, Outdoor learning strategy include excursions and fieldwork carried out in open-air environments ranging from school compounds to community sites such as botanical garden where students can interact directly with real-life materials and situations (Moses, 2018). Such methods strengthen the bond between schools and their surrounding communities, giving students a stronger sense of context and relevance in what they learn (Okon, 2015; Tsai & Yaşın, 2016). According to Richmond et al. (2018) outdoor education enhances social connectedness by increasing students' sense of belonging and improving peer relationships. Learning beyond the classroom enables students to engage with their surroundings in ways that encourage creativity, inquiry, and active, hands-on learning (Harun & Salamuddin, 2017; Morohunfolo, 2020). Consequently, outdoor learning can foster better collaboration, greater self-confidence, stronger leadership skills, and improved academic outcomes. Another contributor to students' low achievement is gender-related factors. Gender encompasses the socially defined roles, expectations, and characteristics that a society assigns to males and females. Research has documented gender gaps in science performance, often tied to cultural, social and psychological factors that shape learners' attitudes and participation in science subjects (Lappin, 2019). Edarho (2020) found that male students performed better than females when taught science through outdoor methods, showing significantly higher retention scores. Other studies, however, indicate that gender does not substantially affect students' retention; when given equal learning opportunities, both boys and girls can perform equally well (Ma, 2017; Kolawole & Popoola, 2017; Joda & Mohammed, 2019; Nzeri, 2024). Conversely, some researchers have reported notable differences in biology performance and retention in favor male students (Ariyo, 2016; Onah & Ugwu, 2019). Therefore, this study seeks to examine comparative effects of indoor and outdoor learning strategies on biology students' academic performance and retention in senior secondary schools in Adamawa State, Nigeria.

### **Statement of the Problem**

In spite of the importance of Biology, it is alarming to note that most students still see and learn Biology as an abstract subject which may be as a result of ineffective use of the teaching strategies. Statistical report of students' performance in 2018 - 2024 respectively showed that out of 31,134 candidates examined for Biology in May/June WASSCE, 32.41% candidates failed. 25.32% failed in Biology in 2023 and 39.65% failed in Biology in 2024. This situation is disturbing and not in the best interest of the science and technological growth and development of Adamawa State in particular and the nation at large. The low achievement and weak retention seen among biology students' issues central to this study have been linked to students' lack of interest in certain biology topics such as ecology, genetics, and classification, as well as the reliance on teaching methods that do not adequately support or engage learners (Isiugo-Abanihe, Long & Ibiene, 2018). The problem of this study therefore, is to investigate the comparative effects of indoor and outdoor learning strategies on biology student's academic performance and retention in senior secondary schools of Adamawa State, Nigeria.

### **Purpose of the Study**

The purpose of the study is to determine the comparative effects of indoor and outdoor learning strategies on biology student's academic performance and retention in senior secondary schools of Adamawa State, Nigeria. The specific objectives of the study are to compare the:

1. Effect of indoor and outdoor learning strategies on Biology students' academic performance in senior secondary schools of Adamawa state.



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2. Effect of indoor and outdoor learning strategies on Biology students' retention in senior secondary schools of Adamawa state.
3. Effect of indoor and outdoor learning strategy of male and female biology students' performance in senior secondary schools of Adamawa state

### Research Questions

The following research questions are formulated to guide this study.

1. What are the pretest and posttest mean performance scores of biology students when taught with indoor and outdoor learning strategies?
2. What are the pretest and posttest mean retention scores of biology students when taught with indoor and outdoor learning strategies?
3. What are the pretest and posttest mean performance scores of male and female biology students when taught with indoor and outdoor learning strategies?

### Research Hypotheses

The following null hypotheses were formulated and will be tested at 0.05 levels of significance to guide the Study;

- H<sub>01</sub>:** There is no significant difference in the mean pretest and posttest performance scores of biology students taught with indoor and outdoor learning strategies in senior secondary schools of Adamawa state.
- H<sub>02</sub>:** There is no significant difference in the mean pretest and posttest retention scores of biology students taught with indoor and outdoor learning strategies in senior secondary schools of Adamawa state.
- H<sub>03</sub>:** There is no significant difference in the mean pretest and posttest performance scores of male and female biology students taught with indoor and outdoor learning strategies in senior secondary schools of Adamawa state by gender

### Methodology

This study employed pretest-posttest, post-posttest quasi-experimental group design. The area of the study is Adamawa State Nigeria. The population of the study consist of 48,760 of all the senior secondary school SS II biology students in Adamawa state. Sample of this study was 192 Biology SS II students' were draw from four intact classes of Senior Secondary Schools (SSS II) in Numan Education zone of Adamawa State. Purposive sampling techniques were used to select four senior secondary schools from the three education zones. The sampled students in each intact class were randomly assigned to experimental groups I and II by ballots. The first two picked papers were assigned as experimental group I (indoor learning). The second two picked papers were assigned as experimental group II (outdoor learning). The selected biology teachers in each school followed the school time table as provided by the school management. The instrument used was Biology Academic Performance Test (BAPT) which contains 50 items. The instrument consists of 50 multiple choice objective tests items with four options (A-D) with one key and three distracters developed to assess the academic performance of the groups. The instrument was adapted from West African examination past question papers from 2019-2024 in biology. The instrument was delimited to Ecology, classification of living things, and environmental biology. The Biology Academic Performance Test (BAPT) was subjected to face and content validity. To ensure the quality, reliability, and internal consistency of the Biology Academic Performance Test (BAPT), the instrument was subjected to a pilot test involving 30 SS II students from Government Day Senior Secondary School Demsa in the Numan Education Zone. The BAPT was analyzed using the Split-Half Method, and the internal consistency was calculated using the Kuder-Richardson Formula 21 (K-R21). A reliability coefficient of 0.78 was obtained. The first week pre-test was administered to both the experimental I and II groups. Indoor and outdoor strategies were carryout for four weeks. The Experimental Groups 1 were taught using the Indoor strategy in the biology in the classroom and experimental group 2 were taught using outdoor teaching strategy outside the classroom environment. After the treatment, post-test were administered to the experimental groups which lasted for one week. The same Biology Performance Test for the pretest and posttest were administered to the subjects as the post post-test (Retention test) which took place two weeks after administration. The BPT were reshuffled as post post test to determine the retention after two weeks of administration. The data collected were analyzed using mean and standard deviation to answer the 3 research questions. For testing the 3 null hypotheses, the Analysis of Covariance (ANCOVA) and Independent Sample *t* – Test were tested at a 0.05 level of significance. The decision rule to be taken on testing the hypothesis is that if  $P < 0.05$  level of significance, reject the null hypothesis and if the  $p > 0.05$  level of significance do not reject the hypothesis.



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## Presentation of Results

**Research Question 1:** What are the pretest and posttest mean performance scores of biology students when taught with indoor and outdoor learning strategies?

**Table 1: Mean and Standard Deviation of Pre – Test and Post Test Scores Difference of Students Taught with Indoor and Outdoor Learning Strategies.**

Group	N	Pre – test		Post – test		Mean difference
		M	S. D	M	S. D	
Indoor	97	25.12	7.01	38.13	6.19	13.01
Outdoor	95	24.30	6.63	43.72	10.92	19.42

Table 1 presents the mean and standard deviation of pretest and posttest scores for students taught Biology using two different instructional strategies: indoor and outdoor learning strategy. In the indoor group, the pretest mean score was 25.12 with a standard deviation of 7.01, while the posttest mean score increased significantly to 38.13 with a standard deviation of 6.19. This resulted in a mean difference of 13.01, indicating a substantial improvement in students' achievement after the intervention. For the outdoor group, the pretest mean score was 24.30 with a standard deviation of 6.63, and the posttest mean score was 43.72 with a standard deviation of 10.92, yielding a mean difference of 19.42. This group also showed a significant improvement, with the outdoor learning showing the highest mean difference, followed closely by the indoor learning strategy.

**Research Question 2:** What are the pretest and posttest mean retention scores of biology students when taught with indoor and outdoor learning strategies?

**Table 2: Mean and Standard Deviation of Post Test and Retention Scores Difference of Students taught Biology using Indoor and Outdoor Learning Strategies**

Group	N	Post – test		Retention		Mean difference
		M	S. D	M	S. D	
Indoor	97	38.13	6.19	42.05	5.34	3.92
Outdoor	95	43.72	10.92	49.13	6.03	5.41

Table 2 provides the mean and standard deviation of posttest and retention scores for the same groups. In the indoor group, the posttest mean score was 38.13 with a standard deviation of 6.19, and the retention mean score was 42.05 with a standard deviation of 5.34, resulting in a mean difference of 3.92. For the outdoor group, the posttest mean score was 43.72 with a standard deviation of 10.92, and the retention mean score was 49.13 with a standard deviation of 6.03, yielding a mean difference of 5.41.

**Research Question 3:** What are the pretest and posttest mean performance scores of male and female biology students when taught with indoor and outdoor learning strategies?

**Table 3: Mean and Standard Deviation of Pre – Test and Post Test Scores Difference of Male and Female Students taught Biology using Indoor and Outdoor Learning Strategies**

Group	Gender	n	Pre – test		Post – test		Mean difference
			M	S. D	M	S. D	
Indoor	Male	53	11.34	2.01	15.67	3.22	4.33
	Female	44	13.07	3.70	18.34	2.01	5.27
Outdoor	Male	52	10.59	3.10	23.03	5.31	12.44
	Female	43	14.27	4.82	20.63	7.02	6.36

Table 3 examines the mean and standard deviation of pretest and posttest scores for male and female students taught Biology using the same learning strategies. In the indoor group male students had a pretest mean score of 11.34 with a standard deviation of 2.01, and a posttest mean score of 15.67 with a standard deviation of 3.22, resulting in a mean difference of 4.33. Female students had a pretest mean score of 13.07 with a standard deviation of 3.70, and a posttest mean score of 18.34 with a standard deviation of 2.01, yielding a mean difference of 5.27. For the outdoor group, male students had a pretest mean score of 10.59 with a standard deviation of 3.10, and a posttest mean score of 23.03 with a standard



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deviation of 5.31, resulting in a mean difference of 12.44. Female students had a pretest mean score of 14.27 with a standard deviation of 4.82, and a posttest mean score of 20.63 with a standard deviation of 7.02, yielding a mean difference of 6.36. These results indicate that female students generally showing slightly higher mean differences in the indoor while male students performing better than female in the outdoor learning strategy.

### Hypotheses Testing

**H<sub>01</sub>:** There is no significant difference in the mean pretest and posttest performance scores of biology students taught with indoor and outdoor learning strategies in senior secondary schools of Adamawa state

**Table 4: Summary of ANCOVA of Difference between the Mean Academic Achievement Scores of Students taught Biology using Indoor and Outdoor Learning Strategies**

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	2837.761a	2	753.701	9.310	.000	.193
Intercept	16701.490	1	16701.490	152.531	.000	.233
Pretest	53.682	1	53.682	.649	.462	.003
Learning Strategies	2370.108	1	2185.054	14.314	.000	.407
Error	10763.327	190	87.583			
Total	274323.000	192				
Corrected Total	141274.510	191				

a. R Squared = .169 (Adjusted R Squared = .151)

The ANCOVA results in Table 4 reveal significant differences in the mean achievement scores of Biology students taught using different instructional strategies,  $F_{(1, 191)} = 14.314$ ,  $p < 0.00$ , Since the computed p-value (0.00) is less than 0.05 level of significant, therefore, the null hypothesis of no significant difference is rejected. This implies that there is significant difference in the achievement scores of students taught biology with indoor and outdoor learning strategies in senior secondary schools of Adamawa state.

**H<sub>02</sub>:** There is no significant difference in the mean pretest and posttest retention scores of biology students taught with indoor and outdoor learning strategies in senior secondary schools of Adamawa state

**Table 5: Summary of ANCOVA of Difference between the Mean Retention Scores of Students Taught Biology using Indoor and Outdoor Learning Strategies**

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	2623.497a	3	874.499	9.809	.000	.169
Intercept	17086.807	1	17086.807	191.652	.000	.569
Pretest	94.951	1	94.951	1.065	.304	.007
Learning Strategies methods	2385.211	2	1192.606	8.613	.000	.516
Error	12927.537	190	89.155			
Total	292085.000	192				
Corrected Total	15551.034	191				

a. R Squared = .169 (Adjusted R Squared = .152)

The ANCOVA results in Table 5 indicate significant differences in the mean retention scores of Biology students taught using different instructional strategies,  $F_{(1, 191)} = 8.513$ ,  $p < 0.00$ , Since the computed p-value (0.00) is less than 0.05 level of significant, therefore, the null hypothesis of no significant difference is rejected. This implies that there is a significant difference in the achievement retention scores of students taught biology with indoor and outdoor learning strategies in senior secondary schools of Adamawa state.

**H<sub>03</sub>:** There is no significant difference in the mean pretest and posttest performance scores of biology students taught with indoor and outdoor learning strategies in senior secondary schools of Adamawa state by gender

**Table 6: Summary of Independent Sample t – Test of Students’ Academic Achievement Based on Gender when Taught Biology with Indoor and Outdoor Learning Strategies**

Achievement scores	Gender	n	Mean	S. D	DF	t – value	P – value	Remarks
Indoor learning strategy	M	53	18.6023	8.5735	96	7.531	0.001	H <sub>03</sub> rejected
	F	44	20.6808	6.3764				



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Outdoor learning strategy	M	52	25.5741	10.4065	95	3.175	0.000	H <sub>03</sub> rejected
	F	43	23.3005	18.4701				

From Table 6, presents the analysis of independent sample *t* – test of students’ academic achievement based on gender when taught biology with indoor and outdoor learning strategies. For students taught using indoor learning strategy  $t=7.531$ ;  $df=(1, 96)$ ,  $P<0.05$ . Since the computed P-value (0.000) is less than 0.05 level of significance, the null hypothesis is rejected. This implies that there is significant gender difference on students’ academic achievement in biology when taught with indoor learning strategy. Also, For students taught using outdoor,  $t=3.175$ ,  $df = (1, 95)$ ,  $P<0.05$ . Since the computed P-value (0.000) is less than 0.05 level of significance, the null hypothesis is rejected. This implies that there is significant gender difference on students’ academic achievement in biology when taught with outdoor learning strategy.

### Findings of the Study

1. There significant difference in the achievement scores of students taught biology with indoor and outdoor learning strategies in senior secondary schools of Adamawa state.
2. There significant difference in the retention scores of students taught biology with indoor and outdoor learning strategies in senior secondary schools of Adamawa state.
3. There is significant gender difference and treatment on students’ academic achievement in biology.

### Discussion of Findings

There significant difference in the achievement scores of students taught biology with indoor and outdoor learning strategies in senior secondary schools of Adamawa state. These findings align with Eriwell (2021) reported that students taught biology through outdoor instruction outperformed those taught indoors. In the same vein, Olagunju and Oloyede (2021) found that outdoor learning experiences significantly improved students’ environmental attitudes. Jeremiah (2023) also observed that teaching ecological concepts was more effective when delivered through outdoor methods. Conversely, Jan-Erik (2018) and Saroja (2023) showed that indoor and outdoor learning approaches work best when used together, as both contribute to enhancing students’ academic achievement. Their studies further indicated that students generally expressed a preference for outdoor settings when learning science. Overall, outdoor learning serves as a valuable supplement to conventional classroom instruction, particularly in encouraging students to be more physically active. The result also show there significant difference in the achievement retention scores of students taught biology with indoor and outdoor learning strategies in senior secondary schools of Adamawa state. The findings of this study are consistent with Emmanuel (2024), who reported a significant difference in students’ retention scores when comparing those taught through outdoor activities with those taught using the lecture method. Similarly, Oyovwi (2020) and Berberoğlu (2020) found that students who learned in outdoor environments such as ecological parks, botanical gardens and conservation areas demonstrated much stronger conceptual understanding and longer-lasting retention than students taught with indoor learning strategy. The findings also indicated that there is significant gender difference and treatment on students’ academic achievement in biology. This finding agreed with Edarho (2020) found a significant difference in the mean retention scores between male and female students taught science with outdoor science activities in favour of male students. Saidu and Suleiman (2024) revealed that there was no significant change in the performance of students at different ability levels but gender played a significant role in the performance of students in biology. On the contrary, Adesoji (2018) found no significant difference in academic performance between male and female students after exposure to outdoor laboratories. This implies that indoor and outdoor learning strategies are gender friendly at different levels and also improve student performance.

### Conclusion

The study concluded that both indoor and outdoor instructional approaches influence biology students’ performance and retention in senior secondary schools in Adamawa State. However, outdoor learning proved to be more effective than indoor methods. Additionally, both strategies were found to be supportive and suitable for learners of all genders.

### Recommendations

Based on the findings of this study, the following recommendations are made;

1. School administrators should encourage biology teachers to integrate both indoor and outdoor, activity-based instructional strategies that actively involve students in learning process.



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2. School administrators should support biology teachers by organizing seminars and workshops focused on how to implement effective indoor and outdoor teaching strategies.
3. School administrators should encourage biology teachers to actively involve both male and female students in lessons, ensuring that indoor and outdoor learning strategies are integrated during instruction

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