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Editorial

It is with great pleasure that we present Volume 2, Issue 3 of the *Global Journal of Modern Research and Emerging Trends (GJMRET)*. This edition continues to advance scholarly discourse through the publication of rigorous, innovative, and socially relevant research across diverse academic disciplines. The articles featured in this issue reflect contemporary concerns and emerging trends shaping society, technology, health, education, and communication in both local and global contexts.

Notably, this edition prides in its interdisciplinary outlook. The studies published herein explore pressing issues such as the growing influence of artificial intelligence in banking and customer relations, public health concerns associated with biomass fuel exposure, and other contemporary challenges confronting developing societies. These contributions show the increasing role of research in providing evidence-based solutions to societal and institutional problems.

This issue also highlights the commitment of researchers to addressing practical realities through empirical inquiry and systematic analysis. The articles collectively underscore the importance of innovation, technological adaptation, public health awareness, and policy-driven interventions in achieving sustainable development and improving quality of life. The editorial board appreciates the scholarly depth, methodological soundness, and originality demonstrated by the contributors.

We sincerely acknowledge the efforts of our reviewers, editorial team, and authors whose dedication and professionalism made this publication possible. Their commitment to academic excellence continues to strengthen the credibility and visibility of GJMRET as a journal for impactful research dissemination.

We trust that the insights presented in this edition will enrich scholarly conversations, inspire further investigations, and contribute meaningfully to knowledge development across disciplines. We warmly welcome researchers, academics, and professionals to engage with the ideas shared in this issue and to continue supporting the advancement of quality research.

Prof. Joe Ushie
Editor-in-Chief
Global Journal of Modern Research and Emerging Trends (GJMRET)

About the Journal

Global Journal of Modern Research and Emerging Trends (GJMRET) is a quarterly publication by *Word Astra Publisher*s. It is an open-access, peer-reviewed journal dedicated to advancing scholarly research across a wide range of academic disciplines.

Committed to upholding the highest standards of academic publishing, GJMRET provides a global platform for researchers, academicians, and industry professionals to disseminate their latest findings, innovative ideas, and emerging trends.

Scope of the Journal

The journal welcomes original research articles, review papers, case studies, and technical reports across diverse fields, including:

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Artificial Intelligence Chabots Utilisation and Customer Patronage of Selected Banks in Akwa Ibom State, Nigeria

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Abstract

This study employed the survey research technique and the questionnaire as an instrument in gathering primary data from customers of Zenith, UBA, and Stanbic IBTC banks in Akwa Ibom State, to ascertain whether any significant relationship existed between their utilisation of the banks' AI chatbots for self-service banking transactions and patronage of the banks. The population of this study comprised a cumulative population of 643,487 customers of the select banks, while data aimed at achieving the research objectives were collected from a sample of 400 customers of the select banks as determined using the Taro Yamane formula. To reach the respondents with the research instrument, the researcher adopted the Probability Proportionate to Size (P.P.S.) and availability sampling

procedures. The primary data gathered were analysed using simple percentages and presented in frequency tables. The major findings of the study revealed that customers of the select banks patronised the banks as a result of the banks' AI chatbots (248 [62%]). Among other relevant recommendations, the branch managers, corporate communications/public relations, and technical/ICT units of the select banks should mitigate the risk perception of AI chatbots among some sections of their clientele to ensure wider acceptance, adoption, and patronage of the self-service innovations.

Keywords: artificial intelligence, chatbots, patronage, banks, self-service, innovations.

Introduction

As of 2026, there are almost no aspects of human endeavour not influenced in some way by the ubiquity of artificial intelligence (AI). Aside from deep emotional care therapy and high-stakes ethical judgement, AI has had tremendous influence in the day-to-day activities of humans, from education to medicine, agriculture, aviation, maritime, meteorology, commerce, and banking. Artificial intelligence as an expert system is a smart and intelligent machine with memories programmed with relevant humanistic knowledge in such a way that it can offer intelligent advice, explanations, suggestions, and justifications of its programmatic decisions as human beings would (Singh, Misha & Sagar, 2013). AI is adopted to enhance and improve organisations' service delivery, especially in areas, environments, or contexts not suitable or conducive for humans. It is in this instance that AI is considered to serve better functions with consistency, precision, and fewer mistakes as well as improving organisations' productivity compared to humans (Singh *et al.*, 2013).

The application and integration of the affordances of AI to bank operations, practices, and processes come with less financial cost compared to the cost of having to pay human experts. AI, as applied to banking services by most Nigerian retail banks, performs or completes banking tasks that would otherwise require human intelligence and expertise (Mohammed, 2019). Hence, AI programmed for customer care or customer relationship management performs services that are characteristic of human customer care agents or human relations experts. In view of the foregoing, Oyeleye and Ademosu (2021) submit that AI has altered and disrupted the landscape of how humans interact with their surroundings and communicate with others.

In the aspect of enhancing banks' corporate communication, customer relationship management, and seamless self-service interface, AI has been integrated to perform functions that were once the exclusive preserve of human customer care agents. Because of the conversational and interactive prowess of AI innovations in serving specialised functions in the banking industry, they have earned the name 'chatbots'. Artificial intelligence chatbots are smart and intelligent conversational machines programmed with natural language processing and deep learning abilities. They are adopted by banks to assist customers in a self-service approach in getting specialised tasks done.

The adoption and utilisation of AI-powered chatbots by banks in Nigeria are done with a view to integrating the innovations to advance the self-service approach to procuring banking services. AI chatbots, as self-service technological innovations, are technological interfaces that enable bank customers to produce a service independent of direct service involvement of bank staff (Ezechirinum *et al*., 2020). Valtolina and Neri (2021) believe that it is through the pre-programmed dialogue interfaces of AI chatbots that bank customers are able to navigate and communicate with banks in an automated yet highly individualised manner. This is an idea Kaczorowska-Spychalska (2019) refers to as the dehumanisation of what is human and the humanisation of technology in bank service delivery.

As self-service innovations, AI chatbots engage banks' customers in a virtual conversation in view of solving problems and offering services, which range from giving customers insight into the banks' products and services. They offer guided assistance to customers on how to open an account or block an account in the eventuality of imminent fraud; check an account balance; fund a transfer; pay bills or tariffs; retrieve an account number; and serve other personalised functions upon request. In short, they are innovations that enable customers to deliver services themselves through the use of smart and intelligent technology (Meuter, Ostrom, Roundtree & Bitner, 2000) without having to pay a physical visit to their designated banks. The implication of this self-service innovative scenario is that AI-powered chatbots have become an extension of the banks' customer relationship management, troubleshooting desks, resolution platforms, and corporate services and functions.

By advancing banks' service delivery, the customer-AI-chatbot solution-based interface enhances banks' corporate reputation among stakeholders, publics, and customers. Though driven by AI computing technology, the interactive interface of chatbots is problem-solving and result-orientated in purpose. Such an interactive interface serves both ends: the customers and the mainstream banks. The customers do not need to

be physically present in the banking halls to get the required services but can do so in the comfort of their private, personal, or official spaces with the assistance of AI-powered chatbots. The banks' personnel, on the other hand, are relieved from undue pressures that come with addressing customers' complaints. As a large chunk of their works are automated, they can have rest from fatigue and stress of having to attend to long queues on bank premises. Again, automation of banks' customer service delivery helps to decongest banking premises as the bulk of customers' issues are annexed to AI-powered chatbots.

Considering the perceived ways in which AI chatbots are institutionalising bank customers' self-service approach to accessing selected bank services in Akwa Ibom State and interfacing with customer relationships, it has become imperative to interrogate whether such a technological trend exerts any sort of influence on the patronage of the banks. In addition, if yes, what is the extent of satisfaction? By problematising these issues, this paper hopes to bring empirical evidence to either refuted or validated opinions on the subject matter.

Statement of the Problem

Artificial intelligence chatbots have become a permanent feature, with many organisations, including banks, adopting them to streamline operations, enhance self-service delivery, and improve customer relations. It is worth considering the extent to which customers of these banks have adapted to using AI chatbots and how this influences their decision to patronise these services. As customers' knowledge of the availability of the AI-powered, chatbots in the select banks and their level of patronage of the self-service innovations are uncertain, this study seeks to interrogate the assumption that a nexus exists between the deployment of AI chatbots and the patronage of selected banks in Akwa Ibom State. This study, therefore, focuses on the gaps in evidence, population, gratifications, and practical knowledge between utilisation of AI chatbots by selected banks in Akwa Ibom State and customers' patronage of the banks. The empirical quest to bridge these research gaps prompts the researchers to ask; to what extent does the utilisation of AI chatbots by selected banks in Akwa Ibom State influence customer patronage of the banks? What is their level of satisfaction?

Objectives of the Study

The objectives of this study are to:

i. ascertain the extent to which customers of select banks in Akwa Ibom State patronise selected banks as a result of the banks' utilisation of AI chatbots as interactive communication tools for self-service banking transactions.

ii. determine the level of satisfaction that customers of selected banks in Akwa Ibom State have derived from their utilisation of AI chatbots in their self-service transactions with the banks.

Conceptual Review

Artificial Intelligence Chatbots

Etymologically, what later became 'chatbot' was initially called 'ChatterBot'. The term was coined by Michael Mauldin, who is credited with having created the first-ever conversational programmes in 1994 called 'Verbot'. Originally, a chatbot is an automated software application designed to mimic human conversation through text or voice interactions, typically conducted online (Caldarini, Jaf & McGarry, 2022; Techtarget.com, 2023). Chatbots are artificial intelligence (AI) systems that offer a conversational experience with a user in natural language and simulate or mimic the way a human would behave as a conversational partner in a real communication context (Mauldin, 1994; Deloitte Digital, 2018).

'Chatbots' simply means 'chatting robots' (Tascini, 2019). They have also been referred to as 'smart bots', 'interactive agents', 'digital assistants', 'intelligent agents', 'artificial conversation entities', 'virtual assistants' or 'virtual agents' (Gomathy, Narayana, Krishna, & Geetha, 2022; IBM, 2023). When the term 'AI (Artificial Intelligence)' is added to 'chatbot', it implies that the chatbot possesses human-like intelligence, enabling it to maintain interactions and conversations aimed at solving specific problems or completing tasks in real time.

Hence, artificial intelligence chatbots are those chat-engaging innovations that are powered by the affordances of artificial intelligence to engage human agents in a problem-solving interaction and conversation. AI-enabled chatbots utilise AI-enabled expert systems and natural language processors which comprise content extraction, classification, machine translation, question answering, text generation, text-to-speech and speech-to-text in order to be able to deliver specific results pertaining to the enquiries and queries posed by human agents. They are conversational tools, resources, or

innovations that engage human agents in a communication encounter in view of solving problems that have to do with the extraction of need-driven information in a specific context of demand. Their conversational abilities are a typical example of man-machine or machine-man collaboration and dialogue in solving specific problems or undertaking specific tasks. They are computerised and programmatic innovations that enable human-like interaction delivered through a channel that is easily scalable (Deloitte Digital, 2018).

Tascini (2019) sees artificial intelligence chatbots as being capable of creating conversation not just between human agents but also between virtual agents. Chatbots enabled by the affordances of artificial intelligence, which often operate in the form of chats, are automated systems that are specifically programmed to respond to specific inputs in view of meeting specific demands and addressing specific issues with the potential of generating user feedback. They are programmatic software that are programmed with codes and protocols to mimic and simulate the human intelligence in smart conversation with the users (Tacini, 2019). The conversation simulated by AI-enabled chatbots is done using textual or audio data input-output techniques. Natural language processing enables chatbots to converse with composite agents in the most natural manner possible (Gomathy *et al*., 2022).

As smart and intelligent conversation agents, AI-enabled chatbots can perform a variety of specialised tasks, especially when those tasks have to do with responding to queries, in which they act as smart entities when conversed with through text or voice, as they can understand one or more human languages by Natural Language Processing (NLP). It is within such context that chatbots have been touted and presumed to be more effective than human beings in reaching out to a big audience via messaging applications and platforms (Gomathy *et al*., 2022).

According to Gupta *et al.* (2020), artificial intelligence chatbots are computerised programmes that act or behave like interlocutors between the human and the bots and are virtual assistants that have become exceptionally popular in recent years mainly due to tremendous improvements in artificial intelligence, machine learning and other underlying technologies such as neural networks and natural language processing. These chatbots effectively communicate with any human being using interactive queries (Gupta *et al.*, 2020). They use natural language understanding (NLU) to contextually discern the user's need, and then they use advanced AI tools to determine what the user is trying to accomplish (IBM, 2023).

The characteristics of artificial intelligence chatbots, according to Deloitte Digital (2018, p. 18), include the following: intent recognition, dialogue management, humanisation, interaction channels, task automation capability, reporting and monitoring, ease of implementation, security and compliance.

Customer Patronage

The concept of *patronage* refers to the extent to which products or goods manufactured, as well as services rendered or offered, are purchased, subscribed to, or consumed by both potential and existing customers as a result of marketing efforts. It is a widely recognised term that is synonymous with concepts such as 'purchase', 'subscription', 'buying', 'consumption', and 'exchange transaction', among others. In this context, patronage represents the desired outcome that manufacturers and service-orientated organisations seek after engaging in any form of marketing activity. Therefore, when a potential or existing customer purchases or subscribes to a particular product or service, he or she is said to be patronising that product or service.

Customer patronage can be likened to the material, tangible, or manifest encouragement that a customer (whether potential or current) gives to a business-orientated organisation in a transactional exchange of value for money (Ezechirinum, Igwe, and Anucha, 2020). It is an action stage in a marketing process or encounter that suggests or shows indication that potential consumers of a given product or service have complied with the goals, desires, and expectations of an organisation's marketing efforts and intentions. Ozioma and Marcus (2020) posit that as the action component of customer attitudes in a given marketing process or encounter, customer patronage indicates the eventual actual purchase of a company's goods or services by the actual consumer.

Customer patronage, whether of products or services, is vital to the success of business-orientated organisations. This is as a result of the fact that customer patronage represents the support and encouragement a business-orientated organisation enjoys from its current or potential customers. Buttressing this viewpoint, Uvais and Sulaiman (2017) are of the opinion that for a successful business operation, all service-ended organisations, particularly financial institutions, rely heavily on their customers and their collaboration.

Customer patronage is often triggered by certain psychological factors, of which behavioural intention is key. This is the sole justification for why patronage is an intention-driven process. Thus, patronage intention describes the likelihood and

unlikelihood that a given consumer will be willing or unwilling to buy a particular product or subscribe to a given service at a predetermined period of time (Ezechirinum *et al*., 2020; Ozioma and Marcus, 2020). Nwulu and Asiegbu (2015) assert that customer patronage could be assessed through two major routes: patronage intention or repeat purchase.

Adebisi and Akinruwa (2019) offer a varying view of the concept 'customer patronage' in light of brands' market penetration and competition. Hence, customer patronage, whether of products or services, is considered a deeply held commitment to repurchase an organisation's products or services at the expense of a competitor offering (Adebisi and Akinruwa, 2019). Adiele *et al*. (2015) believe that customer patronage can serve as a yardstick for evaluating or assessing an organisation's performance index. This is in consideration of who considers customer patronage as an intentional act or gesture of a customer's rating for his or her organisation's sales volume, profit margin, and customer retention level (Adiele *et al*., 2015).

Customer patronage can as well take an emotional turn when customers patronise an organisation based on their emotional responses to what is offered. Given the diverse emotional appeals deployed in marketing products and services, potential and current customers are often triggered to take action through the affective route rather than the logical or rational route. Hence, patronising an organisation may outrightly depend on where the emotional appeal hits the customers' affective domain. At this instance, patronage may be to satisfy emotional needs rather than rational ones.

AI Chatbots: Customer Self-Service Innovations and Patronage of Banks' Services/Products

The adoption of artificial intelligence chatbots in the banking sector has revolutionised how banking operations are organised. This is in consideration of their faster speed, insight-driven mechanisms, and personalised support (Binder, Pellegrini, Pellegrini, & Gujral, 2017; Lou, Gang, Gang, & Tse, 2021). The affordances of AI chatbots have significantly impacted how banks relate to their customers in terms of service delivery and product offering. The human roles and expertise in these processes have been surrogated, supplanted, superimposed or annexed to AI chatbots. AI chatbots.

Currently, within the banking sector, artificial intelligence chatbots have heralded automated processes and trends in the way banking operations are carried out. Especially those banking operations that relate to customer relationships. They have orchestrated a

phenomenon Kaczorowska-Spychalska (2019) refers to as the dehumanisation of what is human and the humanisation of technology in bank service delivery.

However, the term 'automation in customer relationship management' refers to the replacement of human tasks and skills by smart technologies like AI chatbots, leading to customers using technology to serve themselves. Self-service technological innovations are technological interfaces that enable bank customers to produce a service independent of direct service involvement of bank staff (Ezechirinum *et al*., 2020).

Technological innovations that are touted to aid customers in a self-serving experience are likely to have a technological interface where users can be guided or assisted in generating programmed services without direct involvement from the service company employee (Meuter *et al*., 2000). According to the authors, self-service innovations are where consumers deliver services themselves through the use of technology. By leveraging self-service technological innovations, bank customers engage in a sort of joint venture in the banking process and system in which bank customers increasingly assume the role of co-producer in service delivery.

Self-service AI chatbots provide unique and relative advantages to bank customers (Li & Zhang, 2023) as well as disadvantages when engaged and used. The advantages are that they are fast, prompt, and speedy in generating results; accurate, precise, and reliable; simultaneous; regulated emotions; multi-contextual; multi-tasking; and user-friendly. -friendly.

Some of the noticeable factors influencing customer patronage of banks' products or services in the wake of self-service innovations include customers' satisfaction, quality service delivery or product offering, needs and motives, self-concept, past experience, current experience, current psychological state, beliefs, and expectations.

Theoretical Framework

This study is grounded in the Unified Theory of Acceptance and Use of Technology (UTAUT), a well-established theoretical framework that explains users' perceptions, intentions, and behaviours regarding the adoption of technologies and innovations in social, cultural, and organisational contexts. The theory was developed by Viswanath Venkatesh, Michael Morris, Gordon Davis, and Fred Davis in 2003.

To explain the processes underlying technology acceptance, the theorists identified four key constructs: performance expectancy (PE), effort expectancy (EE), social influence (SI), and facilitating conditions (FC). In the context of this study, these

constructs suggest that before bank customers adopt AI-enabled chatbots for handling specialised issues with their banks, the chatbots must meet certain expectations:

Performance Expectancy (PE): This refers to customers' belief that AI-enabled chatbots can effectively address their specific needs, concerns, or issues with their banks. When chatbots consistently perform as expected, customers are more likely to adopt and continue using them. In essence, users expect the chatbots to efficiently manage customer service, customer relations, and corporate communication challenges encountered during their interactions with the bank.

Effort Expectancy (EE): Beyond functionality, the chatbot must be easy to use. This implies that the user interface should be simple, intuitive, and user-friendly rather than overly technical or complex. The design should enable even non-expert users to navigate and utilise the system with minimal effort.

Social influence (SI): Before an AI-enabled chatbot is accepted, it must have social relevance and applicability. It should have a reputation for resolving financial issues of real people in the society. It is on the strength of this that its perception of efficacy and efficiency is based.

Facilitating conditions (FC): This implies an AI-enabled chatbot being an extension of human functions in the dimensions of customer care, customer relations and corporate communication. It should be able to facilitate communication with the customers in view of solving their specific needs, which could be solved by a human expert.

All the constructs discussed above are processes that affect the perception of banks' customers toward the acceptance of using technological innovation such as AI-enabled chatbots in solving their financial issues in place of human bankers or banks' human customer care personnel. When the perception of each of the processes is positive, adoption and acceptance of the technology and innovation among the customers become an easy task.

In the theory, effort expectancy (EE) can be considered as perceived ease of use (PEOU) of the Technological Acceptance Model (TAM), as both focus on the ease-of-use aspect (Joshi, 2021). Similarly, performance expectancy (PE) is similar to perceived usefulness (PU), as both focus on improving business performance.

In explicating a whole lot of processes taken into consideration before banks' customers can adopt, accept or utilise banking technologies or innovations such as AI-enabled chatbots, the setting of this theory as a theoretical framework for this study is relevant. The UTAUT provides explications on why the select banks' customers in Nigeria who engage AI-enabled Chatbots accepted and used the technology or innovation in their banking efforts with profound exposition on their perceptions and behavioural intentions.

Research Methodology

This study adopted the survey research method, with the structured 5-scale Likert (compromising Strongly Agree (SA), Agree (A), Undecided (U), Strong Disagree (SD), and Disagree (D)) questionnaire as the data-gathering instrument. The population of this study comprised all the customers of the Uyo branches of Zenith Bank (Oron Road Branch), United Bank for Africa (Banking Layout Branch) and Stanbic IBTC Bank (Nwaniba Road Branch) in Akwa Ibom State. According to the data obtained from the manager, human relations/public relations departments of the Uyo branches of the select banks, the customer base of the banks was provided as follows: Zenith Bank (292,349), United Bank for Africa (152,937) and Stanbic IBTC Bank (198,201). Therefore, the cumulative/total population of the study is 643,487 customers of the select banks as at June 2023.

A representative sample of 400 bank customers in Akwa Ibom State was selected using Taro Yamene's statistical formula. Of the 400 copies of the questionnaire administered to the respondents, 399 copies were retrieved and found fit for the analysis of data for this study, using simple percentage calculation and frequency tables. The Likert scales were presented to find the weighted mean for decision-making in Akwa Ibom State. According to the data obtained from the human relations/public relations departments of the Uyo branches of the select banks, the customer base of the banks was provided as follows; Zenith Bank (292,349) United Bank for Africa (152,937) and Stanbic IBTC Bank (198,201). Therefore, the cumulative/total population of the study is 643,487 customers of the select banks as at June 2023.

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Data Presentation, Analysis and Discussion of Findings

Table 1: Respondents' patronage of the select banks because of their perception of the banks' reputation in utilising AI chatbots to facilitate customer relationship management via self-service innovations

Item	Nature of Responses							
	SA (5)	A (4)	U (3)	D (2)	SD (1)	Total (15)	WMS	Decision
The perception I have of my bank's reputation in customer relationship management with regard to her utilisation of AI-chatbots in facilitating self-service banking transaction(s) influenced my patronage of the bank.	177 885	199 796	14 42	6 12	3 3	399 1,738	4.35	Accept

Source: Field data (2024)

Since the computed value (4.35) of the weighted mean score is greater than the mean of the aggregate weighting (3.0), it is inferred that customers' patronage of the select banks in Akwa Ibom State was a result of their perception of the banks' reputation in utilising AI chatbots to facilitate customer relationship management via self-service innovations.

Table 2: Analysis of responses on whether respondents' patronage of the select banks in Akwa Ibom State is duly dependent on the banks' utilisation of the self-service innovations of AI chatbots for customer relationship management

Item	Nature of Responses							
	SA (5)	A (4)	U (3)	D (2)	SD (1)	Total (15)	WMS	Decision
My patronage of my bank is duly dependent on the bank's utilisation of the self-service innovations of AI-chatbots in customer relationship management.	110 550	224 896	28 84	34 68	3 3	399 1,601	4.01	Accept

Source: Field data (2024)

Since the computed value (4.01) of the weighted mean score is greater than the mean of the aggregate weighting (3.0), it is inferred that customers' patronage of the select banks

in Akwa Ibom State was duly dependent on the banks' utilisation of the self-service innovations of AI chatbots for customer relationship management.

Table 3: Respondents' satisfaction with their utilisation of AI chatbots of select banks in Akwa Ibom State for specialised self-service banking transaction(s)

Item	Nature of Responses							
	SA (5)	A (4)	U (3)	D (2)	SD (1)	Total (15)	WMS	Decision
I am satisfied with my utilisation of my bank's AI-chatbots for specialised self-service banking transaction(s).	207 1,035	186 744	3 9	0 2	3 3	399 1,793	4.49	Accept

Source: Field data (2024)

Since the computed value (4.49) of the weighted mean score is greater than the mean of the aggregate weighting (3.0), it therefore implies that customers of select banks in Akwa Ibom State were satisfied with their utilisation of the banks' AI-chatbots for specialised self-service banking transaction(s).

Table 4: The extent to which respondents are satisfied with their utilisation of AI-chatbots for self-service banking transaction(s) with the select banks in Akwa Ibom State

Extent of Satisfaction	Frequency	Percentage
Completely satisfied	241	60
Very satisfied	117	29
Moderately satisfied	3	1
Slightly satisfied	11	3
Not at all satisfied	27	7
Total	399	100

Source: Field data (2024)

The presentation and analysis of data in Table 4 show that the majority of the customers (241 [60%]) of the select banks in Akwa Ibom State were completely satisfied with their utilisation of AI chatbots for self-service banking transaction(s) with the banks.

Research Question One

To what extent do customers of select banks in Akwa Ibom State patronise the banks as a result of the banks' utilisation of AI chatbots as interactive communication tools for self-service banking transactions?

The answers to the research question One can be deduced from data-related insights presented in Table 1, concerned with whether customers' patronage of the select banks was a result of their perception of the banks' reputations in utilising AI chatbots to facilitate customer relationship management via self-service innovations. The analysis of data in the table yielded a weighted mean score (WMS) of 4.35, which was found to be greater than the mean of the aggregate weighting (3.0). Therefore, it was concluded that customers' patronage of the selected banks in Akwa Ibom State was influenced by their perception of the banks' reputation for using AI chatbots to enhance customer relationship management through self-service innovations. Table 2 was concerned with the analysis of responses on whether customers' patronage of the select banks in Akwa Ibom State is duly dependent on the banks' utilisation of the self-service innovations of AI chatbots for customer relationship management. The analysis of data in the table yielded a weighted mean score (WMS) of 4.01, which was found to be greater than the mean of the aggregate weighting (3.0). This implies that customers' patronage of the select banks in Akwa Ibom State was duly dependent on the banks' utilisation of AI chatbots for self-service banking transactions.

Research Question Two

What is the level of satisfaction that customers of select banks in Akwa Ibom State have derived from their utilisation of AI chatbots in their self-service transactions with the banks?

Table 3 focused on customers' satisfaction with their use of AI chatbots by selected banks in Akwa Ibom State for specialised self-service banking transactions. The data analysis yielded a weighted mean score (WMS) of 4.49, exceeding the aggregate mean of 3.0. This indicates that customers of the selected banks in Akwa Ibom State were

satisfied with their experience using the banks' AI chatbots for specialised self-service transactions. Table 4 bordered on the extent to which customers were satisfied with their utilisation of AI chatbots for self-service banking transactions with the select banks in Akwa Ibom State. The presentation and analysis of data in the table show that the majority of the customers (241 [60%]) of the select banks in Akwa Ibom State were completely satisfied with their utilisation of AI chatbots for self-service banking transactions with the banks.

In summation of the data-related insights in the tables above, the inferences that could be drawn are that customers of the select banks in Akwa Ibom State utilised the banks' AI chatbots for self-service banking transactions to a very large extent. The experiences that came with the extent to which they utilised AI chatbots for specialised banking transactions left them completely satisfied with the banks' self-service innovations. Hence, it can be submitted that customers of the select banks in Akwa Ibom State were completely satisfied with their utilisation of AI chatbots for self-service banking transactions with the banks. This finding is corroborated by the findings in Joshi's (2021) study, where it was found that trust and facilitating conditions of AI chatbots impacted Indian bank customers' satisfaction significantly. With respect to the adoption of AI chatbots in banking transactions among bank customers in India, facilitating conditions, satisfaction and behavioural intention were found to have a positive but insignificant impact.

The finding that customers of selected banks in Akwa Ibom State are satisfied with their use of AI chatbots for self-service banking transactions lends support to the central claims of the Uses and Gratifications theory. It reinforces the view that media users are neither passive nor inert; rather, they are active, goal-orientated individuals who consciously choose how to engage with technological innovations based on the gratifications they expect to obtain (Obong & Targema, 2023; Akpabio, Obong & Christian, 2023).

Furthermore, the results of this study illustrate how bank customers actively engage with AI chatbots and derive satisfaction from these interactions, thereby expanding the explanatory scope of the theory from individual (micro) to broader (macro) contexts (Baran & Davis, 2010; Idiong, Obong & Samuel, 2023; Targema, Obong & Akpan, 2023).

Consequently, customer satisfaction is the largest competitive advantage for banks (Rakshith and Vinay, 2021). As Ikpefan, Olaolu, Omankhanlen, Osuma, & Evbuomwan. (2018) note, satisfaction of customers is what guarantees continuous

patronage of the deposit money banks' offerings. According to Ganguli and Roy (2011), there is substantial empirical evidence on the correlation between bank customers' utilisation of self-service technologies and customer satisfaction. Hence, the utilisation of self-service technological innovations, such as AI chatbots, is one of the banks' creative and deliberate strategies to retain and satisfy customers and to create a competitive advantage among competing brands (Ezechirinum et al., 2020). This makes it the fundamental goal of virtual customer relationship management via self-service innovations to create greater customer loyalty, sales, and satisfaction and to provide a rich source of customer knowledge that can be used to gain a deeper understanding of customers in order to facilitate the provision of fully personalised service (Viljoen *et al.*, 2005).

Conscientiously, scholars maintain that customers' patronage of banks depends on factors such as location, assortment, fast checkout, personnel friendliness and courtesy, congenial shop atmosphere, service quality and price/cost variables as well as technology in use (Olise, Okoli, Ekeke, 2015; Okeke and Okoye, 2021). These factors are critical determinants of customer patronage and are arguably significant influences on customers' decisions to patronise banks' products or services (Olise *et al.,* 2015; Ozioma and Marcus, 2020). Customer patronage hinges on these factors, with customer satisfaction being a prime motivation for patronage. In order to sustain patronage of the customers in a highly competitive banking system, customer satisfaction can be primarily prioritised by banks using self-service technological innovations (Kivela *et al*., 2011; Sulek and Hensley, 2014). Rahman, AbdelFattah & Mohamad (2014) support this position by observing a direct positive relationship between customer satisfaction and their repurchase intention – a necessary prerequisite for product and service patronage.

However, when a customer is satisfied with innovation-driven services offered by banks through technological intervention, such as the AI chatbots in the course of attempting to solve a particular problem or meet specific needs, they are likely to continue to patronise the banks. But if reverse is the case, patronage will likely decline or stop entirely. In this regard, Rizan *et al.* (2014) posit that customer satisfaction entirely hinges on how the customer rates the quality of innovation-driven services provided by service-orientated organisations in tandem with the customer's expectation. If the quality of services banks' technological innovations offer matches or meets the customer's expectations, the customer is said to be satisfied (Renner and Ezekiel-Hart, 2022). Daisy (2014) is in agreement with this position by buttressing that a customer can only be satisfied if the service rendered by a company matches his or her expectations and

dissatisfied if the services offered fall short of his or her expectations. Perhaps when a customer is satisfied with the use of banks' technological innovations in meeting specific service needs, there is likely to be continuity in patronage. As Ting (2004) submits, the more satisfied customers are with innovation-driven service, the greater their patronage.

Conclusion and Recommendations

From the foregoing, this paper has established that bank customers in Akwa Ibom State patronised the banks as a result of the banks' utilisation of AI chatbots as interactive communication tools for self-service banking transactions to a large extent. The finding that customers of selected banks in Akwa Ibom State are satisfied with their use of AI chatbots for self-service banking transactions lends support to the central claims of the Uses and Gratifications theory. It reinforces the view that media users are neither passive nor inert; rather, they are active, goal-orientated individuals who consciously choose how to engage with technological innovations based on the gratifications they expect to obtain (Obong & Targema, 2023; Akpabio, Obong & Christian, 2023).

Furthermore, the results of this study demonstrate how bank customers actively utilise AI chatbots and derive satisfaction from such interactions, thereby extending the explanatory power of the theory from individual (micro) to broader (macro) contexts (Baran & Davis, 2010; Idiong, Obong & Samuel, 2023; Targema, Obong & Akpan, 2023). It is therefore commonsensical and in the best interest of banks to maintain the winning formula as it offers them an edge in the competition.

On the strength of the findings, the study recommends that Nigerian banks which are yet to tap fully into the affordances of AI chatbots in self-service banking should take advantage of the possibilities it offers and the fact that continued patronage in the future would be defined by technology, innovation, and ease of operations. Technological integration of AI chatbots' self-service interfaces will continue to gain traction and will be critical to customer patronage of banks.

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Health Risks and Respiratory Symptoms Associated with Biomass Fuel Smoke Exposure Among Adults: A Systematic Review

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Abstract

This study examined the health risks and respiratory symptoms associated with biomass fuel smoke exposure among adults using a systematic review approach. The study synthesised evidence from fifteen empirical studies, comprising seven from Nigeria, five from other African countries, and three from global contexts. The review was conducted in accordance with PRISMA guidelines. A structured search was conducted using databases such as PubMed, Google Scholar, and African Journals Online (AJOL), with inclusion criteria focusing on studies that addressed biomass fuel use and respiratory health outcomes among adults. Findings from the review

revealed that biomass fuel smoke exposure is significantly associated with a high prevalence of respiratory symptoms, including chronic cough, wheezing, dyspnoea, and chest pain. The review indicated a strong link between prolonged exposure and chronic respiratory diseases such as chronic obstructive pulmonary disease (COPD), asthma, lung cancer, and recurrent respiratory infections. The evidence also indicated that prolonged exposure disproportionately affects women and occupational groups such as fish smokers and food vendors. Environmental factors such as poor ventilation and inefficient cooking technologies were identified as key contributors to increased exposure levels, while socio-economic constraints, including poverty and limited access to clean energy, sustain the continued use of biomass fuels. The analysis indicated that the health impacts of biomass smoke exposure are consistent across Nigeria, Africa, and global contexts, indicating a widespread public health concern. The review identified significant policy gaps, including limited implementation of clean energy interventions and inadequate public health awareness. Based on these findings, it was concluded that exposure to biomass fuel smoke remains a major contributor to respiratory morbidity among adults. It recommended that governments strengthen policy implementation for the promotion of clean energy alternatives, improved ventilation, and targeted interventions for high-risk groups to reduce exposure and improve health outcomes.

Keywords: Adults, biomass fuel, COPD, Household air pollution Indoor air pollution, respiratory symptoms

Introduction

The persistent use of biomass fuels for cooking and heating remains a major global public health problem, particularly in low- and middle-income countries where access to clean energy is limited. Despite decades of interventions, approximately 2.1 billion people worldwide still rely on solid fuels such as wood, charcoal, crop residues, and animal dung, exposing them to harmful household air pollution (HAP) on a daily basis (World Health Organization WHO, 2023). This exposure is responsible for an estimated 2.9 million deaths annually and contributes substantially to the global burden of disease, particularly through respiratory and cardiovascular conditions (WHO, 2023). The problem is further aggravated

by poor ventilation and inefficient cooking technologies, which result in pollutant concentrations far exceeding recommended safety standards, thereby increasing the risk of adverse health outcomes among exposed populations.

Biomass fuel refers to organic materials derived from plant and animal sources, such as firewood, charcoal, agricultural residues, and animal dung, that are burned as energy sources for domestic use (Awopeju, 2020). The combustion of these fuels produces a complex mixture of pollutants, including particulate matter (PM2.5), carbon monoxide, nitrogen oxides, and other toxic compounds that penetrate deep into the lungs and bloodstream. Respiratory symptoms commonly associated with such exposure among adults include chronic cough, wheezing, shortness of breath, chest tightness, and increased susceptibility to respiratory infections. Long-term exposure has been strongly linked to chronic obstructive pulmonary disease (COPD), lung cancer, and other non-communicable diseases (Fullerton *et al.,* 2008).

At the global level, household air pollution from biomass fuel is recognised as one of the leading environmental risk factors contributing to morbidity and mortality. It is associated with a wide range of diseases, including stroke, ischaemic heart disease, lung cancer, and chronic respiratory conditions (WHO, 2023). Short-term exposure also leads to acute symptoms such as eye irritation, coughing, and throat discomfort, while long-term exposure results in irreversible damage to lung function and increased risk of premature death (WHO, 2014). The burden is disproportionately borne by women and adults in rural households who are primarily responsible for cooking and thus experience prolonged and repeated exposure to biomass smoke.

In Nigeria, the situation is particularly concerning due to widespread reliance on biomass fuels, especially in rural and peri-urban communities. Evidence from national surveys indicates that a significant proportion of households continue to depend on firewood and charcoal despite the availability of cleaner alternatives such as liquefied petroleum gas (LPG) (National Population Commission NPC and ICF, 2019). This persistent dependence is driven by factors such as poverty, limited infrastructure, and cultural cooking practices. Consequently, household air pollution has become a major contributor to respiratory illnesses, including COPD and acute respiratory infections, as well as cardiovascular diseases among Nigerian adults (Ezeh *et al.,* 2017). The health burden is further intensified by inadequate housing conditions and poor ventilation systems that trap smoke indoors.

At the local level, particularly in rural communities and riverine areas in southern Nigeria, the reliance on biomass fuels remains deeply entrenched due to economic constraints and

limited access to clean energy technologies. Adults in these settings are continuously exposed to high levels of indoor smoke, often in enclosed cooking spaces, leading to chronic respiratory symptoms and reduced quality of life. This raises particular concern for public health, as prolonged exposure not only increases disease risk but also imposes economic burdens through healthcare costs and lost productivity. Addressing this issue requires targeted interventions, including improved access to clean cooking technologies, health education, and policy enforcement aimed at reducing exposure to biomass fuel smoke and its associated health risks.

Although several studies have established a link between biomass fuel smoke exposure and adverse respiratory outcomes. Existing studies largely focus on isolated populations and occupational groups, with limited synthesis of evidence across local, regional, and global contexts. As a result, interventions may not adequately address the unique circumstances of affected populations.

Furthermore, the health implications suggest limitations in current policies, awareness campaigns, and access to affordable clean energy alternatives. Many households are either unaware of the long-term health risks or are constrained by economic realities that make transition to cleaner fuels difficult. This creates a cycle of continuous exposure and increasing health burden, which not only affects individual well-being but also places additional strain on healthcare systems.

Therefore, the problem of biomass fuel smoke exposure and its associated respiratory health risks among adults remains inadequately addressed, particularly at the local level. There is a need for context-specific research to better understand the magnitude of the problem, identify key determinants, and provide evidence-based recommendations for effective intervention strategies. This study is thus designed to examine the health risks and respiratory symptoms associated with biomass fuel smoke exposure among adults, with a view to contributing to improved public health outcomes and policy development.

Objectives of the Study

i. To identify respiratory symptoms associated with biomass fuel smoke exposure among adults.

ii. To examine the health risks linked to prolonged biomass fuel smoke exposure.

iii. To assess environmental and socio-economic factors influencing exposure patterns

Methodology

The study adopted a systematic review approach to synthesise empirical evidence on health risks and respiratory symptoms associated with biomass fuel smoke exposure among adults. The review followed a structured process involving identification, screening, eligibility assessment, quality appraisal, and inclusion of relevant studies. A comprehensive search of peer-reviewed journal articles, national reports, and institutional publications published between 2008 and 2025 was conducted using electronic databases such as PubMed, Google Scholar, African Journals Online (AJOL), ScienceDirect, and institutional repositories.

The search strategy involved the use of specific keywords and Boolean operators to refine and combine search terms. The major search terms included *biomass fuel*, *household air pollution*, *respiratory symptoms*, *indoor air pollution*, *chronic obstructive pulmonary disease*, *smoke exposure*, *Nigeria*, *Africa*, and *adults*. Examples of search combinations used include:

i. "biomass fuel" AND "respiratory symptoms" AND adults
ii. ("household air pollution" AND COPD AND Africa)
iii. ("indoor air pollution" OR "biomass smoke") AND ("lung disease" OR "respiratory infection")
iv. ("biomass fuel use" AND Nigeria AND adults)
v. ("smoke exposure" AND asthma AND household cooking)

Database-specific searches were also conducted to improve precision and relevance of retrieved studies. In PubMed, Medical Subject Headings (MeSH) and filters for publication year and adult populations were applied, while Google Scholar and AJOL searches utilised phrase matching and relevance ranking.

Inclusion criteria were:

i. empirical studies conducted in Nigeria, other African countries, or globally relevant contexts;
ii. studies focusing on biomass fuel use or household air pollution;
iii. studies reporting respiratory symptoms or health outcomes among adults; and
iv. studies published from 2008 onward.

Exclusion criteria included studies focusing exclusively on children, studies unrelated to biomass fuel exposure, and studies lacking clear respiratory health outcomes. Although review articles without primary data were generally excluded, some major systematic reviews and institutional reports, such as World Health Organization (WHO) reports and large-scale review studies, were included because they provided globally recognised epidemiological evidence, policy context, and comprehensive synthesis relevant to the subject matter. These sources were used primarily to support global perspectives and contextual interpretation of findings rather than as primary empirical evidence.

Data Extraction Process

A total of 36 studies were initially identified through database searches. After removing duplicates and screening abstracts, 21 studies remained. Following full-text assessment and eligibility screening, 15 studies met the inclusion criteria and were used for the final analysis. Data extracted from the selected studies included author(s), year of publication, study location, research design, sample size, focus area, key findings, and identified gaps.

To ensure methodological rigour and reliability of findings, the quality of the selected studies was assessed using the Joanna Briggs Institute (JBI) Critical Appraisal Checklist for cross-sectional and observational studies. The appraisal focused on clarity of study objectives, appropriateness of methodology, sample adequacy, validity of data collection instruments, management of bias, and reliability of reported findings. Only studies that met acceptable quality standards were retained for the final synthesis and analysis.

Table 1: Summary of Studies

S/N	Author(s) and Year	Location	Design	Sample Size	Focus Area	Key Findings	Identified Gap
1	Dienye *et al.,* (2016)	Rivers State, Nigeria	Case-control	210	Fish smoking exposure	High prevalence of cough, catarrh, chest pain	Limited generalisation beyond occupational group
2	Abonyi *et al.,* (2022)	Enugu, Nigeria	Cross-sectional	342	Cooking fuel use	49% had respiratory symptoms (COPD, irritation)	Did not assess long-term lung function

S/N	Author(s) and Year	Location	Design	Sample Size	Focus Area	Key Findings	Identified Gap
3	Abdullahi et al., (2025)	Maiduguri, Nigeria	Cross-sectional	198	Food vendors exposure	High dyspnea and chronic cough prevalence	Limited rural comparison
4	Ezeh *et al.,* (2017)	Nigeria	Systematic review	National survey	Indoor air pollution	Linked biomass to COPD and infections	Lack of primary data
5	NPC and ICF (2019)	Nigeria	Survey	National survey	Fuel usage	High biomass dependence and health risks	Limited clinical outcomes
6	Ogbonna (2017)	Nigeria	Descriptive	Household-survey	Indoor pollution	Identified COPD and lung cancer risks	No quantitative symptom data
7	Awopeju (2020)	Nigeria	Review	-	Biomass health effects	Strong link to chronic respiratory diseases	Limited field-based evidence
8	Mabeleng *et al.,* (2024)	Lesotho	Cross-sectional	600	Household fuel	High cough prevalence (27.6%)	Did not assess severity
9	Adama *et al.,* (2020)	Burkina Faso	Cross-sectional	1,200	Biomass and asthma	Significant asthma association	Gender-focused only
10	Diiso *et al.,* (2024)	Somalia	Cross-sectional	450	Indoor pollution	37.3% had respiratory symptoms	Limited clinical diagnosis
11	Wernecke *et al.,* (2025)	South Africa	Observational	500	PM2.5 exposure	Linked to airway obstruction	Limited to rural population
12	Jafta *et al.,* (2024)	Africa	Review	Regional survey	Air pollution	Strong link to chronic respiratory diseases	Limited Nigeria-specific data
13	Fullerton *et al.,* (2008)	Global	Review		Biomass exposure	COPD, TB, pneumonia risk	Older data
14	Piddock *et al.,* (2014)	Malawi	Cross-sectional	1,000	Lung function	Reduced lung function observed	Limited symptom reporting
15	WHO (2023)	Global	Report	Global survey	Health burden	Major contributor to respiratory mortality	Not context-specific

Results

The reviewed studies consistently reported a high prevalence of respiratory symptoms among adults exposed to biomass fuel smoke. Across the studies, prevalence rates of respiratory symptoms ranged from 27.6% to 54.4%, depending on the population studied and exposure conditions. Commonly reported symptoms included chronic cough, wheezing, dyspnoea (shortness of breath), chest pain, nasal irritation, and catarrh. In Nigeria, Dienye et al. (2016) reported cough prevalence of 65.7% and catarrh prevalence of 75.7% among rural fish smokers exposed to biomass smoke, while the Maiduguri study recorded dyspnoea prevalence of 54.4% among food vendors. Similarly, Mabeleng et al. (2024) reported a cough prevalence rate of 27.6% among biomass fuel users in Lesotho.

Evidence from the reviewed studies also showed a consistent association between biomass fuel smoke exposure and chronic respiratory diseases. Conditions frequently reported across the studies included chronic obstructive pulmonary disease (COPD), asthma, lung cancer, obstructive airway disease, and recurrent respiratory infections. Abonyi et al. (2022) identified respiratory conditions among approximately 49% of biomass fuel users in Enugu State, Nigeria, while Adama et al. (2020) reported a statistically significant association between biomass fuel exposure and asthma among women in Burkina Faso. Studies from South Africa and Malawi additionally reported reduced lung function and airway obstruction among adults exposed to household air pollution.

The studies further revealed variations in exposure patterns across different population groups. Women constituted the most affected group due to their prolonged involvement in domestic cooking activities using biomass fuels. Occupational exposure was also prominent among fish smokers and food vendors who experienced repeated and prolonged exposure to smoke during daily activities. Most studies identified indoor cooking practices and enclosed cooking environments as common exposure settings. Environmental conditions associated with biomass fuel use were also frequently reported across the studies. Poor ventilation, enclosed cooking spaces, and inefficient cooking technologies were identified as major factors contributing to increased indoor smoke concentration. Several studies documented that prolonged exposure in poorly ventilated environments was associated with increased levels of particulate matter and inhalation of harmful pollutants.

In addition, socio-economic factors such as poverty, low household income, limited access to clean energy alternatives, and traditional cooking practices were consistently identified as major determinants of biomass fuel use. National survey reports showed

widespread dependence on firewood and charcoal, particularly among rural and low-income households. Findings from Nigeria, other African countries, and global studies showed similar patterns of respiratory symptoms and respiratory disease outcomes associated with biomass fuel smoke exposure. Despite differences in study locations and population characteristics, the reported health outcomes remained largely consistent across the reviewed studies. The review also identified policy and intervention gaps across many of the studies. Limited implementation of clean cooking interventions, inadequate public health awareness programmes, and insufficient access to affordable clean energy alternatives were frequently reported. Several studies further highlighted weak enforcement of environmental health regulations and limited institutional support for reducing household air pollution exposure.

Discussion of Findings

The findings from the reviewed studies consistently demonstrate that biomass fuel smoke exposure constitutes a major environmental and public health challenge, particularly in developing countries such as Nigeria and other African nations. Across the reviewed literature, exposure to biomass smoke was strongly associated with a high prevalence of respiratory symptoms, including chronic cough, wheezing, dyspnoea, chest discomfort, and recurrent respiratory infections. Studies by Dienye et al. (2016) and Abonyi et al. (2022) revealed significantly higher rates of respiratory symptoms among adults exposed to biomass fuel smoke compared to non-exposed populations. Similarly, Fullerton et al. (2008) identified biomass smoke exposure as a major contributor to chronic respiratory diseases in low- and middle-income countries. These findings align with the environmental health theory, which posits that environmental exposures, particularly pollutants in living environments, directly influence human health outcomes by increasing susceptibility to disease conditions.

However, variations in prevalence rates across the reviewed studies suggest important methodological and contextual differences. For instance, respiratory symptom prevalence ranged from 27.6% in Lesotho (Mabeleng et al., 2024) to over 54% among food vendors in Maiduguri, Nigeria. These differences may be attributed to variations in study design, exposure duration, population characteristics, occupational exposure levels, sample size, and methods of measuring respiratory outcomes. Studies involving occupational groups such as fish smokers and food vendors generally reported higher prevalence rates because of prolonged and intensive smoke exposure compared to household-based populations.

Also, differences in ventilation systems, type of biomass fuel used, and socio-economic conditions may have contributed to the observed disparities in respiratory health outcomes across settings. This finding supports the exposure-disease model, which explains that the intensity, frequency, and duration of exposure to environmental pollutants significantly determine disease occurrence and severity. Studies (Dienye et al., 2016; Diiso et al., 2024) reported that prolonged exposure in enclosed cooking environments increased the likelihood of chronic respiratory symptoms and impaired lung function in Nigeria and Somalia, respectively.

Environmental and structural factors also emerged as significant determinants of respiratory health outcomes. Several studies identified poor ventilation, indoor cooking practices, and inefficient cooking technologies as factors that increase indoor air pollution levels (Wernecke et al., 2025; Jafta et al., 2024). In many rural and low-income communities, cooking is carried out in enclosed or semi-enclosed spaces without adequate ventilation systems, leading to the accumulation of harmful pollutants such as particulate matter (PM2.5) and carbon monoxide. The consistency of these findings across multiple African contexts suggests that environmental conditions play a central role in shaping exposure patterns and respiratory disease burden.

Another important issue highlighted by the review is the role of socio-economic factors in sustaining biomass fuel dependence. Evidence from the Nigeria Demographic and Health Survey (NPC and ICF, 2019) and other reviewed studies indicates that poverty, low household income, limited access to clean energy alternatives, and entrenched cultural cooking practices contribute significantly to the continued use of biomass fuels. This finding is consistent with the Social Determinants of Health Framework, which emphasises that health outcomes are influenced not only by biological and environmental factors but also by broader social and economic conditions. In many developing regions, households rely on firewood and charcoal because cleaner fuels such as liquefied petroleum gas (LPG) and electricity are either unaffordable or inaccessible.

The reviewed studies also highlighted important implications for public health policy and intervention strategies. Despite increasing evidence regarding the harmful effects of biomass smoke exposure, implementation of clean cooking interventions and household air pollution control measures remains limited across many African countries. Weak enforcement of environmental health regulations, inadequate public awareness programmes, and insufficient investment in affordable clean energy infrastructure continue to hinder progress in reducing exposure levels (WHO, 2023). The persistence of these gaps suggests the need for integrated public health policies that combine environmental

regulation, poverty reduction strategies, and expanded access to clean household energy technologies.

Furthermore, the consistency of findings across Nigeria, other African countries, and global studies strengthens the validity and generalisability of the relationship between biomass fuel smoke exposure and respiratory health risks. Although methodological differences existed among the reviewed studies, the direction of findings remained largely uniform, thereby reinforcing the robustness of the association between household air pollution and adverse respiratory outcomes. This widespread consistency suggests that biomass fuel smoke exposure remains a universal environmental health problem requiring urgent and coordinated global attention.

Conclusion

The reviewed studies collectively establish that household air pollution resulting from biomass fuel combustion remains a major environmental health burden, particularly within low- and middle-income countries where dependence on traditional fuels is still widespread. The review advances scholarly understanding by demonstrating that respiratory health risks associated with biomass smoke exposure are not isolated occurrences but consistent patterns observed across diverse geographical and socio-economic contexts. Thus, the review contributes to the growing body of evidence on the relationship between biomass fuel smoke exposure and respiratory health outcomes among adults. The study further highlights the multidimensional nature of biomass fuel exposure by showing how environmental, occupational, and socio-economic conditions interact to influence respiratory health outcomes. The findings reinforce the relevance of environmental health and social determinants frameworks in explaining the unequal distribution of exposure risks among vulnerable populations, particularly women and low-income households. By synthesising evidence from Nigeria, other African countries, and global studies, the review provides a broader perspective on the universality of biomass-related respiratory health problems and strengthens the evidence base for future environmental health research.

From a public health perspective, the review underscores the urgent need for integrated interventions aimed at reducing household air pollution exposure. The persistence of biomass fuel use despite increasing awareness of its harmful effects suggests that health education alone may be insufficient without parallel improvements in energy accessibility, poverty reduction, and environmental policy implementation. The study, therefore, contributes to knowledge by emphasising the need for multidisciplinary

approaches that combine public health action, energy policy reforms, environmental regulation, and community-based interventions to address the long-term health consequences of biomass fuel smoke exposure. The review provides valuable evidence that may guide policymakers, healthcare practitioners, environmental agencies, and researchers in designing targeted interventions and evidence-based policies for improving respiratory health outcomes among vulnerable populations. The findings also highlight the importance of expanding access to affordable clean cooking technologies and strengthening institutional commitment toward household air pollution control programmes.

Limitations of the Study

Despite the strengths of this systematic review, certain limitations should be acknowledged. First, the study relied entirely on secondary data obtained from previously published studies, which limited control over data quality, study design, and methods of outcome measurement. Variations in methodological approaches across the reviewed studies may have affected the comparability of findings. Second, the number of eligible studies included in the review was relatively limited, particularly studies conducted within specific local contexts in Nigeria and other African countries. This may restrict the comprehensiveness of the conclusions drawn from the review. Third, there was a regional imbalance in the distribution of reviewed studies, with more evidence available from certain countries and urban settings than from rural and under-represented regions. Consequently, some contextual variations in exposure patterns and respiratory health outcomes may not have been fully captured. The study did not conduct a meta-analysis due to differences in study designs, outcome measures, exposure assessment methods, and reporting formats among the selected studies. As a result, the review relied primarily on narrative synthesis rather than pooled statistical analysis.

Recommendations

Based on the findings of this review, the following recommendations are proposed:

i. Government and relevant stakeholders should intensify efforts to promote the adoption of clean cooking fuels such as liquefied petroleum gas (LPG), electricity, biogas, and solar energy, particularly in rural and low-income communities where dependence on biomass fuels remains high.

ii. Subsidies and financial support programmes should be introduced to make clean cooking technologies and alternative energy sources more affordable and accessible to economically disadvantaged households. This may encourage a gradual transition away from traditional biomass fuels.

iii. Development agencies should invest in rural energy infrastructure, including rural electrification projects and clean energy distribution systems, to reduce dependence on firewood and charcoal in underserved communities.

iv. Sustained community-based awareness programmes should be implemented to educate individuals on the health risks associated with biomass fuel smoke exposure, the importance of proper ventilation, and the benefits of cleaner energy alternatives.

v. Households using biomass fuels should be encouraged to improve ventilation within cooking areas through the installation of windows, chimneys, smoke outlets, and improved cookstoves designed to reduce indoor smoke accumulation.

vi. Health interventions such as provision of protective equipment, improved work environments, and regular respiratory health screening should be developed for high-risk groups such as fish smokers, food vendors, and other individuals exposed to biomass smoke in occupational settings.

vii. Environmental protection agencies and public health authorities should strengthen the enforcement of environmental and indoor air quality regulations aimed at reducing household air pollution and protecting vulnerable populations from harmful smoke exposure.

viii. Household air pollution prevention strategies should be integrated into national public health programmes and environmental policies to ensure coordinated intervention efforts across the health, energy, and environmental sectors.

ix. Community leaders and healthcare agencies should collaborate in implementing local intervention programmes that encourage behavioural

change, adoption of safer cooking practices, and community participation in clean energy initiatives.

x. Future studies should adopt longitudinal and experimental research designs to provide stronger evidence on the long-term respiratory effects of biomass fuel smoke exposure and to evaluate the effectiveness of intervention strategies across different populations and settings.

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Effect of Activity-Based Learning Method on Students' Achievement in Three-Dimensional Shapes in Senior Secondary Mathematics in Oruk Anam, Nigeria

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Abstract

This study investigated the effects of Activity-Based Learning (ABL) on the achievement of Senior Secondary One (SS1) students in three-dimensional shapes in mathematics in Oruk Anam Local Government Area of Akwa Ibom State, Nigeria. A quasi-experimental post-test-only non-equivalent control group design using intact classes was adopted. Two research questions and two hypotheses were formulated to guide the study and tested at the 0.05 level of significance. The target population comprised all 2,400 SS1 students in the 15 public secondary schools in Oruk Anam. A sample of 100 students from two randomly selected schools was initially enrolled; 79 students (experimental group: n = 37; control group: n = 42) completed the study and were included in the final analysis. The experimental group received instruction using ABL strategies, while the control group received

conventional lecture instruction on the same 3D shapes content. The instrument used for data collection was the Mathematics Achievement Test (MAT), a 20-item four-option multiple-choice test on three-dimensional shapes. The instrument was validated by the researcher's supervisor using a table of specifications based on Bloom's taxonomy, and a reliability coefficient of r = 0.99 was obtained using the Spearman-Brown formula. Data were analysed using independent samples t-tests. Findings revealed a significant difference in the post-test achievement scores of students taught 3D shapes using ABL compared with those taught using the conventional lecture method. The findings also revealed no significant difference between the mean achievement scores of male and female students taught 3D shapes using ABL. It is recommended that ABL be adopted as the preferred instructional approach for geometry topics in Nigerian secondary schools.

Keywords: Activity-based learning (abl), three-dimensional shapes, mathematics achievement, secondary school students, geometry instruction

1. Introduction

Education is a fundamental tool for intellectual growth and character development. The Federal Republic of Nigeria's National Policy on Education (FRN, 2013) affirms that education should foster critical and independent thinking, develop personal potential, and equip citizens to participate effectively in a democratic society. Mathematics occupies a pivotal role in this mission; it is made compulsory in both primary and secondary schools in Nigeria owing to its importance to individuals, the economy, and national development.

The scientific and technological development of any nation depends on the efforts made by that nation to advance its students' learning of mathematics and other mathematical sciences (Wonu & Arokoyu, 2016). The contributory role of mathematics to the curriculum cannot be overemphasised, especially in secondary schools. Despite the usefulness and benefits derived from the study of mathematics, there has been a persistent stereotype that mathematics is difficult. This stereotype has made a great number of people (especially learners) anxious and unable to live up to expectations, and this adversely affects their performance in external examinations such as the West African Senior School Certificate Examination (WASSCE) and the National Examinations Council (NECO) assessments.

Mathematics is also among the subjects most poorly taught and least understood in primary and secondary schools, a situation attributable to factors such as inadequate instructional approaches. The dominance of the conventional, teacher-centred, didactic method in Nigerian secondary schools limits student engagement and fails to foster deep conceptual understanding (Festus, 2013). Merely delivering a lesson as a lecture does not give learners an opportunity to participate actively.

Modern educational paradigms encourage student-centred approaches, where learners actively construct knowledge through exploration, experimentation, and real-world problem-solving (Centre for Education Innovations [CEI], 2021). In ABL, learners are expected to experiment and explore a given mathematical concept while the teacher supervises the activities. By practising the activities themselves, learners come to understand the procedures involved in the concept. A popular educational aphorism states, "What I hear I forget, what I see I remember, and what I do I understand," underscoring the need for teachers to use appropriate instructional materials in their lessons.

The outcome of the conventional teaching method, which is teacher-centred and didactic, has been consistently poor. This prompted the researcher to investigate the efficacy of the ABL method in teaching three-dimensional shapes to SS1 students, a level at which the foundational knowledge required for the senior certificate examination is established.

1.1 Statement of the Problem

Many students find mathematics to be a difficult subject; anxiety engulfs them whenever they find themselves in a mathematics classroom, leading to poor performance in examinations. Research indicates that students understand and retain mathematical concepts more effectively when they are actively involved in the learning process (Oribhabor, 2020).

Also, research has shown that students understand and retain learning experiences with reference to the instructional strategy used. However, ABL is often neglected despite its essential role in facilitating the teaching and learning of mathematics in secondary schools. While studies such as Oribhabor (2020) and Celik (2018) have demonstrated the effectiveness of ABL in improving student achievement in mathematics generally, there is a notable gap in the literature specifically addressing the use of ABL for teaching three-dimensional shapes among SS1 students in Oruk Anam Local Government Area. Existing studies have not examined whether the documented benefits of ABL transfer to this particular population and content area, nor have they accounted for the unique instructional

challenges posed by the largely rural school contexts in Oruk Anam. This study, therefore, seeks to fill that gap by investigating the extent to which the ABL method improves students' achievement in three-dimensional shapes in Oruk Anam.

1.2 Objectives of the Study

The main purpose of the study was to determine the effect of the ABL method on the teaching and learning of mathematics in Senior Secondary One (SS1). The specific objectives were as follows:

i. To determine the effect of the ABL method on students' achievement in mathematics.
ii. To examine the effect of the ABL method on students' achievement by gender.

1.3 Research Questions

The following research questions provided a guide to this study:

i. What is the difference between the mean post-test achievement scores of students taught using ABL and those taught using the conventional lecture method?
ii. What is the difference between the mean post-test achievement scores of male and female students taught using ABL?

1.4 Research Hypotheses

The following research hypotheses were formulated to guide the study:

i. H_{01}: There is no significant difference between the mean post-test achievement scores of students taught using ABL and those taught using the conventional lecture method.
ii. H_{02}: There is no significant difference between the mean post-test achievement scores of male and female students taught using ABL.

1.5 Significance of the Study

This study examines the effect of the ABL method on Senior Secondary One (SS1) students' achievement in mathematics in Oruk Anam Local Government Area. It is noted that poor teaching approaches discourage students in the study of the subject. It is the expectation of the researcher that this study will provide teachers, educators, philosophers, psychologists, and prospective researchers with the necessary insight into the challenges associated with the non-utilisation of appropriate teaching approaches. It is believed that

the study may help mathematics teachers to review their techniques and approaches in order to meet the standards expected of them.

2. Review of Related Literature

2.1 Conceptual Framework

2.1.1 Activity-Based Learning (ABL)

Activity-based learning was first pioneered by David Horsburgh, a British-born educationist, in 1944. Activity-based learning is a methodology in which children learn at their own pace through various supervised activities. It is an engaging approach to learning, as it boosts brain development in children through constant stimulus and response.

The key feature of the ABL method is that it uses child-friendly educational aids to foster self-learning and allows a child to study according to his or her aptitude and skill. It is a child-centred, self-paced instructional methodology in which learners acquire knowledge through three core processes: experimentation (learning through direct experience), exploration (constructing knowledge through active investigation), and expression (communicating understanding through presentations and discussion) (CEI, 2021; Noreen et al., 2019).

In an ABL environment, the teacher is a facilitator, not a lecturer, directing learners through structured activities while providing formative feedback. Assessment is criterion-referenced rather than norm-referenced, as the goal is individual mastery rather than peer comparison. Instructional materials are central to ABL, enabling learners to manipulate, observe, and discover mathematical relationships independently.

Critics of ABL contend that it can be time-intensive and may sacrifice breadth of curriculum coverage (Noreen et al., 2019). Nevertheless, empirical studies consistently report that ABL yields higher achievement and greater engagement compared to traditional lecture methods.

2.1.2. Mathematics and the Secondary School Curriculum

Mathematics is defined by the Federal Republic of Nigeria's curriculum as a science of structure, order, and relation encompassing counting, measuring, logical reasoning, and quantitative calculation (FRN, 2013). The definition covers virtually all aspects of human life, which makes mathematics an indispensable tool for the human race. In its study, mathematics has been developed into vast and diverse topics, which can be grouped into pure and applied mathematics.

In the Nigerian Senior Secondary School Curriculum (revised 2007), mathematics is organised into five themes: Number and Numeration, Algebraic Processes, Geometry, Statistics, and Introductory Calculus. The curriculum aims to develop positive attitudes towards mathematics, problem-solving competencies, mathematical language proficiency, and conceptual understanding appropriate to learners' developmental levels.

2.1.3 Geometry and Three-Dimensional Shapes

Geometry has its origin in the Greek meaning "earth measurement"; it is the visual study of shapes, sizes, and patterns and how they fit together in space. The Chambers Dictionary (1989 edition) defines geometry as a branch of mathematics that treats the properties of points, lines, surfaces, and solids. Research in mathematics education has established that 3D shapes present conceptual challenges for secondary school students, in part because they require learners to mentally coordinate spatial properties such as the relationship between a solid's face, edge, and vertex that cannot be fully appreciated through static diagrams alone (Wonu & Arokoyu, 2016). Van Hiele's (1986) model of geometric thinking suggests that most secondary school students operate at the visualisation and analysis levels, meaning they identify shapes by appearance rather than by property, and therefore benefit substantially from hands-on, activity-based instruction that makes the properties of 3D solids tangible.

Three-dimensional shapes like prisms, pyramids, cylinders, cones, and spheres are classified under the Mensuration theme of the Nigerian curriculum which require understanding of surface area, volume, and other cross-sectional properties. The practical relevance of geometry can be seen in architecture, engineering, navigation, and everyday construction, reinforcing the importance of effective pedagogical approaches to this content.

2.1.4 Gender, Mathematics Anxiety, and Instructional Method

The relationship between gender and mathematics achievement has been debated in literature. Historical research attributed performance gaps to biological differences, but contemporary scholarship attributes them predominantly to sociocultural factors, including mathematics anxiety and differential exposure to collaborative learning environments (Noreen et al., 2019). ABL, with its emphasis on group-based investigation and shared problem-solving, is theorised to reduce mathematics anxiety by distributing the cognitive and social burden of problem-solving across peers. This rationale justifies examining

whether ABL differentially benefits male or female learners, particularly in a context such as Oruk Anam where gender norms may shape classroom participation.

2.2 Theoretical Framework

2.2.1 Cognitive Load Theory

The cognitive load theory, as developed by John Sweller in 1988, holds that for schema acquisition to occur, instruction should be designed to reduce working memory load (Sweller, 1988). The theory divides human cognitive processing into two components: long-term memory and working memory. Long-term memory has a large capacity and can store information for extended periods, while working memory has a limited capacity and combines temporary storage with the manipulation of information.

According to Sweller, the contents of long-term memory are sophisticated structures that permit us to perceive, think, and solve problems, rather than a collection of rote-learned facts. He further argued that since working memory has limited capacity, instructional methods should avoid overloading it.

In Sweller et al. (2011), the critical function of instruction, given the centrality of the information store, is to provide efficient and effective procedures for acquiring the information to be stored in long-term memory. This theory suggests that learning is most effective under conditions aligned with human cognitive architecture, meaning that teachers should adopt appropriate instructional methods and strategies to transmit the required knowledge and content to learners. Instructions should also be designed in a way that minimises working memory load and keeps extraneous cognitive load to a minimum during the learning process.

2.2.2 Thorndike's Laws of Learning

Edward Lee Thorndike (1874–1949) developed a connectionist theory of learning based on experimental work with animals (Okoro, 2002). He proposed three main laws of learning. The Law of Readiness holds that learning is most effective when the learner is prepared and motivated, emphasising that teachers must link new knowledge to prior experience. The Law of Exercise holds that stimulus-response bonds are strengthened through repeated practice, highlighting the value of continuous assessments and drills. The Law of Effect holds that behaviours followed by satisfying outcomes are more likely to recur; accordingly, teachers should provide prompt, positive reinforcement (Enang, 2006). ABL naturally operationalises these laws by creating motivating contexts for repeated practice and offering immediate corrective feedback.

2.3 Empirical Review

2.3.1 ABL and Student Achievement

Celik (2018) conducted a study with sixth-grade students in mathematics using an experimental research design, in which 78 students were divided into two groups by random assignment. The study, carried out over four weeks, revealed a noticeable performance advantage in the experimental group taught using the activity-based learning method.

Festus (2013) identified reasons for poor student performance in public examinations and highlighted several strategies to address this. He recommended the use of the ABL approach as a more effective alternative to conventional teaching.

Oribhabor (2020) conducted a study using a quasi-experimental pretest-posttest research design using intact classes. A sample of ninety-six (96) students from two secondary schools in Calabar Metropolis were given a 20-item essay mathematics test. It was indicated that students taught using the ABL method performed better than those taught using the lecture method. These findings collectively provide strong evidence for the efficacy of ABL in secondary mathematics education. These studies are directly relevant to the present study in that they demonstrate the consistent superiority of ABL over conventional lecture instruction across different school contexts and age groups. The present study extends this evidence base to SS1 students in Oruk Anam, a rural local government area in Akwa Ibom State, thereby filling a geographic and contextual gap in the existing literature.

2.3.2 ABL and Gender Achievement in Mathematics

Mishra and Yadav (2013) carried out research on the effect of an activity-based learning approach on achievement in science at the elementary stage. A total of sixty (60) students participated of which thirty-five (35) were boys and twenty-five (25) were girls. and an experimental research design was used. The study concluded that gender had a significant influence on achievement in the experimental group, which was taught using the activity-based learning approach. Girls in the experimental group performed better than boys with respect to knowledge-based items. This study is relevant to the present investigation in that it raises the question of whether ABL produces differential gender outcomes, a question the present study examines specifically in the context of SS1 mathematics in Oruk Anam. The present study thus builds on and contextualises Mishra and Yadav's findings at the secondary school level.

3. Methodology

3.1 Research Design

The research design adopted for this study was a quasi-experimental post-test-only non-equivalent control group design. Intact classes were used because random assignment of individual students was not feasible. The SS1 classes served as the unit of assignment to the experimental and control conditions. The post-test-only design was appropriate because pre-test data were not collected. Group equivalence was addressed through the use of randomised school selection and intact class assignment.

3.2 Area of Study

This research study was carried out in Oruk Anam Local Government Area of Akwa Ibom State, Nigeria. Oruk Anam lies between latitude 4°54′N and longitude 7°43′E, with a total population of approximately 172,000 people (FRN, 2006). Oruk Anam is regarded as the largest local government area in Akwa Ibom State by land area. The area hosts 15 co-educational public secondary schools.

3.3 Population and Sample

The study population comprised SS1 students in 15 co-educational public secondary schools in Oruk Anam Local Government Area, with a total population of approximately 2,400 students. Two schools were randomly selected from the 15, and 100 students from two intact SS1 classes were initially enrolled in the study (experimental group: n = 50; control group: n = 50). At the time of post-test administration, 21 students were absent and were excluded from the analysis, yielding a final analysable sample of 79 students (experimental group: n = 37; control group: n = 42). The experimental class received ABL instruction, while the control class received conventional lecture instruction on the same 3D shapes content.

3.4 Instrumentation

The instrument used in the data collection for this study was the Mathematics Achievement Test (MAT) on the concept of 3D shapes, which consisted of two sections: Section A gathered demographic information (gender, class, and school name), and Section B contained 20 multiple-choice items structured on four options lettered A–D. Each correct response attracted one mark; incorrect or unanswered items attracted zero marks, giving a maximum score of 20.

3.5 Validity and Reliability

A modified Bloom's taxonomy of educational objectives was used to establish content validity, as shown in Table 1. The content selection covered three cognitive levels: knowledge, comprehension, and application. The instrument was reviewed by the supervisor, who made useful corrections and suggestions. The comments, corrections, and recommendations made by the supervisor were incorporated in constructing the final version of the instrument.

Table 1: **Table of specification for the Mathematics Achievement Test (MAT) on 3D shapes**

Content	Knowledge	Comprehension	Application	Total
Identification and naming of 3D shapes	5	2	1	8
Basic properties of 3D shapes	3	1	1	5
Surface area and volume of shapes	2	0	5	7
Total	10	3	7	20

The instrument was administered once to twenty (20) SS1 students who were not part of the experiment. Thereafter, the reliability of the Mathematics Achievement Test (MAT) was obtained using the split-half method. The test items were split into two comparable halves of odd and even items. The two sets of scores were correlated using Pearson Product Moment Correlation (PPMC) and then corrected for full-test length using the Spearman-Brown formula. A reliability coefficient of r = 0.99 was obtained. This high value is attributable to the homogeneity of the test items, which were all drawn from a single, well-defined content domain (three-dimensional shapes at the SS1 level) and targeted only three cognitive levels (knowledge, comprehension, and application). The narrow cognitive and content scope reduces variability unrelated to the construct being measured, thereby producing a high inter-item consistency. The coefficient was therefore considered adequate for the study.

3.6 Treatment Procedure

Prior to commencing the study, written permission was obtained from the principals of both selected schools. Both groups were taught the same 3D shapes content from the SS1 mathematics curriculum over a period of 2 weeks, comprising 3 forty-minute lessons per week. The experimental group was taught using ABL strategies. In each lesson, the students were provided with physical 3D models (cardboard-constructed prisms, pyramids, cylinders, and cones) and guided through structured activities: identifying and naming each shape, counting faces, edges, and vertices, unfolding nets, and computing surface area and volume through measurement and calculation. The students worked in small groups, with the teacher acting as facilitator, posing questions, correcting errors, and reinforcing correct procedures. Lesson plans were developed by the researcher prior to commencement.

The control group received the same content through conventional lecture instruction, with the teacher presenting definitions, properties, and worked examples on the chalkboard while students took notes and responded to teacher-directed questions. Following the treatment period, the MAT was administered to both groups as a post-test on the same day under standard conditions.

3.7 Method of Data Analysis

Descriptive statistics (means and standard deviations) were computed for both groups. Inferential analysis was conducted using independent samples two-tailed t-tests, tested at the 0.05 level of significance.

4. Results

4.1 Descriptive Statistics

Table 2: Descriptive statistics for both groups on the post-test Mathematics Achievement Test.

Group	N	Mean	SD	Min	Max	Range	%
Experimental (ABL)	37	12.00	3.12	6	20	14	60.0%
Control (Lecture)	42	9.74	1.37	5	14	9	48.7%

The experimental group achieved a mean post-test score of 12.00 (SD = 3.12), equivalent to 60.0% of the maximum score, compared to 9.74 (SD = 1.37), or 48.7%, for the control group. Notably, both group means fall below the conventional 70% mastery threshold,

which indicates that while ABL produced a meaningful advantage, achievement levels across both conditions suggest that further instructional support is warranted for full conceptual mastery of 3D shapes.

4.2 Hypothesis Testing

4.2.1 Hypothesis One

There is no significant difference between the mean post-test achievement scores of students taught using ABL and those taught using the conventional lecture method.

Table 3: Independent Samples t-Test: Post-Test Achievement Scores of the Experimental and Control Group

Groups	N	X	SD	df	t-cal	t-cri	Decision
Experimental group	37	12	3.1180				
				77	4.845	1.99	**H01Rejected**
Control Group	42	9.738	1.3711				

The results in Table 3 show that the mean post-test achievement score of students taught 3D shapes using the ABL method (M = 12.00) is greater than that of students taught using the lecture method (M = 9.74). The calculated t-value of 4.845 is greater than the critical t-value of 1.99 at 77 degrees of freedom and the 0.05 level of significance. Hence, the null hypothesis (HO1) is rejected. The alternative hypothesis was subsequently upheld. Thus, there is a significant difference between the post-test achievement of students taught 3D shapes using the ABL method and those taught using the lecture method.

4.2.2 Hypothesis Two

There is no significant difference between the mean post-test achievement scores of male and female students taught using ABL.

Table 4: Independent Samples t-Test: Post-Test Achievement by Gender (Experimental Group Only)

Gender	N	X	SD	df	t-cal	t-cri	Decision
Male	20	11.15	4.626				

				35	-1.7699	2.03	**H02Accepted**
Female	17	12.411	3.222				

Table 4 shows that the mean score of female students (M = 12.41, SD = 3.22) was slightly higher than that of males (M = 11.15, SD = 4.63). However, the calculated t-value is −1.7699, while the critical value is 2.03. Since the absolute value of the calculated t-value (1.7699) is less than the critical t-value (2.03), the null hypothesis is accepted. There is no statistically significant difference in post-test achievement between male and female students taught using ABL.

5. Discussion

5.1 Effect of ABL on Student Achievement

The findings from Table 3 indicate that students taught using the ABL method performed significantly better than their counterparts taught using the lecture method. This suggests that the ABL method was more effective in enhancing student achievement scores in mathematics than the lecture method.

These findings are consistent with Oribhabor (2020), who found that the activity-based learning method produced significantly higher achievement scores in students than the lecture method. The findings are also in line with those of Celik (2018), who observed a noticeable performance advantage in the group taught using the ABL method.

Theoretically, the result is explicable through Cognitive Load Theory (CLT), whereby ABL reduces extraneous cognitive load by anchoring abstract concepts such as surface area and volume in tangible, manipulative experiences, thereby freeing working memory resources for schema formation (Sweller et al., 2011). Thorndike's Law of Exercise further accounts for the advantage, as repeated hands-on practice strengthens stimulus-response bonds more robustly than passive reception of teacher-delivered content (Enang, 2006).

However, both the experimental (M = 12.00, 60%) and control groups (M = 9.74, 48.7%) fell below the conventional 70% mastery threshold, indicating that even with ABL, full conceptual mastery of 3D shapes was not achieved. This suggests that while ABL markedly outperforms lecture instruction, further curricular or pedagogical refinements, such as extended instructional time, peer tutoring, or additional formative assessment cycles, may be necessary to bring all students to mastery level.

5.2 Gender and Achievement under ABL

Findings from Table 4 showed that there is no significant difference between the mean scores of male and female mathematics students taught the concept of 3D shapes using the ABL method. The result indicates that male and female students can perform comparably in learning mathematics when taught using a suitable method such as ABL.

The findings of this study are in disagreement with those of Mishra and Yadav (2013), whose results showed that female students taught using the ABL method at the elementary level performed better than their male counterparts. The difference may reflect the secondary-level context of the present study, where gender socialisation around mathematics is more entrenched, or the specific demands of 3D spatial reasoning, which some literature associates with greater male advantage.

5.3 Summary of the Findings

The findings of this study indicate that the ABL method has a significant effect on students' achievement in mathematics. The approach also produced higher achievement among students at the knowledge, comprehension, and application levels of the cognitive domain compared with the lecture method.

Also, when using the ABL method, there was no significant difference in academic achievement between male and female students. Thus, both male and female students can perform comparably when taught using the activity-based learning method in mathematics.

6. Conclusion And Recommendation

6.1 Conclusion

From the findings of this study, it was concluded that exposure of students to ABL may enhance academic achievement in three-dimensional shapes. It was also concluded that both male and female students appear to have benefited from the use of ABL to teach 3D shapes in this context. These findings suggest that ABL may serve as an effective and inclusive instructional strategy for secondary school mathematics in Oruk Anam and indicate that its broader adoption in schools where abstract geometry concepts remain a persistent source of student underachievement may be warranted. However, given that the study was limited to two schools in one local government area, these conclusions should be interpreted with caution and confirmed through further research before broader

generalisation. In all, the findings suggest that the ABL method may have a significant positive influence on senior secondary students' achievement in mathematics.

6.2 Implications of the Findings

The findings carry several implications for teachers, school administrators, and stakeholders in secondary mathematics education in Nigeria. For classroom teachers, the study demonstrates that a shift from didactic lecture to structured, hands-on ABL activities produces a large, meaningful improvement in student performance, particularly for a topic as spatially demanding as 3D shapes. For school administrators, the results justify investment in mathematics laboratories stocked with manipulative materials, including nets, 3D solid models, rulers, and measuring tools, as a cost-effective lever for raising achievement. For curriculum developers and examination bodies such as WAEC and NECO, the evidence supports formally integrating ABL-aligned activities into the recommended instructional approach for geometry topics in the national curriculum. For teacher training institutions, pre-service mathematics teacher education programmes should incorporate modules on designing and delivering ABL lessons, including effective use of manipulatives and formative feedback strategies.

6.3 Recommendations

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

i. Every school should be provided with a mathematics laboratory to promote ABL and provide access to 3D instructional materials.

ii. The teaching of mathematics (and other sciences) should be made more practical and less abstract through the use of the activity-based learning method.

iii. The teaching of abstract mathematics concepts should be grounded in concrete, activity-based experiences to promote meaningful understanding beyond rote procedure.

iv. Curriculum planning should include the use of the activity-based learning method in teaching other concepts in mathematics.

6.4 Suggestions for Further Study

The following suggestions for further study are hereby proposed:

i. This study should be replicated using a pre-test/post-test design with random assignment to confirm group equivalence and strengthen causal inference.

ii. The study should be extended to other abstract mathematics concepts (e.g., trigonometry, coordinate geometry) and to other geopolitical zones in Nigeria.

iii. Longitudinal studies examining the sustained effect of ABL on mathematics achievement and attitude are recommended.

iv. Future research should explore the specific design features of ABL (group size, material type, and feedback frequency) that most strongly predict achievement gains.

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Branding Strategies and Patronage of Convenience Goods in Select Supermarkets in Akwa Ibom State

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Abstract

This study examined the branding strategies employed by supermarkets in Akwa Ibom State and their influence on consumer patronage of convenience goods. A survey research design was adopted, and data were collected from 366 respondents using structured questionnaires. The findings revealed that supermarkets employ branding strategies such as distinctive logos, attractive packaging, consistent brand presentation, and in-store promotions, with 45.9% of respondents strongly agreeing and 34.4% agreeing, yielding weighted mean scores (WMS) ranging from 3.15 to 3.23. The study further showed that the frequency and prominence of branding strategies significantly influence consumer awareness and engagement, as 48.1% strongly agreed and 33.9% agreed that these strategies are regularly visible and impactful. The analysis also indicated that branding strategies significantly affect consumer patronage, as strong brand identity, familiarity, and store atmosphere encourage purchase decisions and repeat patronage (WMS = 3.14, 3.23). However, challenges such as high packaging costs, inadequate promotional activities, and poor labeling were identified as factors limiting the effectiveness of branding

strategies. Significant relationships exist between branding strategies and consumer patronage (r = 0.62, r-crit = 0.098) as well as repeat patronage (r = 0.55, r-crit = 0.098). The study concluded that branding strategies significantly influence consumer behavior and loyalty toward convenience goods in supermarkets. It was recommended that supermarkets adopt consistent branding, improve promotional efforts, and maintain appealing store environments to enhance consumer patronage and repeat purchases.

Keywords: Branding strategies, Consumer patronage, Convenience goods, Supermarkets, Akwa Ibom State

Introduction

Branding is a critical aspect of marketing communication, as it involves strategic messaging, audience targeting, and media engagement to influence consumer behavior. According to Ihemereze (2014), branding is simply the process of giving identification marks to products such as brand name, brand mark, and trademark. In other words, it is the process of giving a brand name to a product, designing the brand mark, and legalizing and promoting the brand. He further took the position that a well-promoted brand name that has earned a reputation in the market is difficult to compete with, as it offers customers protection and confidence. Branding is inextricably linked with advertising. According to Krugman & Hayes (2012), branding communicates ideas through consumer products, and in many respects, the brand is what advertising is all about. Just like advertising, brands make promises and seek to create trust between producer and consumer (Umoren, 2019).

Belch and Belch (2018) opine that advertising plays a critical role in building brand awareness, shaping brand perceptions, and influencing consumer attitudes. Branding strategies rely on various communication channels to shape consumer perceptions, establish brand identity, and drive product patronage (Kotler & Keller, 2016). Supermarkets, as key retail outlets, serve as communication platforms where brands interact with consumers through advertising, promotions, packaging, and digital marketing. In Akwa Ibom State, the rapid expansion of supermarkets has intensified brand competition, making effective communication essential for product differentiation and consumer engagement. The mass media play a crucial role in this process by ensuring that branding messages reach the intended audience through both traditional and digital media. Branding in supermarkets is heavily dependent on advertising and public relations, both of which are key elements of marketing communication. Keller (2016) emphasizes that a

brand's success is largely determined by how well its message resonates with its target audience (Umoren, 2025).

The rise of digital media has further transformed branding communication in supermarkets. Social media platforms, online advertisements, and influencer marketing have become key tools for brand communication (Keller & Swaminathan, 2020). In Akwa Ibom State, where internet penetration is increasing, brands leverage Facebook, Instagram, and Twitter to engage with consumers, provide product information, and offer promotional deals (Ibia & Ekott, 2013). Through digital branding strategies such as having a professional website, social media marketing, and utilizing paid advertising, among others, supermarkets can interact with their customers in real time, gather feedback, and build strong consumer-brand relationships.

Public relations and corporate social responsibility (CSR) initiatives also contribute to brand perception and consumer trust. Brands that engage in CSR activities, such as community development projects and environmental sustainability campaigns, use mass media for public awareness campaigns, content marketing, and branding initiatives, among others, to enhance their reputation and establish credibility (Chaudhuri & Holbrook, 2019). Supermarkets that support local initiatives or sponsor community events benefit from positive brand associations, which, in turn, influence brand loyalty among consumers. Effective communication of these CSR efforts through media channels strengthens the emotional connection between brands and consumers, reinforcing long-term brand equity. This study, therefore, seeks to explore the branding strategies employed by selected supermarkets in Akwa Ibom State and their influence on consumers' patronage of convenience goods.

Statement of the Problem

Branding plays a crucial role in influencing consumer behavior, yet many supermarkets struggle to implement effective branding strategies that drive consistent customer loyalty and brand preference. In Akwa Ibom State, where there is an increase in the number of supermarkets, the competition among brands is intensifying. Despite the presence of various convenience goods such as beverages, snacks, and toiletries, and toiletries, among others, on supermarket shelves, consumer purchasing decisions are often inconsistent, with many buyers switching between brands based on price changes, promotional offers, or packaging appeal. This raises concerns about the long-term effectiveness of branding in securing customer retention and product loyalty.

Consumers often make spontaneous purchasing decisions in supermarkets, sometimes choosing a lesser-known brand due to a discount or eye-catching packaging. For instance, while a particular brand of detergent may have a strong reputation, a consumer may still opt for a competitor's product simply because it is placed at a more visible spot or comes with a temporary price reduction. This trend suggests that despite strong brand identities, supermarkets may not be leveraging branding strategies effectively to create lasting consumer attachment to specific products. Additionally, the increasing reliance on digital media and influencer marketing has changed how consumers perceive brands. As a result, some supermarket brands struggle to maintain relevance in a market where consumer preferences are constantly changing. Against this backdrop, this study sought to examine the branding strategies used by selected supermarkets in Akwa Ibom State and how the strategies influenced consumers' patronage of convenience goods.

Objectives of the Study

The objectives of this study were to:

i. Identify the branding strategies employed by supermarkets in Akwa Ibom State to promote convenience goods.

ii. Ascertain which of the strategies are used frequently by supermarkets in Akwa Ibom State to reach consumers of convenience goods.

iii. Find out the extent to which the strategies influence consumers' patronage of convenience goods in select supermarkets in Akwa Ibom State.

iv. Assess the effectiveness of different branding elements in driving repeat patronage among consumers of convenience goods.

v. Analyze the challenges supermarkets face in implementing effective branding strategies for convenience goods.

Research Questions

This study seeks to answer the following research questions:

i. What branding strategies do supermarkets in Akwa Ibom State employ to promote convenience goods?

ii. Which of the strategies are used frequently by supermarkets in Akwa Ibom State to reach consumers of convenience goods?

iii. To what extent do the strategies influence consumers' patronage of convenience goods in selected supermarkets in Akwa Ibom State?

iv. How effective are different branding elements in driving repeat patronage among consumers of convenience goods?

v. What challenges do supermarkets face in implementing effective branding strategies for convenience goods?

Hypotheses

H_{01}: There is no significant relationship between branding strategies employed by supermarkets and the promotion of convenience goods in Akwa Ibom State.

H_{02}: There is no significant relationship between the frequency of branding strategies and patronage of convenience goods in Akwa Ibom State.

H_{03}: There is no significant relationship between branding strategies and consumers' patronage of convenience goods in Akwa Ibom State.

H_{04}: There is no significant relationship between branding elements and repeat patronage of convenience goods in Akwa Ibom State.

H_{05}: There is no significant relationship between branding challenges and effectiveness of branding strategies in Akwa Ibom State.

Branding and Consumer Decision-Making

Branding plays a crucial role in shaping consumer decision-making by influencing perceptions, preferences, and purchasing behavior. A well-established brand serves as a psychological shortcut, helping consumers make quick and informed choices in a crowded marketplace. In the retail industry, particularly in supermarkets, branding differentiates products, creates emotional connections, and builds trust, ultimately guiding consumers toward specific purchasing decisions (Kotler & Keller, 2016). Consumers are more likely

to choose brands that are familiar, reputable, and aligned with their values, making branding a key determinant in product selection (Aaker & Moorman, 2018).

One of the primary ways branding influences consumer decision-making is through brand recognition and recall. Consumers tend to gravitate toward brands they can easily recognize, as familiarity creates a sense of reliability and trust. This is especially important in the convenience goods sector, where consumers often make quick, low-involvement purchases. Strong branding elements such as logos, colors, packaging, and slogans enhance product recall and make it easier for consumers to identify their preferred brands among competing options (Solomon *et al.,* 2019). For example, in Nigeria, well-established brands like Peak Milk, Indomie, and Coca-Cola enjoy high brand recall, leading to repeated purchases and customer loyalty (Ogunyemi & Adebayo, 2021).

Perceived quality and brand trust also play significant roles in consumer decision-making. Many consumers associate strong brands with superior quality and reliability, which influences their willingness to pay a premium price for branded products over generic alternatives (Keller, 2016). When a brand consistently delivers high-quality products, it builds trust and credibility, reducing the perceived risk of making a poor purchase decision. In Nigeria, brands such as Dettol and Milo have built consumer trust over time by consistently providing high-quality products, leading to increased brand loyalty and preference (Eze & Chukwuma, 2018). Trust is particularly important in categories like food, beverages, and healthcare products, where consumers prioritize safety and effectiveness.

Branding also affects consumer decision-making through emotional and psychological connections. Many successful brands use storytelling, advertising, and brand personalities to evoke emotions and create a deeper connection with consumers (Chaudhuri & Holbrook, 2019). Emotional branding fosters long-term relationships, making consumers feel attached to a brand beyond just its functional benefits. For instance, brands that position themselves as family-friendly, health-conscious, or socially responsible appeal to consumers who identify with those values. In Nigeria, brands like Cowbell Milk and Golden Morn use advertisements that emphasize family bonding and childhood memories, reinforcing positive emotional connections that influence consumer decisions (Ajayi & Mbah, 2019).

Theoretical Framework

This study was anchored on the following theories; Brand Equity Theory, Theory of Planned Behavior, Consumer Perception Theory, and Integrated Marketing

Communications. Brand Equity Theory, popularized by David A. Aaker (1991), explains the added value a brand name contributes to a product beyond its functional benefits. The major assumption is that strong brands serve as valuable assets that influence consumer behavior and enhance firm performance over time (Aaker, 1991; Keller, 2013). Key constructs of the theory include brand awareness, perceived quality, brand associations, brand loyalty, and proprietary brand assets. More recent studies affirm that strong brand equity enhances customer preference, willingness to pay premium prices, and long-term loyalty (Keller & Swaminathan, 2020; Foroudi, 2019).

The Theory of Planned Behavior, proposed by Icek Ajzen (1985) and extended in 1991, posits that behavior is driven by behavioral intention, which is influenced by attitude, subjective norms, and perceived behavioral control (Ajzen, 1991). The major assumption is that individuals engage in rational decision-making processes before acting. The key constructs include attitude toward behavior, subjective norms, perceived behavioral control, and behavioral intention. Recent empirical studies continue to validate TPB in predicting consumer purchase intentions across retail settings (Yadav & Pathak, 2017; Paul, Modi & Patel, 2016).

Consumer Perception Theory, rooted in the work of Jerome McCarthy (1960) and expanded by Kotler and Keller (2016), emphasizes that consumers respond to their perceptions of marketing stimuli rather than objective reality. The major assumption is that perception is subjective and significantly influences consumer decision-making. Key constructs include perception, interpretation of stimuli, prior experience, and psychological and environmental influences. Recent research highlights that perception plays a critical role in shaping brand image, trust, and purchase decisions in competitive retail environments (Hoyer, MacInnis & Pieters, 2020; Schiffman & Wisenblit, 2019).

Integrated Marketing Communications (IMC) Theory, developed by Don E. Schultz and colleagues in the early 1990s, emphasizes the coordination of all marketing communication tools to deliver a consistent and unified message to consumers (Schultz & Kitchen, 2000). The major assumption is that integrated and consistent communication across multiple channels enhances brand effectiveness and consumer response. Key constructs include message consistency, communication integration, synergy among promotional tools, and customer-centered communication. Recent studies show that IMC improves brand engagement, strengthens customer relationships, and enhances purchase behavior in retail environments (Porcu, del Barrio-García & Kitchen, 2017; Kitchen & Burgmann, 2015).

Empirical Review

The reviewed empirical studies collectively highlight the significant role of branding strategies in influencing consumer behaviour and patronage across different contexts. Nyong et al. (2023) established that advertisement exposure, particularly through television, significantly affects consumer purchase decisions, emphasizing message presentation as a key driver of brand patronage. Similarly, Everlyne (2018) found that brand image elements such as brand attributes and perceived benefits positively influence consumer buying behaviour in supermarkets. Supporting this, Tarannum et al. (2024) demonstrated that strong branding enhances customer recognition, trust, and loyalty, ultimately improving product performance. Abioro and Odunlami (2021) further confirmed that branding elements like packaging, brand recognition, and perceived quality have a strong positive effect on customer patronage in Nigeria. In addition, Raphael et al. (2024) reinforced that branding components such as logo, packaging, and advertising significantly shape consumer loyalty and purchasing decisions within the local context of Akwa Ibom State.

Furthermore, other studies emphasize the role of both product-related and non-product-related factors in driving patronage behaviour. Jackline et al. (2024) revealed that store convenience factors including accessibility, layout, and checkout efficiency significantly influence retail patronage among supermarket shoppers. Likewise, Oghenekome and Ozuru (2023) highlighted the importance of packaging strategies, showing that elements such as visual appeal, labelling, and functionality positively impact customer patronage. Across these studies, a common theme emerges: consumer behaviour is influenced by a combination of branding elements, marketing communication, and situational factors. These findings are highly relevant to the current research as they provide empirical support those effective branding strategies, ranging from advertising and packaging to store environment and brand image, which plays a crucial role in, shaping consumer perception, purchase decisions, and sustained patronage of convenience goods in supermarket settings.

Research Methodology

The study employed a descriptive survey research design. The population comprised residents of Akwa Ibom State, estimated at 7,200,000 based on 2025 projections from the National Population Commission, alongside 14 supermarket managers. Using Philip Meyer's (2010) sample size determination table, a sample size of 384 consumers was considered appropriate. A multi-stage sampling technique was adopted: purposive

sampling was used to select supermarkets across the three senatorial districts (Uyo, Ibesikpo, Ikot Ekpene, Abak, Eket, and Esit Eket), while convenience sampling was used to select consumers at points of purchase. A census approach was applied to include all 14 supermarket managers. Data were collected using a structured questionnaire and semi-structured interviews; the questionnaire comprised two sections: demographic data and a five-point Likert scale measuring key variables across four research questions. Instrument validity was ensured through expert review, and reliability was confirmed by a pre-test of 30 respondents, yielding a Cronbach alpha coefficient of 0.79. Data analysis was conducted using simple percentages and weighted mean scores, while hypotheses were tested using Pearson Product Moment Correlation.

Data Presentation and Analysis

Table 1: Branding Strategies Supermarkets in Akwa Ibom State Employ to Promote Convenience Goods.

S/N	Questionnaire Statement	SA	A	D	SD	Total	Weighted Mean Score	Decision
1	This supermarket uses unique logos and colour schemes to distinguish its products	168 (45.9%)	126 (34.4%)	48 (13.1%)	24 (6.6%)	366	3.20	Accepted
2	I often see promotional activities (discounts, adverts or in-store displays) encouraging the purchase of convenience goods	154 (42.1%)	138 (37.7%)	50 (13.7%)	24 (6.5%)	366	3.15	Accepted
3	Supermarkets use brand names and logos that make their convenience	176 (48.1%)	122 (33.3%)	44 (12.0%)	24 (6.6%)	366	3.23	Accepted

	goods easy to recognize							
4	Supermarkets maintain a consistent image in the way their convenience goods are presented	162 (44.3%)	132 (36.1%)	46 (12.6%)	26 (7.1%)	366	3.17	Accepted

Source: Field Survey, 2025

Table 1 shows that most of the 366 respondents agreed that supermarkets use key branding strategies to promote convenience goods. Agreement ranged from 79.8% to 81.4% across all items, with mean scores between 3.15 and 3.23. Respondents particularly confirmed the use of unique logos and color schemes (80.3%), promotional activities (79.8%), recognizable brand names and logos (81.4%), and consistent brand presentation (80.4%). This indicates strong agreement that branding strategies are effectively used to influence consumer patronage.

Table 2: Strategies Used Frequently by Supermarkets in Akwa Ibom State to Reach Consumers of Convenience Goods.

S/N	Statement	SA	A	D	SD	Total	WMS	Decision
5	Branding elements are updated or refreshed regularly to keep up with market trends.	158 (43.2%)	136 (37.2%)	46 (12.6%)	26 (7.1%)	366	3.16	Agree
6	Promotional branding materials (banners/flyers) are frequently displayed in this store.	162 (44.3%)	132 (36.1%)	48 (13.1%)	24 (6.6%)	366	3.18	Agree
7	Convenience goods are often arranged on shelves in a way that easily draws my attention.	170 (46.4%)	128 (35.0%)	44 (12.0%)	24 (6.6%)	366	3.21	Agree

8	I frequently receive promotional offers or loyalty rewards for buying convenience goods from certain supermarkets.	150 (41.0%)	138 (37.7%)	50 (13.7%)	28 (7.6%)	366	3.12	Agree

Source: Field Survey, 2025

Table 2 shows that respondents generally agreed that supermarkets frequently apply multiple branding strategies to attract consumers of convenience goods. Agreement levels were consistently high across all items, with 80.4% (43.2% strongly agreed; 37.2% agreed; mean = 3.16) noting that branding elements are regularly updated, 80.4% (44.3% strongly agreed; 36.1% agreed; mean = 3.18) confirming frequent use of promotional materials such as banners and flyers, and 81.4% (46.4% strongly agreed; 35.0% agreed; mean = 3.21) agreeing that shelf arrangement is used to attract attention. Supermarkets actively employ branding strategies such as shelf placement, promotional displays, brand updates, and incentives to influence consumer-purchasing behavior.

Table 3: Strategies That Influence Consumers' Patronage of Convenience Goods in Selected Supermarkets in Akwa Ibom State.

S/N	Statement	S	A	D	SD	Total	WMS	Decision
9	The way a convenience good is branded influences my decision to buy it.	176 (48.1%)	124 (33.9%)	42 (11.5%)	24 (6.6%)	366	3.23	Agree
10	The reputation of the supermarket's brand is the main reason I shop here.	164 (44.8%)	132 (36.1%)	44 (12.0%)	26 (7.1%)	366	3.18	Agree
11	When a supermarket has a strong and familiar brand, I am more confident buying from it.	172 (47.0%)	126 (34.4%)	42 (11.5%)	26 (7.1%)	366	3.21	Agree
12	Branding strategies encourage me to visit a particular supermarket more often for convenience goods.	160 (43.7%)	134 (36.6%)	46 (12.6%)	26 (7.1%)	366	3.17	Agree

Source: Field Survey, 2025

Table 3 shows that branding strategies strongly influence consumers' patronage of convenience goods in supermarkets. Across all items, a clear majority agreed, with positive responses ranging from 78.7% to 81.4%. Specifically, 81.4% (mean = 3.23) indicated that product branding affects purchase decisions, 80.9% (mean = 3.18) agreed that supermarket brand reputation influences shopping choice, 81.4% (mean = 3.21) reported increased confidence when the brand is familiar, and 80.3% (mean = 3.17) said branding encourages repeat visits. Strong branding, familiarity, and reputation significantly drive consumer patronage of convenience goods.

Table 4: Effects of different branding elements in driving repeat patronage among consumers of convenience goods.

S/N	Questionnaire statement	SA	A	D	SD	Total	WMS	Decision
14	The brand name of a product is more important to me than the way it is packaged.	152 (41.5%)	140 (38.3%)	46 (12.6%)	28 (7.6%)	366	3.14	Agree
15	The internal atmosphere/ambience of the store encourages me to stay and shop longer.	168 (45.9%)	130 (35.5%)	44 (12.0%)	24 (6.6%)	366	3.20	Agree
16	Clear and visible brand labeling is the most effective factor in my product selection.	174 (47.5%)	128 (35.0%)	40 (10.9%)	24 (6.6%)	366	3.23	Agree
17	Promotional offers (buy-one-get-one-free) are more effective than visual packaging.	162 (44.3%)	134 (36.6%)	44 (12.0%)	26 (7.1%)	366	3.18	Agree

Source: Field Survey, 2025

Table 4 shows that branding elements significantly influence repeat patronage of convenience goods. Agreement levels were consistently high, ranging from 79.8% to 82.5% across all items. Specifically, 79.8% (mean = 3.14) agreed that brand name is more important than packaging, 81.4% (mean = 3.20) confirmed that store ambience encourages longer shopping time, 82.5% (mean = 3.23) identified clear brand labeling as the most important factor in product selection, and 80.9% (mean = 3.18) agreed that promotional offers are more effective than packaging. Brand name, store ambience, product labeling, and promotional incentives strongly drive repeat patronage of convenience goods.

Table 5: Challenges Supermarkets Face in Implementing Effective Branding Strategies for Convenience Goods.

S/N	Questionnaire statement	SA	A	D	SD	Total	WMS	Decision
18	High costs of quality packaging materials make branding difficult to maintain.	158 (43.2%)	136 (37.2%)	46 (12.6%)	26 (7.1%)	366	3.16	Agree
19	Many supermarkets do not promote their convenience goods well enough to attract customers.	150 (41.0%)	142 (38.8%)	46 (12.6%)	28 (7.6%)	366	3.13	Agree
20	The high prices of branded convenience goods discourage me from buying them regularly.	164 (44.8%)	134 (36.6%)	42 (11.5%)	26 (7.1%)	366	3.18	Agree
21	Poor packaging or unclear labeling makes it difficult for me to trust some convenience goods.	170 (46.4%)	130 (35.5%)	40 (10.9%)	26 (7.1%)	366	3.20	Agree

Source: Field Survey, 2025

Table 5 shows that most respondents agreed that key challenges affect branding in supermarkets. Agreement ranged from 79.8% to 81.9%, with mean scores between 3.13 and 3.20. Respondents identified high packaging costs (80.4%), inadequate promotion (79.8%), high product prices (81.4%), and poor labeling (81.9%) as major constraints. These factors significantly hinder effective branding of convenience goods in supermarkets.

Testing of Hypothesis

Hypothesis One (H_{01}): There is no significant relationship between branding strategies employed by supermarkets and the promotion of convenience goods.

Table 6: Pearson Product Moment Correlation Coefficient

Variable	N	∑X	∑Y	∑X²	∑Y²	∑XY	r-cal	r-crit	Decision
Branding Strategies (X)	366	1,248		4,362					
Promotion of Convenience Goods (Y)	366		1,196		4,108	4,226	0.64	0.098	Reject H_0

Table 6 shows that the calculated correlation coefficient (r = 0.64) is greater than the critical value (r = 0.098) at the 0.05 level of significance. This indicates a significant positive relationship between supermarkets' branding practices and promotion of convenience goods. Therefore, the null hypothesis (H_{01}) is rejected, implying that there is a significant relationship between branding strategies employed by supermarkets and the promotion of convenience goods in Akwa Ibom State**.**

Hypothesis Two (H_{02}): There is no significant relationship between the frequency and prominence of branding strategies and consumers of convenience goods.

Table 7: Pearson Product Moment Correlation Coefficient

Variable	N	∑X	∑Y	∑X²	∑Y²	∑XY	r-cal	r-crit	Decision
Frequency of Branding Strategies (X)	366	1,214		4,210					
Consumers of Convenience Goods (Y)	366		1,175		4,020	4,058	0.58	0.098	Reject H_0

Table 7 shows that the computed r-value (0.58) exceeds the critical r-value (0.98) at the 0.05 significance level. This implies that there is a significant relationship between the frequency of branding strategies and how effectively supermarkets reach consumers. Therefore, the null hypothesis (H_{02}) is rejected**.**

Hypothesis Three (H_{03}): There is no significant relationship between branding strategies and consumers' patronage of convenience goods.

Table 8: Pearson Product Moment Correlation Coefficient

Variable	N	∑X	∑Y	∑X²	∑Y²	∑XY	r-cal	r-crit	Decision
Branding Strategies (X)	366	1,232		4,320					
Consumers Patronage (Y)	366		1,208		4,146	4,182	0.62	0.098	Reject H_0

Table 8 shows that the computed correlation coefficient (r = 0.62) is less than the critical r-value (0.98) at the 0.05 level of significance. This means there is a strong and positive relationship between branding strategies and consumers' patronage of convenience goods.

The null hypothesis (H_{03}) is therefore rejected**,** indicating that effective branding significantly influences consumer patronage.

Hypothesis Four (H_{04}): There is no significant relationship between branding elements and repeat patronage of convenience goods.

Table 9: Pearson Product Moment Correlation Coefficient

Variable	N	∑X	∑Y	∑X²	∑Y²	∑XY	r-cal	r-crit	Decision
Branding Elements (X)	366	1,205		4,102					
Repeat Patronage (Y)	366		1,184		4,012	3,980	**0.55**	0.098	Reject H_0

Table 9 shows that there is a significant positive relationship between branding elements and consumer repeat patronage. This indicates that a strong brand name, attractive packaging, a clean store environment, and consistent branding significantly influence consumers to repurchase convenience goods. The table shows that r-calculated (0.55) is greater than r-critical (0.98). Therefore, the null hypothesis H_{05} is rejected. This means that branding elements employed by supermarkets in Akwa Ibom State significantly influence consumer repeat patronage of convenience goods.

Hypothesis Five (H_{05}): There is no significant relationship between branding challenges and the effectiveness of branding strategies.

Table 10: Pearson Product Moment Correlation Coefficient

Variable	N	∑X	∑Y	∑X²	∑Y²	∑XY	r-cal	r-crit	Decision
Branding Challenges (X)	366	1,188		4,018					
Effectiveness of Branding Strategies (Y)	366		1,160		3,940	3,902	0.49	0.098	Reject H_0

The analysis on Table 4.2.5 shows that the computed r-value (0.49) is greater than the critical r-value (0.098) at the 0.05 significance level. This result indicates a significant relationship between the challenges supermarkets face and the effectiveness of branding strategy implementation. Hence, the null hypothesis (H_{04}) is rejected.

Discussion of Findings

The findings reveal that supermarkets in Akwa Ibom State employ a range of branding strategies, particularly the use of unique logos, consistent color schemes, recognizable brand names, in-store promotions, and strategic shelf arrangements, with weighted mean scores ranging from 3.15 to 3.23. A significant proportion of respondents (80.3%) agreed that visual identity elements play a central role in differentiating products and attracting consumer attention. These findings align with conceptual views of branding as a tool for creating a unique identity that shapes consumer perception (Kotler & Keller, 2016) and are supported by Brand Equity Theory (Aaker, 1991), which emphasizes the role of brand awareness and associations in influencing consumer behavior. Empirical evidence also supports that supermarkets utilize branding elements to build trust and loyalty (Ebitu & Basil, 2020; Okon & Udoh, 2021). Branding strategies are deliberately and effectively used to promote convenience goods and differentiate supermarkets in a competitive environment.

Supermarkets frequently use branding strategies such as price discounts, product displays, shelf arrangements, social media campaigns, promotional displays, and branded shopping materials to reach consumers. High agreement levels were recorded, with 71.2% of respondents affirming the frequent use of discounts (WMS = 3.87) and similar strong responses for display strategies and promotional activities (WMS between 3.81 and 3.85). Frequent exposure to branding messages improves familiarity and purchase intention (Okon & Udoh, 2021). Thus, frequency and visibility are critical components of effective branding strategies used by supermarkets to reach consumers.

Branding strategies significantly influence consumer patronage of convenience goods, with activities such as frequent promotional displays, effective shelf arrangements, brand updates, and loyalty programs recording weighted mean scores between 3.12 and 3.21. The hypothesis test further confirmed a strong positive relationship ($r = 0.58$) between branding strategies and consumer patronage. Consistent branding enhances repeat patronage (Ebitu & Basil, 2020). Therefore, branding strategies are not only influential but also essential in shaping consumer buying behavior and loyalty in supermarket settings.

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& Basil, 2020). Therefore, branding strategies are not only influential but also essential in shaping consumer buying behavior and loyalty in supermarket settings.

Branding elements such as brand familiarity, supermarket reputation, and visually appealing displays significantly drive repeat patronage, with weighted mean scores ranging from 3.17 to 3.23 and over 80% of respondents acknowledging the influence of branding on their buying decisions. The Pearson correlation result ($r = 0.62$) further confirmed a strong positive relationship between branding elements and repeat patronage. Effective branding fosters customer loyalty and repeat shopping behavior (Okon & Udoh, 2021; Ebitu & Basil, 2020). Hence, well-designed and consistently applied branding elements are key drivers of repeat patronage.

Several challenges affecting the implementation of branding strategies, including high packaging costs, inadequate promotional reach, high pricing of branded goods, and poor labeling, had weighted mean scores between 3.13 and 3.20. Resource limitations and lack of expertise constrain branding effectiveness in retail settings (Adebayo, 2019; Okon & Udoh, 2021). Overall, while branding strategies are impactful, their effectiveness is limited by operational and financial challenges, indicating the need for improved resource allocation, staff training, and strategic investment to enhance branding outcomes.

Conclusion

Branding plays a significant role in promoting convenience goods in supermarkets across Akwa Ibom State. Findings show that supermarkets use various strategies such as packaging, advertising, promotional displays, and loyalty programs to attract customers, build trust, and influence purchase decisions. Among these, advertising, discounts, and distinctive packaging are the most frequently used and effective in enhancing visibility and encouraging patronage. The results further indicate that consumers prefer brands that are consistent, reliable, and visually appealing. However, supermarkets face challenges including high branding costs, limited digital marketing capacity, inadequate expertise, and strong competition. Despite these constraints, branding remains essential for sustaining sales, improving customer satisfaction, and achieving long-term business growth in the retail sector.

Recommendations

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

i. Supermarkets should maintain and enhance the use of branding tools such as attractive packaging, consistent logos, in-store displays, and advertising to strengthen consumer recognition and preference.

ii. Branding initiatives should be consistently visible and frequently applied across supermarkets and all their digital platforms to increase consumer awareness, recall, and engagement.

iii. Supermarkets should focus on strategies that build consumer trust and perceived value, including maintaining quality products, clear communication, and promotional initiatives that encourage repeat purchases.

iv. Supermarkets should maintain consistency in key branding elements such as logos, packaging, store environment, and promotions. Regular monitoring of these elements and adapting based on consumer feedback will strengthen loyalty and encourage repeat patronage.

v. Operational and resource challenges should be addressed through staff training, investment in digital and marketing tools, and partnerships with marketing agencies to improve branding efficiency.

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Effect of Digital Technology Instruction on Intermediate Science Students' Academic Performance in Secondary Schools in Ikono, Akwa Ibom State

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Abstract

This study investigated the effect of digital technology instruction on intermediate science students' academic performance in secondary schools in the Ikono Local Government Area of Akwa Ibom State, Nigeria. Two research questions and two null hypotheses guided the study. A quasi-experimental post-test-only research design was adopted for the study. The population consisted of 3,898 Junior Secondary Two students from fifteen secondary schools in the area. The criterion sampling technique was used to select two schools with ICT facilities, while the intact sampling technique was used to select two intact classes, resulting in a sample size of 100 students. The experimental group was taught using digital technology instruction, whereas the control group was taught using the conventional lecture method. The instrument used for data collection was the Intermediate Science Achievement Test (ISAT), which consisted of twenty multiple-choice questions on heat flow. The instrument was face and

content validated by experts in intermediate science and measurement and evaluation. The reliability coefficient of the instrument was 0.76, obtained using the split-half method and analysed with Kuder-Richardson Formula 20 (KR-20). Data collected were analysed using mean, standard deviation, and independent t-test statistics at a 0.05 level of significance. The results revealed a significant difference in academic achievement of intermediate science students in favour of those taught using digital technology instruction. The study also revealed no significant gender difference in students' achievement, indicating that digital technology instruction is gender-friendly. The study concluded that digital technology instruction is more effective than the conventional lecture method in enhancing students' academic performance in intermediate science. It was therefore recommended that teachers integrate digital technology into classroom instruction and that the government should provide adequate digital technology facilities in schools.

Keywords: Digital, Technology, Instruction, Performance, Intermediate Science, Gender.

Introduction

Education is the process of facilitating learning and the acquisition of knowledge, skills, values, morals, beliefs, and habits. It may occur in formal or informal settings, and any experience that influences how an individual thinks, feels, or acts may be considered educational. Education plays a vital role in the social and economic development of a nation and is widely regarded as a major instrument for national development (Kuranking et al., 2023; Onebunne, 2022).

Historically, the teaching of science subjects, including Intermediate Science (formerly Intermediate science), was largely theoretical, relying mainly on conventional lecture methods with limited practical demonstrations. This method often made it difficult for junior secondary school students to understand abstract scientific concepts. Students who encountered learning difficulties had limited opportunities to access supplementary learning materials outside the classroom and often depended on family members who might not possess the necessary scientific knowledge to support them (Arinde & Mohammed, 2021; Oboqua et al., 2017).

Intermediate Science is a core subject in the Nigerian junior secondary school curriculum and serves as the foundation for advanced science subjects such as biology, chemistry, and

physics. Effective teaching of intermediate science requires active student participation, practical engagement, and the use of multiple senses in learning. Consequently, there is a growing need for innovative instructional approaches that can enhance students' understanding and participation in science learning.

Delphonso et al. (2023) observed that the traditional teacher-centred teaching approach, which emphasises passive reception of knowledge, is still prevalent in many secondary schools across Nigeria. This approach has been criticised for limiting students' opportunities to learn from diverse instructional sources and interactive experiences. As a result, attention has increasingly shifted toward the integration of digital technology instruction as a means of improving classroom pedagogy. In many developed countries across America, Europe, and Asia, educational systems have progressed from basic digital integration to more advanced technology-supported learning environments, including artificial intelligence (AI)-assisted instruction. In contrast, many Nigerian schools are still in the process of effectively integrating digital technology into classroom teaching and learning. Consequently, the adoption of appropriate digital tools and instructional resources in science education may enhance students' engagement, understanding, and overall learning experiences.

Digital technology instruction in science education refers to the application of information and communication technology tools and resources in the teaching and learning of science subjects. Through the use of computers, software applications, multimedia materials, interactive simulations, and online platforms, educators can create more engaging and effective learning experiences for students (Arukaroon & Krairit, 2017). These innovations enable teachers to explain complex scientific concepts in clearer and more visually stimulating ways, thereby improving students' understanding and retention of knowledge. Virtual laboratories and simulated activities also provide opportunities for practical experiences without relying entirely on physical equipment, which helps to develop learners' practical and critical thinking skills.

In recent years, technological advancement has significantly influenced educational practices and improved access to instructional materials. Learners can now utilise online videos, animations, virtual experiments, electronic textbooks, and other web-based resources to support their study of intermediate science both within and outside the classroom (Obodo, 2020). This development encourages independent and self-paced learning among students. Unlike earlier periods when students relied mainly on poorly equipped school libraries, modern technological facilities now provide broader access to books, journals, and other academic materials through the internet.

The use of technology-supported instruction further promotes effective science teaching by presenting concepts through animations, videos, simulations, and three-dimensional representations. These instructional materials stimulate learners' visual and auditory senses, making lessons more practical, meaningful, and easier to comprehend (Wang, 2017; Farhana & Chowdhury, 2019; Adie, Obi, Okri & Ogbe, 2020; Olofu et al., 2017; Inyang, Kankpang, Eyam, & Ajim, 2022).

Researchers have also associated technology-based science instruction with improved academic performance, enhanced problem-solving ability, critical thinking, and better data analysis skills among students. Findings from several studies conducted in Nigeria indicate that the use of technological resources increases students' interest, participation, and engagement in science learning. Nevertheless, despite government efforts to provide facilities such as computers, tablets, and internet-enabled devices in schools, the effective classroom application of these facilities remains limited. For example, studies in Anambra State showed that only a small proportion of intermediate science teachers possess sufficient competence in the use of technological tools for classroom instruction (Okeke, 2024). Similar observations were reported in Enugu State, where teachers demonstrated basic digital literacy but still experienced difficulties in applying such skills effectively during teaching (Obodo, 2020).

Although the adoption of technological facilities in education requires substantial resources, it has become widely recognised as an important innovation in modern teaching and learning. It supports conventional instructional approaches such as lecture and demonstration methods while encouraging more learner-centred classroom practices. In Nigeria, schools are gradually embracing these modern instructional approaches as part of ongoing educational improvement efforts. Empirical studies have shown that technology-supported instruction contributes positively to students' motivation, classroom participation, skill acquisition, and academic achievement (Afolabi & Adebanjo, 2023; Bessong et al., 2024; Meremikwu, Ibok, Adie, Inah, Tawo & Okri, 2022).

Beyond instructional strategies, students' academic performance may also be influenced by demographic factors such as gender (Umar & Samuel, 2018). Gender has long been identified as an important variable in science education because male and female students may differ in their attitudes toward science, access to digital resources, technological confidence, and learning outcomes (Okeke, 2024). Studies by Umar and Samuel (2018) revealed that there is a significant gender influence on students' achievement in intermediate science, now known as intermediate science. Similarly, some researchers reported that male students tend to show higher confidence and participation

in technology-based learning environments than their female counterparts, which may influence academic achievement.

Conversely, other studies found no significant gender influence on students' performance in Intermediate Science (Matazu & Kamar, 2018; Baba, Jemma, & Zachariah, 2022; Obodo, Animercy, & Okolo, 2021). These conflicting findings indicate that the relationship between gender and academic performance in science remains inconclusive. With the introduction of digital technology instruction, it becomes important to examine whether male and female students benefit equally from technology-enhanced learning environments. Some studies suggest that digital learning platforms may reduce traditional gender disparities in science achievement by creating more interactive and self-paced learning opportunities, while other studies report differences in participation and digital confidence between male and female learners (Okeke, 2024). Therefore, gender becomes an important factor to consider when examining the effect of digital technology instruction on students' academic performance in intermediate science. Understanding whether gender influences students' achievement under digital technology instruction will help educators, curriculum planners, and policymakers develop inclusive teaching strategies that ensure equal learning opportunities for both male and female students.

Despite the numerous benefits associated with digital technology instruction, concerns still exist regarding the availability, accessibility, and effective utilisation of digital technology resources in schools. Questions remain as to whether these resources are equally accessible to all students and whether they are effectively used to enhance learning outcomes in Intermediate Science (Bessong, Bessong, & Patrick, 2024). These concerns, alongside the need to examine gender differences in students' academic performance under digital technology instruction, form the basis for this study on the effect of digital technology instruction on intermediate science students' academic performance in secondary schools in the Ikono Local Government Area of Akwa Ibom State, Nigeria.

Statement of the Problem

Teaching in secondary schools is generally characterised by the use of conventional instructional methods such as note-giving and copying, chalkboard illustrations, demonstrations, and other teacher-centred approaches. These methods often encourage students to form only mental representations of concepts presented during instruction, with limited opportunities for active participation and practical engagement. Consequently, students may gradually lose interest in learning and experience difficulty retaining what has been taught.

Furthermore, the persistent use of teacher-dominated instructional practices, where the teacher primarily controls classroom activities and communication, may reduce students' enthusiasm and motivation to learn. Science subjects, particularly intermediate science, appear to be more affected because many of the concepts taught are abstract and require considerable effort on the part of learners to visualise and understand them effectively. This situation may contribute to the poor academic performance commonly observed among students in intermediate science. Therefore, this study seeks to determine whether the use of digital technology instruction, when compared with the conventional teaching method, can improve students' academic performance in intermediate science.

Purpose of the Study

The purpose of the study is to investigate the effect of digital technology on intermediate science students' academic performance in junior secondary schools. Specifically, the study sought to:

i. Examine the effect of digital technology instruction on intermediate science students' academic performance.
ii. Ascertain the effect of gender on the academic performance of intermediate science students taught using digital technology instruction.

Research Questions

i. What is the difference between the mean academic performance scores of students taught intermediate science using digital technology instruction and those taught using the lecture teaching method?
ii. What is the difference between the mean academic performance scores of male and female students taught intermediate science using digital technology instruction?

Research Hypotheses

The following null hypotheses were formulated to guide the study:

i. There is no significant difference between the mean academic performance scores of intermediate science students taught digital technology instruction and those taught using the lecture method.
ii. There is no significant difference between the mean academic performance scores of male and female intermediate science students taught using digital technology instruction.

Methodology

The research design used for the study is a quasi-experimental design that employed a post-test only. This means that the design included two instructional groups: an experimental group exposed to digital technology instruction and a control group exposed to the lecture method. This design aimed at comparing the effectiveness of the two teaching strategies and was determined using the students' academic performance. After treatment, a post-test was administered to the learners. The population consists of 3898 junior secondary two students from fifteen secondary schools in the Ikono Local Government Area (State Universal Basic Education Board, 2025). The criterion sampling technique was used to select two secondary schools having ICT facilities for classroom instruction in the area. An intact sampling technique was also used to select an intact class of 50 students in one of the schools as the experimental group, and another intact class of 50 students in the second school was selected as the control group, resulting in a sample size of one hundred (100) students. The experimental group was taught using digital technology instruction, while the control group was taught using the lecture method.

The instrument used for data collection was the Intermediate Science Achievement Test (ISAT). This instrument had two sections. Section A contains student personal information like name of school, name, class and sex, while Section B contains the Intermediate Science Achievement Test (ISAT) on the concept of heat flow. The test had twenty (20) multiple-choice questions with four options: A, B, C and D. Each question had one correct option and three wrong options. The ISAT was face and content validated by three experienced intermediate science teachers and a specialist in test, measurement and evaluation. The validators scrutinised the instrument in terms of clarity to the subject, proper wording of items, and appropriateness and adequacy of the items for the study. The comments and recommendations of the validators helped to modify the items in the instrument. The reliability of the instrument was determined using the split-half method and analysed with Kuder-Richardson Formula 20 (KR-20), yielding a reliability coefficient of 0.76. The Test Blue Print for Junior Secondary Two Intermediate Science Objective Test was used to prepare questions for the Achievement Test. Data were analysed using mean, standard deviation and independent t-test statistics to test the hypotheses at a 0.05 level of significance.

Results

Research Question One

What is the difference between the mean academic performance scores of students taught intermediate science using digital technology instruction and those taught using the lecture teaching method?

Table 1: Mean Achievement Scores of Students in the Experimental and Control Groups in Post-test taught with Digital Technology Instruction and those taught with Lecture Method

Group	N	$\bar{x}$	Mean Difference
Experimental	50	78.40	13.20
Control	50	65.20	

The result shows that students taught using digital technology instruction obtained a higher mean score (78.40) than those taught using the lecture method, with a mean difference of 13.20. This indicates that students taught with digital technology instruction performed better than those taught with the lecture method.

Hypothesis One

There is no significant difference between the mean academic performance scores of intermediate science students taught digital technology instruction and those taught using the lecture method.

Table 2: Independent T-Test Analysis of Students in the Experimental and Control Groups in Post-Test Taught with Digital Technology Instruction and those Taught with Lecture Method.

Group	**N**	$\bar{x}$	**SD**	**df**	**t-cal**	**t-crit. (0.05)**	**Decision**
Experimental	50	78.40	8.60	98	7.46	1.98	Significant
Control	50	65.20	9.10				

The result shows that students taught using digital technology instruction obtained a higher mean score (78.40) than those taught using the lecture method (65.20). The calculated t-

value (7.46) is greater than the critical t-value (1.98) at the 0.05 level of significance with 98 degrees of freedom. Therefore, the null hypothesis, which states that there is no significant difference between the mean academic performance scores of intermediate science students taught digital technology instruction and those taught using the lecture method, is rejected.

Research Question Two

What is the difference between the mean academic performance scores of male and female students taught intermediate science using digital technology instruction?

Table 3: Mean Achievement Scores of Male and Female Students in the Experimental Group in Post-Test Taught with Digital Technology Instruction

Gender	N	$\bar{x}$	Mean Difference
Male Students	24	79.50	5.30
Female Students	26	74.20	

The result shows that students taught using digital technology instruction obtained a higher mean score (78.40) than those taught using the lecture method (65.20). The calculated t-value (7.46) is greater than the critical t-value (1.98) at the 0.05 level of significance with 98 degrees of freedom. Therefore, the null hypothesis, which states that there is no significant difference between the mean academic performance scores of intermediate science students taught digital technology instruction and those taught using the lecture method, is rejected.

Research Question Two

What is the difference between the mean academic performance scores of male and female students taught intermediate science using digital technology instruction?

Table 4: Independent T-Test Analysis of Male and Female Students in the Experimental Group in Post-Test Taught with Digital Technology Instruction.

Gender	N	$\bar{x}$	SD	df	t-cal	t-crit. (0.05)	Decision
Male	24	79.50	7.85				

Female	26	74.20	8.05	48	0.84	2.01	Not Significant

The result shows that male students taught using digital technology instruction had a higher mean score (79.50) than female students (74.20). The calculated t-value (2.36) is greater than the critical t-value (2.01) at the 0.05 level of significance with 48 degrees of freedom. Therefore, the null hypothesis was accepted since there was no significant difference between male and female students taught using digital technology instruction.

Discussion of Findings

From the tables presented, the results revealed that the teaching method was a significant factor influencing students' achievement in intermediate science. This implies that students' academic performance was closely related to the way concepts were presented during instruction. Evidence from tables 1 and 2 showed that the post-test mean achievement score (78.40) of students exposed to technology-based instruction was higher than the post-test mean score (65.20) of those taught using the conventional lecture method. The findings further indicated a significant difference in achievement between students taught with technology-supported instruction and those taught using the traditional method. This suggests that the use of technology-enhanced instructional strategies was more effective in improving students' academic performance in intermediate science than the conventional lecture approach.

This result agrees with the findings of Obodo, Animercy, and Okolo (2021) as well as Eno, Uko, and Utibe (2023), who reported that students taught with technology-supported instructional approaches performed better than those exposed to conventional teaching methods. The improved performance of the experimental group may be attributed to the availability of diverse instructional materials, systematic presentation of concepts, and interactive learning opportunities that enhanced students' understanding and retention of knowledge.

Similarly, Taiwo, Falade, Ayotunde, and Onasanya (2025), in their study on the effect of the digital interactive learning method on the academic performance of basic technology students in junior secondary schools in Ilorin, found a significant improvement in students' academic performance when the instructional approach was used.

Results from Tables 3 and 4 further revealed no significant difference between the mean achievement scores of male and female students taught intermediate science using technology-supported instruction. This indicates a gender balance in students' academic achievement under the instructional approach. The finding is consistent with Eno, Uko,

and Utibe (2023), whose study showed no significant gender difference in the achievement of male and female students taught nutrition using projectors, mobile phones, and expository strategies. The result, therefore, suggests that technology-supported instruction is gender-friendly and can effectively support the teaching and learning of intermediate science and other science-related subjects.

A similar outcome was reported by Taiwo, Falade, Ayotunde, and Onasanya (2025), who found no significant gender difference in the academic performance of students taught basic technology using the digital interactive learning method.

Conclusion

The study investigated the effect of digital technology as an innovative approach in enhancing intermediate science students' academic performance in secondary schools in Ikono Local Government. The importance of digital technology cannot be overemphasised. From the finding and discussion of the study, the following conclusions are made: Digital technology as an innovational teaching approach was significantly better than the conventional method in enhancing students' achievement in intermediate science. Students recognise the positive impact of digital technology on their understanding and performance when it is effectively integrated into instruction. The study also revealed a gender balance in academic performance when students are taught with digital technology instruction.

Recommendations

Based on the findings of the study, the following suggestions are hereby made:

i. Male and female students should be given equal opportunity to use digital technology facilities in junior secondary schools.
ii. Teachers should integrate digital technology instruction into classroom instruction.
iii. Government should recruit qualified intermediate science teachers who are computer literate and also provide adequate digital technology facilities in schools.
iv. The curriculum planners should emphasise the importance of using digital technology instruction to teach intermediate science by the teachers of junior secondary school.

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Application of RUSLE Integrated with GIS and Remote Sensing Techniques to Assess Soil Erosion in Uyo and Its Environs in Akwa Ibom State, Nigeria

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Abstract

Soil erosion is a major environmental challenge that threatens sustainable land management, particularly in tropical regions where intense rainfall and human activities accelerate land degradation. This study assesses soil loss in Uyo and its environs, Akwa Ibom State, Nigeria, using an integrated Geographic Information Systems (GIS) and Remote Sensing (RS) approach based on the Revised Universal Soil Loss Equation (RUSLE). The study utilised both primary and secondary datasets, including 39 years (1986–2024) of monthly rainfall data from NASA, Landsat 8 Operational Land Imager (OLI) imagery, and a 30 m resolution ASTER Global Digital Elevation Model (GDEM). In addition, 50 soil samples were collected and analysed to estimate soil erodibility. The RUSLE model was implemented in ArcGIS 10.5 by integrating rainfall erosivity (R), soil erodibility (K), slope length and steepness (LS), cover-management (C), and conservation practice (P) factors. Results revealed that rainfall erosivity ranged from 667.75 to 943.86 MJ mm ha⁻¹ h⁻¹ yr⁻¹, with higher values in the southern part of the study area. Soil erodibility values varied between 0.039 and 0.078, while the LS factor showed higher values in areas of steep terrain. NDVI-based analysis indicated that sparsely vegetated areas are more

prone to erosion. The P factor was assumed to be 1, reflecting minimal conservation practices. Estimated annual soil loss ranged from 0 to 2694.39 tons/ha/yr, with a mean of 5.68 tons/ha/yr. High erosion risk zones were widespread, especially in areas with steep slopes and disturbed surfaces. These findings highlight the need for effective soil conservation and improved land-use planning in the study area.

Keywords: soil loss, GIS, remote sensing, RUSLE model

1.0 Introduction

Soil erosion remains one of the most critical environmental challenges affecting sustainable land management worldwide. It is a major form of land degradation that reduces soil fertility, decreases agricultural productivity, and contributes to sedimentation in rivers and reservoirs (FAO & ITPS, 2015). Globally, accelerated soil loss driven by anthropogenic activities such as deforestation, urban expansion, and intensive agriculture has significantly exceeded natural soil formation rates, particularly in developing countries (Pimentel & Burgess, 2013). In tropical regions, high rainfall intensity combined with fragile soils and improper land-use practices further exacerbates erosion processes.

In Nigeria, soil erosion constitutes a serious environmental and socio-economic problem, especially in the southern states where high precipitation and unconsolidated coastal plain sands increase susceptibility to runoff and gully formation (Igwe, 2005). The south-eastern and south-southern regions have experienced severe land degradation due to rapid urbanisation, poor drainage systems, and vegetation loss. Akwa Ibom State, characterised by a humid tropical climate and intense seasonal rainfall, is particularly susceptible to soil erosion hazards. Increasing population pressure and infrastructure development around Uyo have intensified land surface disturbances, making systematic soil loss assessment essential for effective planning and environmental protection.

Traditional methods of measuring soil erosion are often time-consuming, expensive, and spatially limited. However, the integration of Geographic Information Systems (GIS) and Remote Sensing (RS) techniques has significantly improved the accuracy and efficiency of soil erosion modelling. GIS provides a powerful platform for spatial data integration, analysis, and visualisation, while remote sensing offers reliable temporal and spatial datasets for monitoring land use/land cover dynamics (Wischmeier & Smith, 1978; Renard et al., 1997). Satellite imagery enables the derivation of critical

erosion parameters such as vegetation cover, slope gradient, rainfall intensity, and soil characteristics.

Among the various empirical models developed for estimating soil loss, the Revised Universal Soil Loss Equation (RUSLE) has been widely adopted due to its relative simplicity, adaptability, and compatibility with GIS environments (Renard et al., 1997). The RUSLE model estimates average annual soil loss by integrating rainfall erosivity (R), soil erodibility (K), slope length and steepness (LS), cover-management (C), and conservation practice (P) factors. When combined with spatial datasets derived from remote sensing and digital elevation models (DEMs), RUSLE provides a practical approach for erosion risk assessment at watershed and regional scales (Ganasri & Ramesh, 2016).

Despite the increasing application of GIS-based soil, erosion modelling globally, only a few studies have comprehensively quantified soil loss in Uyo and its environs using integrated geospatial techniques. Given the rapid urban growth and environmental changes occurring in the area, there is a need for spatially explicit erosion risk assessment to guide land-use planning, soil conservation strategies, and sustainable environmental management.

Therefore, this study aims to estimate soil loss using GIS and remote sensing techniques in Uyo and its environs, Akwa Ibom State, Nigeria. Specifically, the study seeks to derive RUSLE model parameters using geospatial datasets, map the spatial distribution of soil erosion risk, and identify areas requiring urgent conservation intervention. The findings will contribute to improved environmental decision-making and sustainable land resource management in the study area.

2.0 Study Area

Uyo and its environs are the study area. Akwa Ibom State is situated in the southern coastal region of Nigeria, with an estimated population of approximately five million people. Notably, it is recognised as the leading oil and gas-producing state in the country. The state shares its southern boundary with the Atlantic Ocean, along a coastline that stretches for about 129 kilometres, extending from Ikot Abasi in the west to Oron in the east. This expansive ocean frontage positions Akwa Ibom as a significant coastal zone in Nigeria, characterised by mangrove forests and sandy beaches. The study area encompasses eight local government areas within Akwa Ibom State surrounding Uyo.

Uyo Local Government Area (LGA) is the capital city of Akwa Ibom State. Uyo was the district headquarters during the colonial era and later upgraded to a Local Government area and the state capital in 1987. The United Nations Population Projection, which runs to 2035, projects that the current metro area population of Uyo in 2024 is 1,393,000, a 4.82% increase from 2023. The study area lies between latitudes 4° 40’ and 5° 20’ North of the Equator and longitudes 7° 40’ and 8° 10’ East of the Greenwich Meridian.

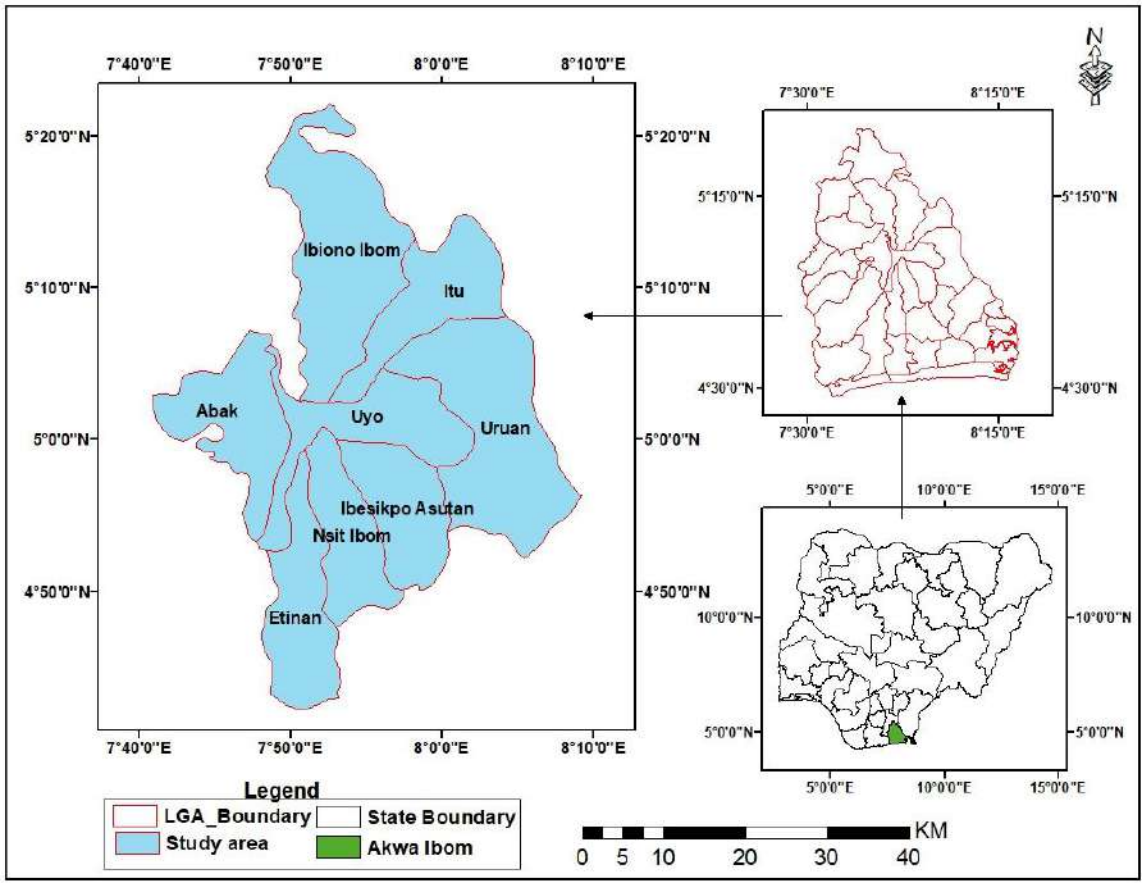


Figure 2.1. Map of study area

3.0 Data source

Primary data

Primary data sources include meteorological records of rainfall variation (monthly), which are compiled to provide annual rainfall data for the study area from the National

Aeronautics and Space Administration (NASA) repository. The soil samples were obtained from the field, and their GPS location is a sample of ground truth location for erodibility computation.

Rainfall Data

The rainfall data used were retrieved weather data with corresponding meteorological, temporal, and spatial features from the NASA repository (Power, 2022). The rainfall data used for this work were from 1986 to 2024, the monthly average data.

Secondary data

Multispectral Satellite Imagery

Optical multispectral imagery from Landsat was used for this study. The LANDSAT data were downloaded from USGS Earth Explorer, the United States Geological Survey (USGS) and the NASA Earth Observatory website. The Landsat satellite images used for this work were the Operational Land Imager (OLI) for 2024. The Landsat image scenes that covered the entire study area were path 188, rows 56 and 57. The image was of a 30m resolution. The data was used for the NDVI and C factor computation of the study area.

Digital Elevation Model

Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) Global Digital Elevation Model (GDEM) version 2, a product of METI and NASA, was used for this study with a 30m resolution. ASTER GDEM was generated using stereo-pair images collected by the ASTER instrument onboard Terra. ASTER GDEM coverage spans from 83 degrees north latitude to 83 degrees south, encompassing 99 percent of Earth's landmass.

4.0 Method

Soil loss plays a fundamental role in the initiation and expansion of gully erosion. When the protective topsoil layer is removed, often due to intense surface runoff, poor land management, or lack of vegetation, exposed subsoils become highly susceptible to concentrated water flow. This process sets the stage for gully development, especially in areas with steep slopes or easily erodable soil types. Excessive soil loss is not only a consequence but also a precondition that accelerates and sustains gully formation and expansion over time (Martins *et al.,* 2022).

The average annual soil loss of the study area has been determined using the Revised Universal Soil Loss Equation (RUSLE) in an ArcGIS environment. RUSLE is an empirical model that has been applied worldwide to estimate soil erosion loss by using five

input parameters. These five factors would be multiplied by applying the following empirical equation in ArcGIS 10.5 using the raster calculator. Mathematically, equation (1) is denoted as:

$A=R*K*LS*C*P$ ……(1)

Where;

A = annual soil loss (metric tons ha^{-1} yr^{-1}),
R = rainfall erosivity factor (MJ mm h^{-1} ha^{-1} yr^{-1}),
K = soil erodibility factor (metric tons ha^{-1} MJ^{-1} mm^{-1}),
LS = slope length and steepness factor (dimensionless)
C = land cover and management factor (dimensionless) and
P = conservation practice factor (dimensionless).
The soil loss was implemented using the method shown in Figure 1 below.

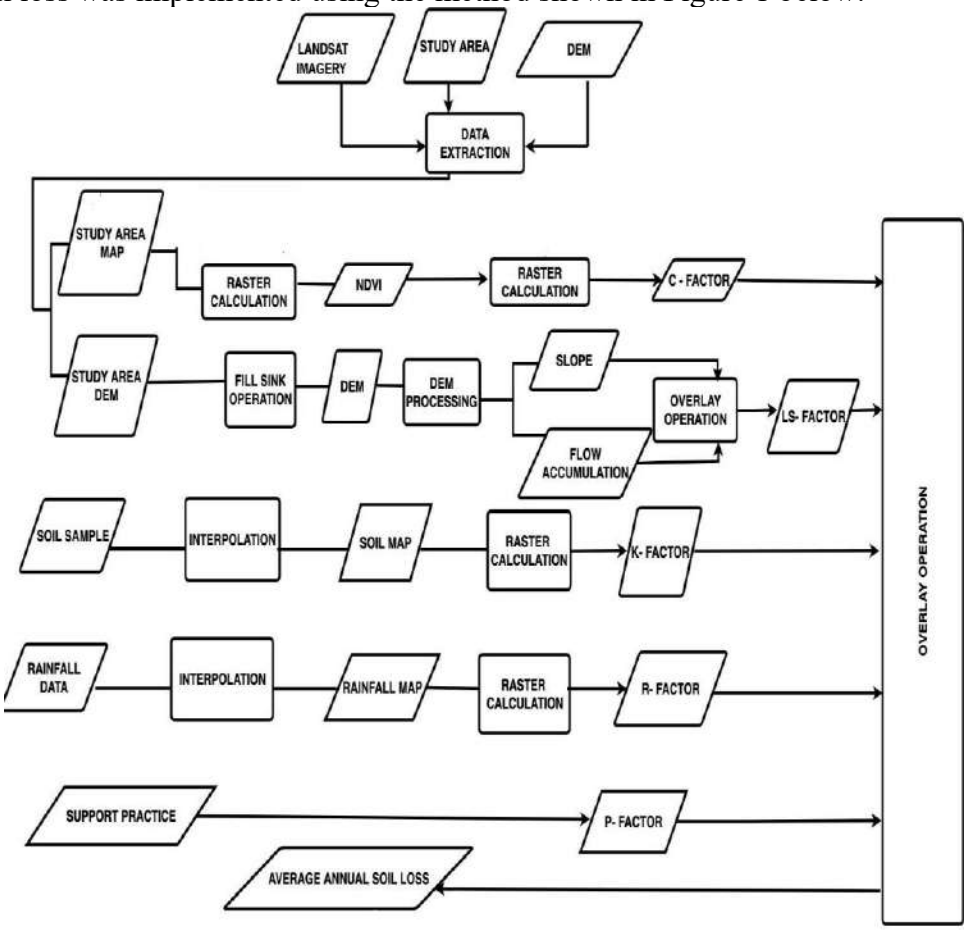


Figure 1: Flowchart methodology

Rainfall Erosivity Factor (R)

The ability of erosion agents to cause soil detachment and transport is called erosivity. This erosivity factor R was calculated based on 39 years of rainfall data recorded at six stations, which exist around the study area, using the equation developed by Wischmeier and Smith (1978).

$$R = \sum_{i=1}^{12} 1.735 \times 10^{(1.5log\frac{p_i^2}{p}0.8188)}$$

Where R is a rainfall erosivity factor (MJ mm ha^{-1} h^{-1} per year); Pi is the monthly rainfall (mm); P is an annual rainfall (mm). The mean annual rainfall (P) of the study area was first interpolated to generate continuous rainfall data for each grid cell, estimated using the 'Inverse Distance Weight' method of interpolation in ArcGIS 10.5. To compute the rainfall erosivity factor, the inputs used are point datasets, such as the locational coordinate of the rain gauge station and the rainfall erosivity value calculated using the equation above. ArcMap cannot read data in degrees-minutes-seconds (DMS), and therefore, these data were converted into decimal degrees (DD) before importing using the Add XY tool in ArcGIS 10.5 to generate the point map of the rainfall erosivity before interpolation using the IDW method to generate the continuous erosivity data raster cell.

The IDW spatial analyst tool in ArcGIS 10.5 takes the concept of spatial autocorrelation literally. It assumes that the nearer a sample point is to the cell whose value is to be estimated, the more closely the cell's value will resemble the sample point's value. In the process of interpolation, 39 years of rainfall data for 6 rain gauge stations were used.

Erodibility Factor (K)

The soil erodibility is a measure of the susceptibility of soil particles to detachment and transport by rainfall and runoff. The erodibility factor was computed from the soil sample analysis and calculation (Songu *et al.,* 2021). The soil sample collection approach employed in this work, was to ensure representative coverage of each geological unit, based on the premise that soil erosion rates vary depending on soil type and influencing factors. Additionally, the sampling aimed to achieve a broad spatial distribution across the study area. A systematic sampling strategy was designed in alignment with the Local Government Areas encompassed within the study boundaries. Sampling points were selected from various villages to ensure a well-distributed representation throughout the area.

A total of 50 soil samples were collected across the study area, comprising 25 main samples and 25 corresponding composite samples. This approach was adopted to enhance the accuracy of soil erodibility estimation across the region. At each sampling location, two soil samples were collected at different depths, 0–15 cm and 0–45 cm, using a soil auger. A GPS receiver was employed to record the exact coordinates of each sampling point. Additionally, village names, specific site identifiers, and the date of collection were documented to facilitate the creation of a comprehensive soil database for the study. The samples were immediately taken to the laboratory for air drying each day of field operation to maximise changes in the concentration of extractable nutrients and some organic constituents.

The erodibility factor was computed using the formula:

$$\mathbf{K} = \frac{2.8 \text{ x } 10^{-5} \times M^{1.14} \times (12 - a) + 0.43 \times (b - 2) + 3.3 \text{ x } (c - 3)}{100}$$

$$M = (\%\ silt + \%\ very\ fine\ sand) \times (100 - \%\ \text{clay})$$

where M is particle-size parameter, a is % of soil organic matter content, b is soil structure code (1 = very fine granular; 2 = fine granular; 3 = medium or coarse granular; 4 = blocky, platy, or massive), and c *is* profile permeability (saturated hydraulic conductivity) class [1 = rapid (150 mmh^{-1}); 2 = moderate to rapid (50–150 mmh^{-1}); 3 = moderate (12–50 mmh^{-1}); 4 = slow to moderate (5–15 mmh^{-1}); 5 = slow (1–5 mmh^{-1}); 6 = very slow (*<1 mmh* $^{-1}$)].

The erodibility factor (K): soil samples of the study area were interpolated to generate a continuous erodibility factor for each grid cell, estimated using the 'Inverse Distance Weight' method of interpolation in ArcGIS 10.5.

The effect of topography on soil erosion has been estimated by the slope length (L) and slope steepness (S). To get the topographic factor of the study area, it was implemented in four steps. (i) Generation of flow direction, (ii) flow accumulation, (iii) slope degree, and (iv) topographic factor generation using the formula.

The flow direction determines the direction of flow from every cell in the raster DEM. This was done with the Flow Direction tool in ArcGIS 10.5. This tool takes the fill DEM as input and outputs a raster showing the direction of flow out of each cell. If the output drop raster option is chosen, an output raster is created showing a ratio of the maximum change in elevation from each cell along the direction of flow to the path length

between centres of cells and is expressed in percentages. There are eight valid output directions relating to the eight adjacent cells into which flow could travel (Jenson & Domingue, 1988). To generate the flow accumulation, the flow direction was used as an input using the flow accumulation tool in the software. The flow accumulation creates a raster of accumulated flow into each cell. The slope degree raster was generated from the fill DEM as input using the slope tool in ArcGIS 10.5. To generate the topographic factor, the equation below was implemented using the raster calculator in ArcGIS 10.5.

LS = Power (Flow accumulation*cellsize / 22.1, 0.6)* Power (Sin (Slope*0.01745)/0.09, 1.3)

Cover Management Factor (C)

The cover management factor reflects the proportion of soil loss occurring under a specific type of vegetation compared to that on bare soil. It serves as an indicator of the extent to which a particular land cover protects the soil from erosion. The value of C depends on vegetation type, stage of growth, and cover percentage. The C factor was derived using the NDVI. The linear equation developed by Sulistyo (2016) was implemented with the raster calculator in ArcGIS 10.5.

C = 0.6 – 0.77 NDVI …… (2)

The C factor values vary between 0 and 1 based on the types of land cover.

Support Practice Factor

The support practice factor reflects the extent to which different agricultural practices influence the rate of soil loss. It evaluates the effectiveness of specific soil conservation methods, such as contour farming, strip cropping, and terracing, in reducing surface runoff and controlling soil loss (Amsalu and Mengaw, 2014). These practices play a critical role in mitigating erosion within cultivated landscapes. The P-value ranges from 0 to 1 depending on the soil management activities employed in the specific plot of land. These management activities are highly dependent on the slope of the area. The P-factor is calculated for agricultural land only, and for all other land use, it is assumed as 1. Because there are no control practice measures within the agricultural land in the study area, the P-factor value was assumed as 1.

Annual Soil Loss

The final soil loss magnitude was obtained by analysing five geo-environmental factors: the Rainfall-Runoff Erosivity factor (R), the Soil-Erodibility factor (K), the Slope length (L) and Slope Steepness (S), the Cover management factor (C), and the Support Practice factor (P). The annual soil loss of the study area was computed using the five-factor map: R, K, LS, C and P as input in ArcGIS 10.5. The raster maps were integrated using the raster calculator tool in ArcGIS 10.5 to generate the soil loss map of the estimated study area.

5.0 Results and Discussion

This study utilises the Revised Universal Soil Loss Equation (RUSLE) model, integrated within a Geographic Information System (GIS) and Remote Sensing (RS) framework. This approach enables a cell-by-cell quantification of the mean annual soil loss rate and maps erosion-prone areas across the study site. The derivation and analysis of the raster-based RUSLE parameters are detailed in the following sections below.

Rainfall Erosivity Factor (R)

The rainfall map and rainfall erosivity map of the study area are presented in Figures 2 and 3, respectively. It was observed that the highest rainfall occurred in the south-western part of the study area, Uyo and Etinan LGA of the study area, with erosivity value peaking at 943.86 MJ mm h^{-1} ha^{-1} yr^{-1} and declining toward the northern hinterland, reaching a minimum in Ibiono Ibom with an erosivity value of 667.75 MJ mm h^{-1} ha^{-1} yr^{-1}. This trend is consistent with coastal influence, which typically drives the heavy and erosive rainfall patterns observed in Figure 3 in the southern portion of the state.

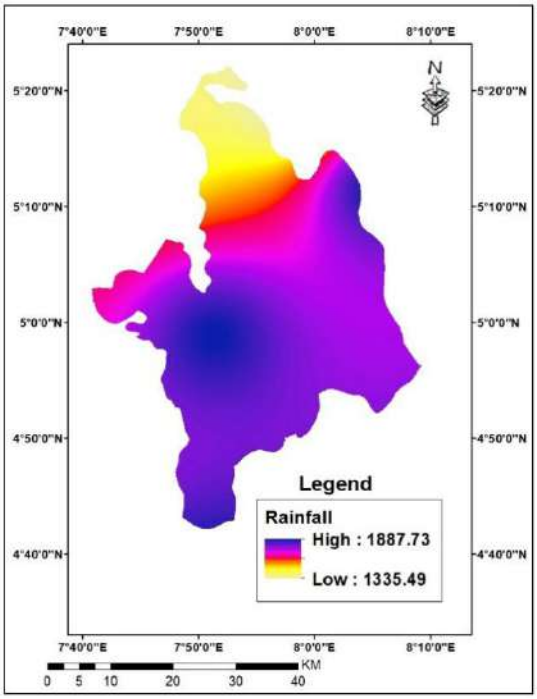


Figure 2: Rainfall map of the study area.

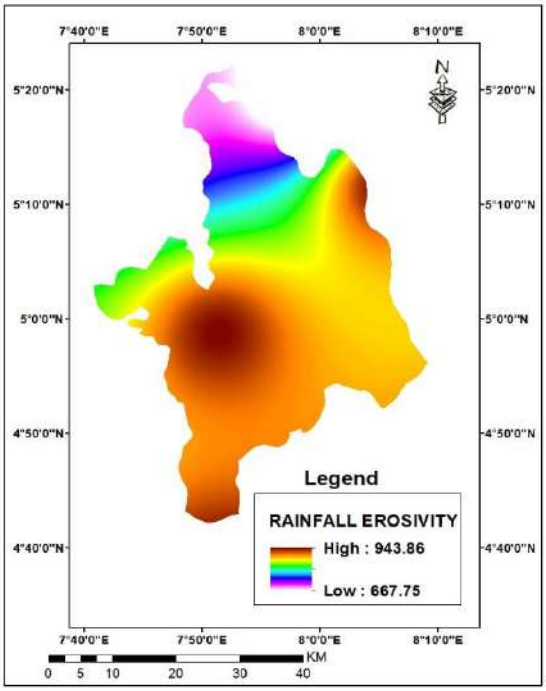


Figure 3: Rainfall erosivity map of the study area

Soil Erodibility Factor (K)

Soil erodibility refers to the degree to which soil is susceptible to erosion. The erodibility factor (K) was estimated based on soil texture, soil structure, organic matter content, and soil permeability. Several intrinsic soil properties were determined through laboratory analyses, including particle size analysis and aggregate size distribution. The calculated soil erodibility values ranged from 0.039, indicating low erodibility, to 0.078, representing high erodibility. Figure 4 shows the erodibility factor of the study area.

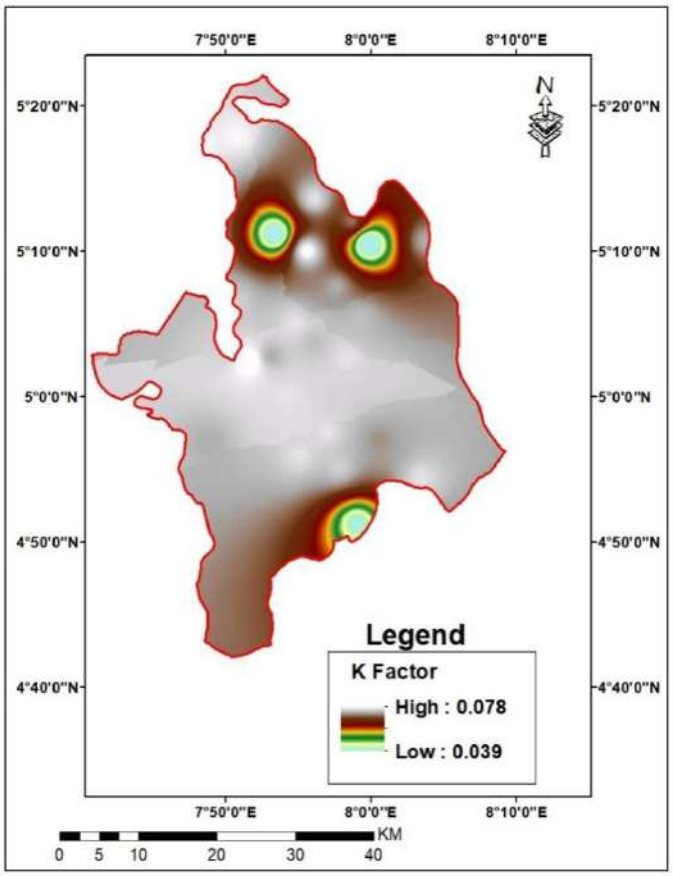


Figure 4: Soil erodibility of the study area

Topographic Factor (LS)

Topographic factors represent the effect of slope length and slope steepness on erosion under given conditions. Most of the study areas had low LS factor values, whereas very few locations had high LS factor values. The LS factor values range from 0 to 1094.68. The high values may be due to highly dissected terrain with abrupt slope changes in a few locations of the study area. The higher LS factor values were scattered and observed in hilly and gully areas with steep topography, and these areas are more prone to erosion and soil loss. The fact remains that Akwa Ibom State is relatively flat with undulating terrain in a few regions of the state, including Itu, Ibiono Ibom and part of Uyo LGA. Areas with a high degree of steepness were observed to experience soil loss even with slight and moderate amounts of rainfall and soil disturbance. High values of slope steepness were

observed in Itu, Ibiono Ibom and Uyo Local Government Areas of Akwa Ibom State.

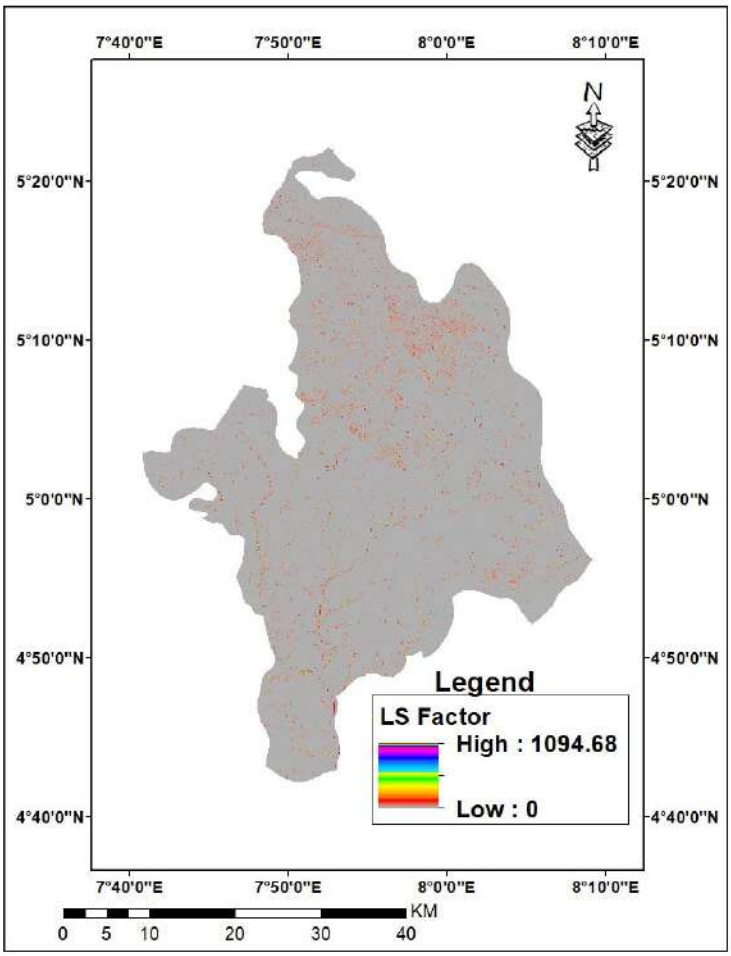


Figure 5: Topographic factor of the study area

Cover Management Factor (C)

The cover management (C) factor values were derived from the normalised difference vegetation index as shown in Figure 6 below. The NDVI shows the level of presence of vegetative cover around the study area. A high C factor indicates no cover effect and, as such, a high erosion probability due to the high vulnerability of the soil surface to erosive forces, as shown in Figure 7 below. Lower C factor values indicate a good vegetation cover effect with negligible erosion, hence little or no soil loss. In the study area, bare surfaces

with very low NDVI values were seen to be highly prone to erosion, whereas the forested areas with high NDVI values were less prone to soil loss.

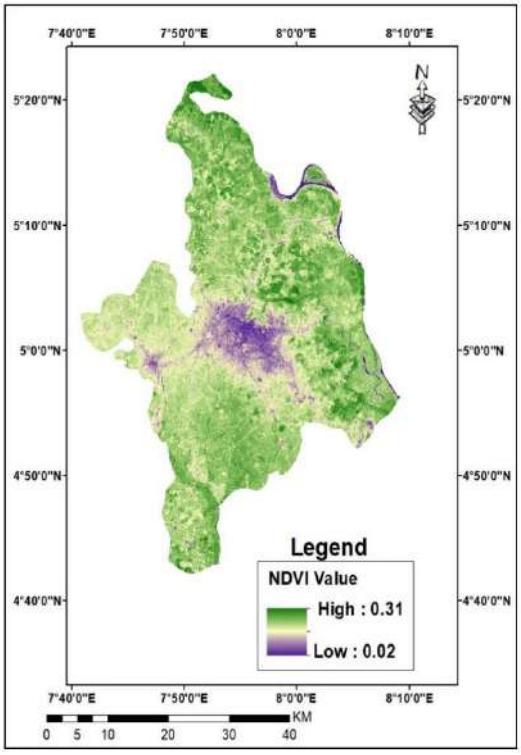


Figure 6: NDVI map of the study area

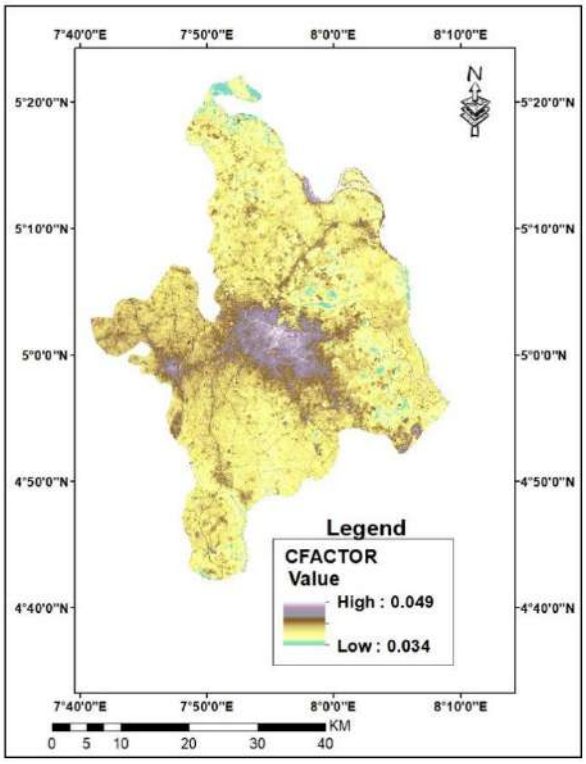


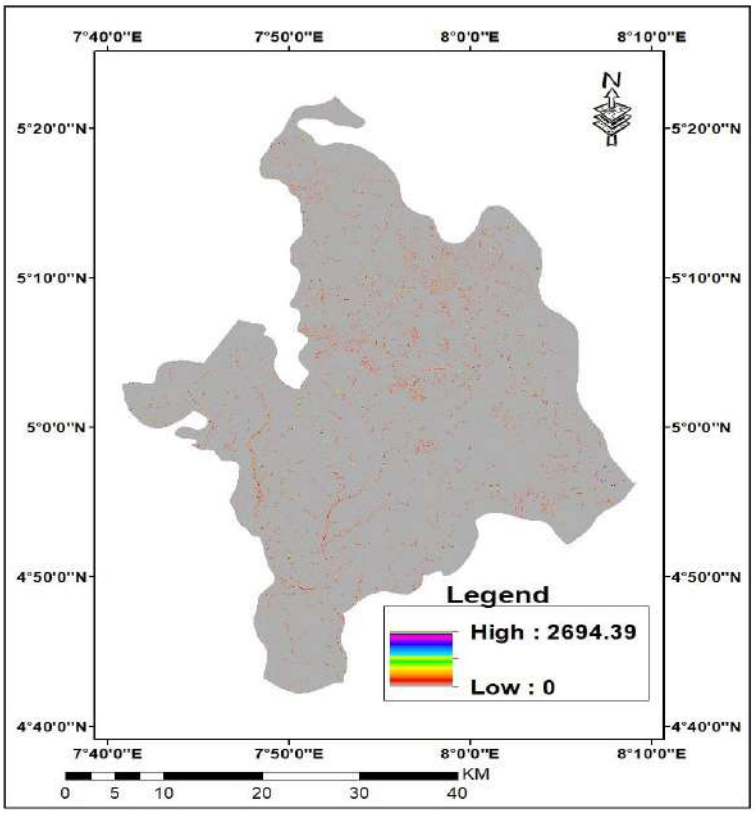
Figure 7: Cover management factor of the study area

Conservation Practice Factor (P)

The conservation practice factor represents the index of erosion control based on erosion control practices. The conservation practice factor value ranges from 0 to 1, with a value of 1 indicating no conservation practice in place. During the site inspection and ground truthing exercise, it was observed that there was really no practical effort to control soil erosion in almost all parts of the study area. A large portion of the study area was built up, farmland and forested land, and had no support or erosion control practices, giving it a support practice factor of 1.0.

Annual Soil Loss (A)

The annual soil loss from the RUSLE model. The RUSLE sub-factors (R, K, LS, C and P factors) were integrated into the equation by multiplying them together in a GIS environment to obtain the average annual soil loss A within the study area. Estimated soil loss rates ranged from 0 (zero) to 2694.39 tonnes/ha/yr, and the average soil loss rate was estimated at 5.68 tonnes/ha/yr. The results obtained from the analysis indicated that high and extreme sections of erosion vulnerability were scattered all over the entire study area, and every part of the study area had some level of erosion severity. The higher values of soil erosion were found to occur on abrupt slopes. Those regions with higher slopes were also affected by rills, gullies and ravines, as well as mass movement of sediments, which were clearly visible during field surveys. Rill erosion, gully erosion and mass transportation of sediments around those regions are a common phenomenon due to the fragile geomorphology of the region and land use practices.



6.0 Conclusion

Environmental and anthropogenic factors have contributed maximally to soil erosion within the study area. Rainfall, topography, soil type, and land use/land cover were the major factors responsible for severe soil loss in the area. Topography adversely affected soil loss in the north and northeast of the study area. Areas with steep slopes and rugged topography were prone to heavy soil loss. The result of rainfall analysis in the study area showed that rainfall was high in Uyo and Etinan LGAs with high erosivity values. The study area has a rainfall pattern that increases southward. The result of this research will play a vital role in policy and decision-making and will help planners in taking measures toward the management of soil erosion hazards.

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Mathematical Creativity and Students' Academic Performance in Secondary Schools in Oruk Anam Local Government Area, Akwa Ibom State

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Abstract

This study investigated "Mathematical Creativity and Students' Academic Performance in Secondary Schools in Oruk Anam Local Government Area, Akwa Ibom State". Two research questions and two null hypotheses were formulated to guide the study. A correlational survey design was adopted. The sample size for the study was 120 students through a purposive sampling technique. The Mathematical Creativity Questionnaire (MCQ) was the validated instrument used for data collection with a reliability coefficient of 0.97. Analysis of data for the study was done using the correlation and regression statistical tool to answer research questions as well as testing of the hypotheses. Findings from the study revealed that mathematical creativity has a significant relationship with the academic performance of students and enhances creative thinking among secondary school students. Based on the findings, it is recommended, among others, that the government ensure that science teachers undergo standard training and creativity tests to make them skilled and qualified teachers in order to meet its educational objectives; stakeholders in education should motivate mathematical teachers to teach the subject effectively to arouse creativity and scientific consciousness in the students. Secondary schools in Akwa Ibom State should be provided with necessary learning aids such as standard slides, well-equipped libraries, a mathematical creativity aptitude box, among others, to enhance teachers' and students' involvement in learning. This will help foster students' mathematical creativity in mathematics.

Keywords: Mathematics, Creativity, Mathematics Creativity, Problem-Solving and Academic Performance

Background of the Study

In recognition of its roles as major machinery behind any nation's advancement in science and technology and its immense contributions towards individual capacity building, mathematics has unavoidably registered itself in the school curriculum right from the primary up to the tertiary level of the education system in Nigeria. No wonder mathematics is a major requirement for securing admission into higher institutions of learning as well as a "scale" used in testing people's level of intelligence before offering them jobs in the country (Adeniji, 2019).

Mathematics is a compulsory subject at the secondary school level because of its utility in society. The subject matter of mathematics cuts across every discipline to a varied degree. Onwudire (2015) posited that everybody, as well as every nation, needs the presence of mathematics for development. Given that mathematics is very important for personal, organisational and societal development, it has been globally observed that the content of general or ordinary mathematics is not sufficient for some higher courses in the tertiary institution; hence, the emergence of further mathematics as a school subject. The Nigerian society keyed into this global trend and advocated that further mathematics should be included as one of the senior secondary school subjects. Participation of students in further mathematics is expected to increase undergraduate students' participation in courses such as the sciences, engineering, mathematics and technology (Lyakhova and Neate, 2018).

Mathematics is a science that deals with the logic of space, quantity and arrangement (Kosmas 2004). It takes a central position in science and technology. The objectives of the mathematics curriculum at the senior secondary school level include knowing and demonstrating understanding of the concepts from the five branches of mathematics (number, algebra, geometry, trigonometry and discrete mathematics). Therefore, mathematics is to develop both the individual and the entire society. It is a necessary prerequisite and integral part of such professions as chartered accountant, data analyst, data scientist, investment analyst, and research scientist, to mention but a few.

Mathematics is the precursor of science and technology and an indispensable single element in modern societal development. This suggests that there could be no real development technologically without a corresponding development in mathematics, both as conceived and practised. As it is rightly observed in Kyari (2018), no nation can make any meaningful progress in this information technology age, particularly in economic development, whose foundation is science and mathematics. Mathematics is the science of measurement, quantity and magnitude. It is also referred to as the abstract science which

investigates deductively the conclusions implicit in the elementary conceptions of spatial and numerical relations. It is also defined as the science of number and space. Mathematics is also called the science of logical reasoning. Locke had said, "Mathematics is a way to settle in the mind a habit of reasoning." Here the results are developed through a process of reasoning. The reasoning in mathematics is of a peculiar kind and possesses a number of characteristics such as simplicity, accuracy, certainty of result, originality and verification.

Mathematical problem-solving is considered one of the many endpoints in teaching mathematics to students. This study looked into the performance in mathematics problem-solving among fourth-year students of Central Mindanao University Laboratory High School and their relationship with students' attitudes towards mathematics. The attitudes measured were attitude towards success in mathematics, mother's mathematics attitude, father's mathematics attitude, motivation, usefulness of mathematics, teacher's mathematics attitude, confidence in learning mathematics, and mathematics anxiety (Dennis, 2018).

Mathematics education is required to meet up with the increase in demand for science and technology by private and government establishments. Without effective mathematics education, the nation will likely become impoverished. This is because the natural resources which abound in Nigeria need to be harnessed, processed and converted to needed products for optimum use (Aduwa 2010). Mathematics education in Nigeria has received attention over the last 50 years. During this period a lot of reforms have taken place in the mathematics education curriculum. To make a breakthrough in science and technology education, this will depend quite well on the level of our mathematics development and achievement in the country. Issues to address in achieving this breakthrough include weakness in current mathematics teachers, curriculum reforms, mathematics teachers' availability and competence, gender and stigmatisation in mathematics, learner interest, funding and performance assessment and evaluation. With mathematics education as the springboard for any meaningful development in science and technology, any reforms taking place in education must focus on the mathematics education unit with lots of concern to address most of the bottlenecks in this presentation. Steven, Akwana & Maaji (2018).

However, as important as mathematics is, science educators have been lamenting over the poor performance and interest of students in the subject in the secondary schools for the past decades (Nzekwe 2018). Students' poor performance and interest in mathematics for quite a long time now have resulted in an inadequate number of students

offering mathematics-orientated courses in tertiary institutions in Nigeria. The persistent poor performance has also contributed to a poor economy, poor industrialisation, lack of jobs and starvation, to mention but a few. Professionals required to take care of those problems can only be effectively produced through mathematics education. Many factors have been attributed to the observed poor performance and lack of interest in mathematics by students. This has called for a boost in mathematical creativity and thereby improves students' academic performance in secondary schools.

Creativity is traditionally supposed to be attributed to art and literature, but nowadays doing meaningful science has also been considered a creative act. In areas of art and literature, it is generally enough to create an extraordinary and novel work, but a creative scientific idea needs not only to be novel but also useful (Neumann, 2007). Technological advances in today's society have been owed to the creativity of scientists and mathematicians. The critical role of these creative mathematicians, who have been able to create new mathematical insights and ideas, is so apparent that there is no need to be emphasised. However, the study of processes of their creative thinking is valuable. Creativity involves "the openness to ideas and the willingness to encourage the exploration of the unknown, even if not easily manageable".

Creativity in education has been viewed since the late 1990s as globally relevant in ways never seen before Craft (2005). Once thought of only as an artistic quality, creativity has become sought after by engineers, executives, and researchers. Anastasia and Anwar, cited in Anwar, Aness, Khizar, Naseer and Muhammad (2012), quoted Albert Einstein as saying, “We can't solve problems by using the same kind of thinking we used when we created them.” Creative thinking has been categorised as something we are born with, but others have said that it can be developed through activities and teaching strategies. Creative thinking is a way of generating ideas that can in some way be applied to the world. This often involves problem-solving utilising particular aspects of intelligence, for example, linguistic, mathematical and interpersonal (Anwar et al., 2012).

Creative thinking involves creating something new or original. It involves the skills of flexibility, originality, fluency, imagery, associative thinking, attribute listing, metaphorical thinking and forced relationships. The aim of creative thinking is to stimulate curiosity and promote divergence. Gough (1991), cited in Anwar et al. (2012), said, “Perhaps most importantly in today's information age, thinking skills are viewed as crucial for educated persons to cope with a rapidly changing world. Many educators believe that specific knowledge will not be as important to tomorrow's workers and citizens as the ability to learn and make sense of new information.” Creative thinking is a novel way of

seeing and doing things that is characterised by four components: fluency (generating ideas), flexibility (shifting perspectives easily), originality (consisting of something new), and elaboration (building on existing ideas).

Mathematical creativity is often considered the exclusive domain of professional mathematicians (Sriraman, 2005). The French mathematician Henri Poincaré believed that discovery in mathematics is a combination of ideas and stated that there are a lot of these combinations, but a few of them are useful. In the process of finding these useful combinations, a great number of combinations are constructed, and then meaningful combinations are distinguished from meaningless ones. In other words, creating could be defined as forming, recognising and choosing important and useful combinations. Also, Boden (2004) states that combining familiar ideas in unfamiliar manners can also be considered a creative work.

Rather similar to these, Ervynck asserts that creating useful mathematical concepts through combining previously known concepts or discovering unknown relations between mathematical facts can be considered as a creative act of doing mathematics. Also, he emphasises that creativity in mathematics plays a key role in the full cycle of advanced mathematical thinking, which helps plausible conjectures to be made in order to develop mathematical theories and generates new mathematical knowledge. Chamberlin and Moon (2005) consider divergent thinking as one of the prevalent descriptors of mathematical creativity. Laycock described mathematical creativity as an ability to analyse a given problem from different perspectives, see patterns, differences and similarities, generate multiple ideas and choose a proper method to deal with unfamiliar mathematical situations (Idris & Nor, 2010).

At the school levels, mathematical creativity is seen as the process that results in unusual (novel) and/or insightful solution(s) to a given problem or analogous problems and/or the formulation of new questions and/or possibilities that allow an old problem to be regarded from a new angle. According to Sriraman's definition, at the school levels, some researchers believe that creativity in mathematics is generally associated with problem-solving or problem-posing (e.g., Chamberlin & Moon, 2005).

Colom and Lyno in Chinelo (2020) saw gender as the range of physical, biological, mental and behavioural characteristics pertaining to and differentiating between masculinity and femininity populations. The importance of examining achievement in relation to gender is primarily based on the socio-cultural differences between girls and boys. Some trades such as the weaker sex; as such, they are expected to handle the relatively easy and less demanding tasks while the complex tasks are allocated to boys.

Also, certain science subjects, such as physics and mathematics, are regarded as male enterprises, while females tilt to areas like biology. It is noted that the issue of gender is an important one in science education, with increasing emphasis on ways of boosting manpower for technological development as well as increasing the population of females in science and technology fields. Gender has been identified as one of the factors influencing students' achievement in the sciences at the senior secondary school level (Ekenem 2011).

Problem-solving is the process of analysing a problem and resolving it in the best way possible for that situation. This process contains analysing the problem (root cause analysis), defining countermeasures for the problem and implementing the right solution for that situation. For problem-solving, people need critical thinking and analytical skills. Everybody within an organisation or company can benefit from having good skills because there are always problems. There have been lots of scientific and practical studies from a learning point of view. Some of the techniques developed and used in artificial intelligence (AI), computer science, engineering, mathematics, or medicine are related to mental techniques studied in psychology (Kousar, 2022).

Gender is a psychological term and a cultural constant developed by society to differentiate between the roles, behaviour, mental and emotional attributes of males and females (Chinelo, 2019). Iwendi (2009) reported that male students performed better than their female counterparts in science and mathematics concepts. The non-significant gender-related difference in performance could be attributed to the fact that both participated actively in the learning process, thus helping them to acquire meaningful learning. Hypothesis. For instance, Eccles and Wang (2015) emphasised that females express less interest in mathematics than their male peers. Gender is an analytic concept that describes sociological roles, cultural responsibilities and expectations of men and women in a given society or cultural setting (Chinelo, 2019). It describes the personality traits, attributes, behaviour, values, relative power, influence, roles and expectations (femininity and masculinity) that society ascribes to the two sexes on a differential basis (Ezeh, 2013).

The work, therefore, intended to investigate the effect of mathematics creativity and students' academic performance and interest in mathematics in secondary schools. The study therefore intended to ascertain the effectiveness of mathematical creativity on students' academic performance among secondary school students in Oruk Anam Local Government Area of Akwa Ibom State, Nigeria, when taught mathematics using creative learning and teaching strategies.

Statement of the Problem

In Nigeria, mathematics is a compulsory subject up to the secondary school level. During the last couple of years, students' performance in mathematics had fallen below average. For instance, in 2023 the WAEC private candidates' results report showed that 44.95% passed Mathematics between A1 and C6. Recent findings indicate that the level of mathematics academic performance has remained persistently low. The National Examination Council (NECO) reports have continued to raise concern over the poor performance in secondary schools.

The student's poor academic performance and interest in mathematics are alarming in spite of the fact that much research has been carried out to ameliorate the poor situation. Many instructional approaches have been proffered by psychologists like Brunner, Piaget, and Gagné for improved performance and interest in mathematics and other science subjects. They strongly believed that the instructional approach adopted by mathematics teachers in teaching mathematics is to a large extent responsible for the observed consistent poor performance and interest in mathematics.

This study therefore intends to ascertain the effectiveness of mathematics creativity on students' academic performance in mathematics among secondary school students in Oruk Anam Local Government Area of Akwa Ibom State, Nigeria, when taught mathematics using creative learning and teaching strategies.

Purpose of the Study

The main purpose of this study is to examine mathematical creativity and students' academic performance in mathematics among secondary school students in Oruk Anam Local Government Area. Specifically, the study seeks to

i. Examine the relationship between mathematical creativity and students' academic performance among secondary school students in Oruk Anam Local Government Area.
ii. Examine the relationship between gender, mathematical creativity and students' academic performance among secondary school students in Oruk Anam Local Government Area.

Research Questions: The following questions were formulated for the study.

i. What is the relationship between mathematical creativity and academic performance among secondary school students in Oruk Anam Local Government Area?

ii. What is the relationship between gender, mathematical creativity and academic performance among secondary school students in Oruk Anam Local Government Area?

Research Hypotheses: The current study investigated the effects of mathematical creativity and students' academic performance among secondary school students in Oruk Anam Local Government Area of Akwa Ibom State, Nigeria. The study was guided by the following hypothesis:

H_{01}: There is no significant relationship between mathematical creativity and students' academic performance in secondary schools in Oruk Anam Local Government Area of Akwa Ibom State.

H_{02}: There is no significant relationship between gender, mathematics creativity and students' academic performance in secondary schools in Oruk Anam Local Government Area of Akwa Ibom State.

Significance of the Study

For students, it will provide peer groups with suggestions and feedback about what they should think and how they should solve mathematics problems in diverse ways other than the known traditional methods. Parents, it will enable parents to play a large role in how students function in everyday activities. Teachers, it is vital for education-related professionals to understand the need for mathematical creativity in order to influence negative attitudes towards the academic performance of students in mathematics. Teachers can grow and develop to acquire new knowledge, skills and attitudes which, in turn, promote or improve their teaching performance at different stages of their careers and tackle the students' negative traits within and outside the mathematics classroom. State Secondary Education Board (SSEB)/Ministry of Education; it will help the Ministry of Education to plan for the improvement in the educational sector in implementing the Education Development Blueprint. It means that the good integration between the government's efforts and teachers' commitment will lead to the achievement of the educational goal. School administrators, this study also will give advantages to all schools, especially administrators, where they can have a clear view on the education development blueprint and what the best approach is to be practised in order to achieve the desired goals. Finally, this study will enable the researcher to focus on the topic for further research.

Delimitations of the Study

There are many features of mathematical creativity, but this research is delimited to the investigation of the relationship between originality, flexibility, creative thinking and fluency in mathematical creativity and students' academic performance in secondary schools in Oruk Anam Local Government Area of Akwa Ibom State. This study is carried out in five public secondary schools in Oruk Anam Local Government Area to explore the relationship between mathematical creativity and students' academic performance in secondary schools. This research investigated the perception of the causes of poor performance in mathematics and students' creativity in solving mathematical problems.

Limitations of the study: This study is limited by financial constraints, urban migration, poor mathematical creativity and students' academic performance in secondary schools. This research investigated the perception of the causes of poor performance in mathematics and students' creativity in solving mathematical problems.

Definition of terms

Mathematics: Mathematics is the science of structure, order, logical reasoning and quantitative calculation and relation that has evolved from elemental practices of counting, measuring and describing the shapes of objects.

Creativity: Creativity is the ability to transcend traditional ways of thinking or acting and to develop new and original ideas, methods or objects. Creativity is a pattern of thinking and the capacity to accept challenges. Creativity is an ability that allows people to develop new ideas, but that still feels a bit vague and intangible. It is a skill that allows you to draw understanding of the world around you, connect those observations to your existing knowledge reservoirs, and imagine new applications of your knowledge in the world.

Mathematical Creativity: Mathematical creativity is an ability to analyse a given problem from different perspectives, see patterns, differences and similarities, generate multiple ideas and choose a proper method to deal with unfamiliar mathematical situations (Idris & Nor, 2010).

Problem Solving: Problem solving is the act of defining a problem, determining the cause of the problem, identifying, prioritising, and selecting alternatives for a solution, and implementing a solution.

Academic performance: This refers to cognitive ability as measured by tests, assignments and examinations which are used to determine their success or failure in school.

Methodology

The study adopted a correlational survey research design to examine the relationship between mathematical creativity and students' academic performance in mathematics. The design was considered appropriate because the researcher employed both quantitative questionnaire data and students' mathematics performance records from the previous academic session in gathering the required information. The population of the study consisted of all the fourteen public secondary schools with a total population of 17,890 students in the study area, according to records obtained from the State Secondary Education Board in 2013. A sample of students was selected from four public secondary schools using purposive random sampling techniques to ensure that the selected participants were relevant to the objectives of the study.

The instruments used for data collection were the Mathematical Creativity Questionnaire (MCQ) and students' previous academic performance results in mathematics examinations. The questionnaire was designed to measure the various dimensions of mathematical creativity, including originality, flexibility, fluency, divergent thinking, and elaboration. To ensure the validity of the instrument, the questionnaire was submitted to the researcher's supervisor in the Department of Science Education, Faculty of Education, University of Uyo, for expert scrutiny and validation. All corrections and suggestions provided were incorporated before the final administration of the instrument. The reliability of the instrument was established using Cronbach's alpha, which yielded a reliability coefficient of 0.97, indicating that the instrument was highly reliable for the study. The questionnaire consisted of multiple-choice items with four response options: Strongly Agree (SA), Agree (A), Disagree (D), and Strongly Disagree (SD), which were scored 4, 3, 2, and 1, respectively.

The researcher personally visited the selected schools after obtaining permission from the principals and was introduced to the mathematics teachers for assistance during the data collection process. The Mathematical Creativity Questionnaire (MCQ) was administered to the students under the supervision of some teachers, while all completed copies of the instrument were retrieved immediately to avoid loss of data. In addition, students' academic performance records from previous mathematics examinations were collected to assess their level of mathematical creativity and achievement. The data obtained from the study were analysed using correlation and multiple regression statistical

techniques at the 0.05 level of significance to determine the relationship between mathematical creativity and students' academic performance in mathematics.

Results and Discussion

Results

Research Question 1: What is the relationship between Mathematical Creativity and Academic performance among Secondary Schools Students in Oruk Anam Local Government Area?

Table 1: Correlation: Relationship between Students' Mathematics Creativity and Academic Performance

		AC_SCORES	CREATIVITY
AC_SCORES	Pearson Correlation	1	.456**
	Sig. (2-tailed)		.003
	N	40	40
CREATIVITY	Pearson Correlation	.456**	1
	Sig. (2-tailed)	.003	
	N	40	40

From Table 1 above, it shows that mathematical creativity has a positive correlation of 0.456 with students' academic achievement. Thus, it is empirically established that mathematical creativity apparently has a positive relationship with students' academic performance. This answered the research question that mathematical creativity has a positive relationship with the academic performance of students in Oruk Anam Local Government Area of Akwa Ibom State.

Research Hypothesis 1: There is no significant relationship between Mathematical Creativity and Students' Academic Performance in Secondary Schools in Oruk Anam Local Government Area of Akwa Ibom State.

Table 2: Analysis of Scores of Mathematical Creativity.

Variables	N	Mean	SD	r	r-cal	r-crit	Decision
Mathematical Creativity	40	2.79	0.36				
				0.45	7.93	0.3044	Rejected
Academic Performance	40	51.35	12.82				

Table 2 above explains that mathematical creativity has an r-cal of 7.93, which is greater than the r-critical of 0.3044. Hence, it is empirically established that students' mathematical creativity has a positive relationship with academic performance. From the above, the calculated r-cal of 7.93 is greater than the r-value critical of 0.3044 at alpha = 0.05 and df = 38. This means that there is a significant relationship between mathematical creativity and students' academic performance in secondary schools. Thus, the null hypothesis is rejected because there is a positive significant relationship between mathematical creativity and academic performance of students in mathematics in Oruk Anam Local Government Area of Akwa Ibom State.

Research Question 2: What is the relationship between Gender and Mathematical Creativity on Students' Academic performance in Secondary Schools Students mathematics in Oruk Anam Local Government Area?

Table 3: Model Summary: Gender and Mathematical Creativity on Students' Academic Performance

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.467[a]	.218	.175	11.64494

a. Predictors: (Constant), GENDER, CREATIVITY

From table 3 above, it shows gender and mathematical creativity are predictors of students' academic performance. This shows that gender and mathematical creativity have a positive correlation of 0.467 with students' academic achievement. With this, it is empirically established that gender and mathematical creativity jointly accounted for 21.8% of the variation in students' academic performance. This answered the research question: Do gender and mathematical creativity have a positive relationship with students' academic performance among secondary school mathematics students in Oruk Anam Local Government Area?

Research Hypothesis 2: There is no significant relationship between Gender and Mathematical Creativity on Students' Academic performance in Secondary Schools Mathematics in Oruk Anam Local Government Area of Akwa Ibom State.

ANOVA[a]: Gender and Mathematical Creativity on Academic Performance

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1395.733	2	697.866	5.146	.011[b]
	Residual	5017.367	37	135.605		
	Total	6413.100	39			

a. Dependent Variable: AC_SCORES
b. Predictors: (Constant), GENDER, CREATIVITY

Table 4 above shows that gender and mathematical creativity predict students' academic performance. This follows that the calculated F-value of 5.15 has a significant relationship of 0.011 at $p < 0.05$. This implies that there is a significant relationship between gender and mathematical creativity in students' academic performance in secondary schools. Thus, the null hypothesis is rejected. This means that gender and mathematical creativity predict students' academic performance in secondary schools' mathematics.

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Discussion of Results

This study examines the relationship between mathematical creativity and students' academic performance in secondary school mathematics students and the relationship between gender and mathematical creativity on students' academic performance in secondary school mathematics students in Oruk Anam Local Government Area of Akwa Ibom State. The findings made in this study are discussed below.

There is a significant relationship between mathematical creativity and students' academic performance in secondary schools in a mathematical creativity test conducted on secondary school students in Oruk Anam Local Government Area of Akwa Ibom State. This implies that there is a significant relationship between mathematical creativity and students' academic performance in secondary schools. This is in line with the view of Onwudire (2015), Ebenezer (2019), Adeyemo (2010), and Bhatt (2014), who reported that mathematical creativity has a significant relationship with the academic performance of students and it enhances creative thinking among secondary school students.

There is a significant relationship between gender, mathematical creativity and students' academic performance in secondary schools. This implies that male students have higher mathematical creativity than the female students at the same mathematical creativity test; that is, they perform better and faster than their female counterparts.

Hence, it is concluded that gender and mathematical creativity are predictors of secondary school mathematics students' academic performance. This view was also shared by Ebenezer (2019), Kousar (2010) and Hyde (2008), who reported that gender and mathematical creativity have a significant relationship with the academic performance of students and that it enhances creative thinking among secondary school students.

Summary of Findings

The aim of this study was to examine the relationship between mathematics creativity and students' academic performance in secondary school mathematics students and the relationship between gender and mathematical creativity on students' academic performance in mathematics among secondary school students in Oruk Anam Local Government Area of Akwa Ibom State. To achieve this aim, students were given freedom of choice to express their creative ability using a questionnaire which covers all the components of mathematics creativity.

The students' academic performance was compared using different statistical measures. It was discovered that students with mathematical creativity achieved significantly better and faster in problem-solving and creative thinking. This could be attributed to the mathematics creativity adopted by the teacher and students in the classroom. At first, students found divergent thinking and originality boring and time-consuming but later imbibed them in solving critical problems and also boosted their thinking ability even in everyday life. The null hypotheses were formulated to guide the study. The hypotheses were later rejected since it was found out that there is a significant relationship between mathematics creativity and students' academic performance of mathematics students, which were the variables considered. These findings agree with those of Oribhabor (2020), Ebenezer (2019), Kousar (2010) and Hyde (2008), who reported that mathematics creativity has a significant relationship with the academic performance of students and it enhances creative thinking among secondary school students. Also, it is reported that gender and mathematical creativity have a significant relationship with the academic performance of students, and it enhances creative thinking among secondary school students.

SUMMARY, CONCLUSION AND RECOMMENDATIONS

Summary: This study examines the relationship between mathematical creativity and students' academic performance in secondary school mathematics students and the relationship between gender and mathematical creativity on students' academic

performance in mathematics among secondary school students in Oruk Anam Local Government Area of Akwa Ibom State. The sample comprised 120 mathematics students, forming about 7% of the research population, randomly drawn from 4 secondary schools in Oruk Anam Local Government Area. A 20-item multi-scale instrument (Mathematical Creativity Questionnaire) was drawn, with a reliability of 0.97, which was used to collect relevant data, which were analysed using correlation and regression statistical analysis at the 0.05 level of significance. The results obtained were presented and discussed in chapter four. From the findings, it was discovered that mathematical creativity has a significant relationship with the academic performance of students, and it enhances creative thinking among secondary school students. Hence, teachers should help the students think outside the box by asking the critical questions and incorporate suitable activities into their lessons.

Conclusion

Based on the findings of this study, it is here concluded that mathematical creativity has a significant relationship with the academic performance of students, and it enhances creative thinking among secondary school students. This should be adopted by teachers who are expected to bring out the creative ability from the students by helping them think creatively, thus building a nation of creative thinkers and problem solvers among secondary school students.

Implications of the Findings

i. Developing problem-solving ability necessitates effective teaching and learning of mathematics and scientific concepts.
ii. Students with mathematical creativity perform better and faster in any learned concepts and everyday life situations.
iii. Mathematical creativity is most effective in terms of brainstorming, role-playing, questioning, think-pair-share, self-reflection, learning games and visual simulations but appears to be more advanced and time-consuming at first to the students and thereafter ensures creative problem solvers.

Recommendations: Based on the findings and conclusions reached in this study, the following recommendations are made.

i. Teaching and learning of mathematical concepts and science in general should be brainstorming, role-playing, and question-filling in such a way that students can learn effectively and retain the concepts presented to them. Mathematical creativity seems

to be relevant in achieving this goal, mostly in mathematics problem-solving classrooms. It should therefore be incorporated into the teaching of mathematics at the secondary school level.

ii. In-service training programmes for mathematics teachers in the form of seminars, workshops and conferences should be conducted on the use and effectiveness of mathematical creativity, critical question technique and problem-solving strategy in the teaching of mathematics.

iii. Mathematics teachers should incorporate adequate activities, learning games and reflective thinking into their lessons for effective delivery.

iv. Adequate learning facilities should be made available by the government for effective teaching and learning of mathematics and any other science subjects.

Suggestions for Further Studies

i. It is suggested that this study should be repeated with another population in a different study area.

ii. A similar study should be carried out focusing on the teaching of a different subject and/or mathematical concept, using all the components of creativity.

iii. A similar study should be conducted to investigate the effects of mathematical creativity and problem-solving methods on students' academic performance.

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MATHEMATICAL CREATIVITY QUESTIONNAIRE (MCQ)

Section A: Respondent's Personal Data

Name of School:……
……..

Gender: Male ( ) Female ( ) **Age:** 13 – 14yrs ( )15 – 16yrs ( ) 17yrs and above ( )

Section B:

Instruction: Please complete this section by ticking (√) against any of the columns that best represent your feeling. Each item has four response options; SA=Strongly Agree, A = Agree, D= Disagree, SD= Strongly Disagree.

S/N	Items	SA	A	D	SD
1	I use different strategies to solve Mathematics problems.				
2	I develop new methods in solving Mathematics problems.				
3	I attempt challenging Mathematics problems.				
4	I believe that creativity comes by hard work and persistence				
5	I create Mathematics problems and solve them.				
6	I solve similar Mathematics problems quickly.				
7.	I create Mathematical model to solve real life problems				
8.	I stick to Mathematics problems until I have the solution.				
9.	I enjoy playing Mathematics puzzles.				
10.	I use diagrams to solve words problem.				
11.	I have a lot of self-confidence when it comes to Mathematics.				
12.	I understand quickly when solving with my class mate.				
13	I believe in multiple solutions to Mathematics problem.				
14.	I manipulate Mathematics objects.				
15.	Solving Mathematics is fun for me.				
16	I typically create new ideas from existing ones				
17	I deliberately ignore conventional ideas to come up with new ideas				
18	I do a lot of check and recheck work to come up with a new workable idea				
19	I identity everyday life problems and create mathematical solutions to it				
20	I often use the technique of brainstorming to create new ideas				

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Knowledge of Occupational Hazards Among Palm Oil Plantation Workers in Abak Local Government Area, Akwa Ibom State, Nigeria

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Abstract

Palm oil plantation work is among the most physically demanding and hazardous forms of agricultural employment in sub-Saharan Africa, yet it remains poorly studied in terms of workers' own awareness of the dangers involved. This study examined the level of knowledge of occupational hazards among palm oil plantation workers in Abak Local Government Area (LGA), Akwa Ibom State, Nigeria. A descriptive survey design was adopted. The population comprised all palm oil plantation workers in Abak LGA, from which 210 respondents were selected through a multistage sampling technique. Data were collected using a validated, structured questionnaire titled the Occupational Hazard Knowledge Assessment Scale (OHKAS). Data were analysed using frequency counts, percentages, and chi-square statistics at the 0.05 level of significance. Results indicated that the majority of workers had poor knowledge of physical, chemical, biological, and ergonomic hazards associated with plantation work. Significant associations were found between level of education and knowledge of occupational hazards ($p < 0.05$) and between years of work experience and hazard awareness ($p < 0.05$). The study recommends that health education interventions, regulatory enforcement, and employer-led safety training programmes be instituted to improve hazard awareness among this vulnerable working population.

Keywords: occupational hazards, palm oil plantation, hazard knowledge, agricultural workers, Abak LGA, Akwa Ibom State.

1. Introduction

Agriculture remains the backbone of the Nigerian economy, employing a significant proportion of the rural labour force. Within the agricultural sector, palm oil production occupies a prominent position, particularly in the South-South and South-East geopolitical zones of Nigeria. Akwa Ibom State is among the foremost palm oil-producing states in the country, with Abak Local Government Area historically recognised as a major centre of palm oil cultivation and processing. Despite its economic importance, palm oil plantation work exposes workers to a wide range of occupational hazards that can result in injury, illness, and long-term disability.

Occupational hazards in agricultural settings are broadly classified into physical, chemical, biological, ergonomic, and psychosocial categories (International Labour Organization [ILO], 2011). Physical hazards include exposure to extreme heat, sharp tools, falling objects, and machinery-related injuries. Chemical hazards arise from the use of fertilisers, herbicides, and pesticides, many of which have documented toxic and carcinogenic properties. Biological hazards include exposure to fungi, bacteria, insects, and zoonotic agents present in plantation environments. Ergonomic hazards stem from repetitive motions, awkward postures, and manual handling of heavy loads, all of which are central to palm oil harvesting and processing activities.

In many low- and middle-income countries, agricultural workers are among the least protected members of the workforce. Regulatory oversight is weak, formal safety training is rare, and workers often lack the knowledge needed to identify and respond to the hazards they face daily (Prüss-Üstün et al., 2011). In Nigeria, occupational health legislation such as the Factories Act (Cap F1, LFN 2004) and the Nigeria Social Insurance Trust Fund (NSITF) Act theoretically provide a framework for worker protection, but enforcement remains inconsistent, especially in rural and informal agricultural settings.

Knowledge of occupational hazards is widely regarded as a prerequisite for safe behaviour in the workplace. When workers are aware of the dangers inherent in their tasks, they are better positioned to take preventive action, use protective equipment, and seek medical attention when symptoms arise (Aderaw et al., 2011). Conversely, poor hazard knowledge is associated with higher rates of workplace accidents, inadequate use of personal protective equipment (PPE), and delayed health-seeking behaviour. For palm oil plantation workers in Abak LGA, the extent of such knowledge has not been systematically investigated, creating a gap in the evidence base needed to design targeted interventions.

Although studies have examined occupational hazards among agricultural workers in Nigeria, limited evidence exists regarding the specific knowledge of occupational hazards among palm oil plantation workers in Abak LGA, creating a need for this investigation.

2. Research Questions

1. What is the level of knowledge of occupational hazards among palm oil plantation workers in Abak LGA?
2. Is there a significant association between educational level and knowledge of occupational hazards?
3. Is there a significant association between work experience and knowledge of occupational hazards?

3. Methodology

3.1 Research Design

This study adopted a descriptive survey research design. The design was considered appropriate because the study sought to describe, without manipulation, the current state of knowledge of occupational hazards among palm oil plantation workers in Abak LGA. Descriptive surveys are well suited to large-scale population assessments where the goal is to obtain reliable baseline data on knowledge, attitudes, or behaviours (Cohen et al., 2007).

3.2 Study Area

The Abak Local Government Area is situated in the central zone of Akwa Ibom State, in the South-South geopolitical zone of Nigeria. It shares borders with Uruan, Eket, Etim Ekpo, Ikono, and Ukanafun LGAs. The area has a humid tropical climate with two distinct seasons and is historically noted for its palm oil production. Agriculture, particularly palm cultivation, constitutes the primary livelihood activity for a large proportion of the resident population.

3.3 Population and Sampling

The target population for this study comprised all registered and active palm oil plantation workers in Abak LGA. Based on data obtained from the Abak LGA Agricultural Development Programme (ADP) office for the 2025 farming season, the estimated population was 1,450 workers distributed across 12 registered plantation clusters. A multistage sampling technique was employed. In the first stage, six plantation clusters were

randomly selected from the 12 available. In the second stage, proportionate stratified random sampling was used to select 210 respondents from the six clusters. This sample size was determined using the Taro Yamane formula at a 95% confidence level and a 0.05 margin of error, yielding a minimum required sample of 188, to which a 10% attrition allowance was added to arrive at the final sample of 210.

3.4 Instrument

Data were collected using a researcher-constructed instrument titled the Occupational Hazard Knowledge Assessment Scale (OHKAS). The instrument consisted of two sections. Section A gathered demographic information including sex, age, level of education, and years of work experience. Section B comprised 40 items organised into four sub-scales corresponding to the four major hazard categories: physical (10 items), chemical (10 items), biological (10 items), and ergonomic/psychosocial (10 items). Items were structured in a true/false/do not know format, with each correct response scoring 1 point and incorrect or unknown responses scoring 0, giving a maximum score of 40.

Content validity was established through expert review by three specialists in occupational health and environmental science. The instrument was pilot-tested with 30 workers drawn from a neighbouring LGA not included in the main study. Reliability was assessed using the Kuder-Richardson formula 20 (KR-20), which yielded a reliability coefficient of 0.81, indicating a high level of internal consistency.

3.5 Data Collection and Analysis

The researcher, with the assistance of two trained research assistants, administered the questionnaire in person over a period of four weeks. To accommodate workers with limited reading ability, items were read aloud in English and translated into Ibibio where necessary. A total of 210 questionnaires were distributed, of which 204 were returned fully completed, yielding a response rate of 97.1%. Participants were informed of the purpose of the study, and participation was voluntary. Confidentiality and anonymity of responses were maintained. Data were analysed using the Statistical Package for the Social Sciences (SPSS), version 25.0. Descriptive statistics (frequencies and percentages) were used to describe sociodemographic characteristics and to determine the level of hazard knowledge. For inferential analysis, chi-square tests of independence were used to determine associations between categorical variables at the 0.05 significance level. The cut-off for classifying knowledge as poor 0-19 points, moderate 20-29 points, or good 30-40 points was set at below 50%, 50 to 74%, and 75% and above, respectively.

4. Results

4.1 Socio-demographic Characteristics of Respondents

Table 1 presents the demographic profile of the 204 respondents included in the final analysis.

Table 1: Socio-demographic Characteristics of Respondents (n = 204)

Variable	Frequency (n)	Percentage (%)
Sex		
Male	138	67.6
Female	66	32.4
Age Group (years)		
18 – 25	38	18.6
26 – 35	72	35.3
36 – 45	60	29.4
46 and above	34	16.7
Level of Education		
No formal education	51	25.0
Primary education	74	36.3
Secondary education	63	30.9
Tertiary education	16	7.8
Years of Work Experience		
Less than 2 years	29	14.2
2 – 5 years	58	28.4
6 – 10 years	70	34.3
More than 10 years	47	23.0

4.2 Level of Knowledge of Occupational Hazards

Table 2 presents the distribution of knowledge scores across the four hazard categories.

Table 2: Distribution of Respondents by Level of Knowledge of Occupational Hazards (n = 204)

Hazard Category	Poor n (%)	Moderate n (%)	Good n (%)
Physical Hazards	122 (59.8)	58 (28.4)	24 (11.8)
Chemical Hazards	148 (72.5)	42 (20.6)	14 (6.9)
Biological Hazards	131 (64.2)	53 (26.0)	20 (9.8)
Ergonomic/Psychosocial Hazards	140 (68.6)	47 (23.0)	17 (8.3)
Overall Knowledge Score	138 (67.6)	48 (23.5)	18 (8.8)

Table 2 reveals that the majority of respondents demonstrated poor knowledge across all four hazard categories. The highest proportion of poor knowledge was recorded in the chemical hazards sub-scale, where 72.5% of respondents scored below 50%. Overall, 67.6% of respondents were classified as having poor knowledge of occupational hazards, with only 8.8% achieving a good level of knowledge.

Table 3: Chi-Square Test of Association Between Level of Education and Knowledge of Occupational Hazards

Education Level	Poor n	Moderate n	Good n	Total n
No formal education	48	3	0	51
Primary education	56	14	4	74
Secondary education	29	24	10	63
Tertiary education	5	7	4	16
Total	138	48	18	204
$\chi^2 = 28.41$, df = 6, p = 0.000 (p < 0.05) — Null hypothesis rejected				

The chi-square analysis in Table 3 yielded a calculated value of 28.41 with 6 degrees of freedom at a p-value of 0.000, which is less than the 0.05 significance threshold. The null hypothesis was therefore rejected. Workers with secondary and tertiary education demonstrated markedly higher rates of moderate and good knowledge compared to those with primary or no formal education.

Table 4: Chi-Square Test of Association Between Years of Work Experience and Knowledge of Occupational Hazards

Work Experience	Poor n	Moderate n	Good n	Total n
Less than 2 years	24	4	1	29
2 – 5 years	40	14	4	58
6 – 10 years	47	18	5	70
More than 10 years	27	12	8	47
Total	138	48	18	204
$\chi^2 = 14.87$, df = 6, p = 0.021 (p < 0.05) — Null hypothesis rejected				

Table 4 shows a chi-square value of 14.87 with 6 degrees of freedom at a p-value of 0.021, which falls below the 0.05 significance level. The null hypothesis was accordingly rejected. Workers with more than 10 years of experience had a comparatively higher proportion in the moderate and good knowledge categories, suggesting that accumulated work experience is associated, to some degree, with greater hazard awareness. However, the persistence of poor knowledge scores even among the most experienced group underscores the limitation of experience as a substitute for structured safety education. The study relied on self-reported responses, which may be influenced by recall bias or social desirability bias. The findings are also limited to workers in the Abak Local Government Area and may not be generalised to other settings.

5. Discussion of Findings

4.1 Level of Knowledge of Occupational Hazards

The finding that 67.6% of palm oil plantation workers in Abak Local Government Area demonstrated poor overall knowledge of occupational hazards is both striking and instructive. It points to a workforce that carries out physically demanding and genuinely dangerous work with little understanding of the risks involved. This outcome is consistent with the broader pattern documented in agricultural communities across sub-Saharan Africa, where limited access to formal safety education leaves workers largely reliant on personal observation and informal instruction passed down within work groups.

The particularly low knowledge scores recorded for chemical hazards, where 72.5% of respondents fell in the poor category, deserve specific attention. Palm oil cultivation in Nigeria involves routine use of fertilisers, herbicides, and contact pesticides, many of which belong to hazard classes associated with dermal absorption, respiratory damage, and long-term carcinogenic risk. That fewer than one in ten respondents

demonstrated good knowledge in this area reflects a critical gap at precisely the point where informed behaviour could most directly reduce harm. This finding aligns with the work of Ogah, Adesope, and Mbanisi (2015), who reported comparable deficits in pesticide safety knowledge among rural farmers in Benue State, and with Nwachukwu, Okereke, and Anyaehie (2018), whose study of smallholder farmers in South-Eastern Nigeria similarly documented widespread unawareness of chemical exposure risks.

Ergonomic and psychosocial hazard knowledge was also markedly poor, with 68.6% of respondents in the poor category. This is particularly relevant given that palm oil harvesting involves sustained awkward postures, repetitive overhead cutting motions, and the manual carrying of fresh fruit bunches that can exceed 25 kilograms. Rokhani, Aizzat, and Sulaiman (2012) found that oil palm harvesters in Malaysia were at elevated risk of work-related musculoskeletal disorders, a finding that carries direct implications for workers in Abak LGA who appear largely unaware that their working postures and load-bearing habits constitute a recognised category of occupational risk.

The theoretical basis for these findings is well established. The Health Belief Model, articulated by Rosenstock (1966) and elaborated by Becker (1974), holds that perceived susceptibility to harm is a necessary precondition for protective behaviour. Where workers do not recognise a hazard as such, they are unlikely to take preventive action, use personal protective equipment, or seek medical attention when symptoms develop. The near-absence of good knowledge scores across all four hazard categories in this study suggests that the foundational cognitive conditions for safe workplace behaviour are absent for the great majority of these workers.

4.2 Association Between Level of Education and Knowledge of Occupational Hazards

The statistically significant association between educational attainment and hazard knowledge (chi-square = 28.41, p = 0.000) was one of the more robust findings in this study. The gradient is clear: as formal education increases, so too does the proportion of workers achieving moderate or good knowledge levels. Among respondents with no formal education, virtually the entire group fell in the poor knowledge category, while secondary and tertiary completers showed a markedly better distribution across all three knowledge levels.

This relationship is not surprising in isolation. Formal education develops literacy, numeracy, and the broader cognitive capacity to process written and verbal health information. Workers who can read safety labels, interpret instructional materials, or engage with health education content delivered in written form are at a structural advantage

over those who cannot. Aderaw, Engdaw, and Tadesse (2011), in their study of textile factory workers in Ethiopia, found education to be among the strongest determinants of occupational safety awareness, a finding mirrored here in an agricultural context.

What makes the Abak LGA finding more troubling, however, is the composition of the sample itself. Over 61% of respondents had attained only primary education or no formal schooling at all. This means that the majority of the workforce occupies the very educational categories in which poor hazard knowledge is most concentrated. The implication for programme design is direct: interventions that rely primarily on written materials, standard instructional formats, or formal classroom delivery will reach only the fraction of the workforce most likely to have already acquired some hazard awareness. Any effective occupational health education strategy for this population must be grounded in oral communication, pictorial materials, and delivery in the Ibibio language.

The findings also raise a broader structural question. Education levels in this workforce reflect long-standing patterns of educational disadvantage in rural Akwa Ibom State, and no occupational health programme can redress those patterns in the short term. What can be addressed, however, is the assumption, embedded in current regulatory practice, that written compliance notices and posted safety information are adequate substitutes for direct, face-to-face health education delivered in a language and format accessible to the actual workforce.

4.3 Association Between Years of Work Experience and Knowledge of Occupational Hazards

The statistically significant association between years of work experience and hazard knowledge (chi-square = 14.87, p = 0.021) adds a further dimension to the picture. Workers with more than a decade in the plantation environment did show a somewhat higher representation in the moderate and good knowledge categories compared to those with shorter tenure. This is consistent with the intuitive expectation that prolonged engagement with a work environment produces some accumulation of practical awareness.

Nevertheless, the more consequential finding is that poor knowledge remained the dominant classification even among the most experienced group. Of the 47 workers with more than 10 years of experience, 27 were still classified as having poor knowledge of occupational hazards. This result is broadly consistent with Tolu-Bolaji and Afolabi (2014), whose study of palm oil industry workers in Ondo State found that length of service alone did not produce adequate hazard awareness in the absence of structured safety training. Flin, Mearns, O'Connor, and Bryden (2000) make a related point in their analysis

of safety climate in industrial settings, noting that experiential learning in the workplace tends to reinforce habitual behaviour rather than generate accurate hazard perception, particularly where dangerous practices have not historically produced visible harm.

6. Conclusion

This study has established that the level of knowledge of occupational hazards among palm oil plantation workers in Abak Local Government Area, Akwa Ibom State, is predominantly poor, with chemical and ergonomic hazards being the least understood. Education and work experience are both significantly associated with hazard knowledge, though neither is sufficient on its own to ensure an adequate level of worker awareness. These findings highlight the urgent need for a structured, culturally responsive occupational health education programme directed at this workforce, as well as stronger regulatory engagement by relevant government agencies. Future research should investigate the relationship between hazard knowledge and actual safety behaviour and evaluate the effectiveness of specific intervention models in this population. Improving hazard awareness among plantation workers may contribute significantly to reducing occupational injuries and promoting healthier agricultural work environments.

7. Recommendations

i. On the basis of the findings, the following recommendations are offered:
ii. The Akwa Ibom State Ministry of Agriculture, in collaboration with the Abak LGA Agricultural Development Programme, should develop and implement a systematic occupational health education programme for palm oil plantation workers, with particular emphasis on chemical safety and ergonomic hazards.
iii. Employers and plantation owners should be legally mandated to provide regular, documented safety training to all workers before deployment and at recurring intervals, in line with the provisions of the Factories Act.
iv. Health educators and extension workers operating in Abak LGA should incorporate occupational hazard awareness into routine community health messaging, using pictorial materials and Ibibio-language resources.
v. The National Industrial Safety Council of Nigeria (NISCN) should prioritise enforcement visits and hazard audits in the palm oil-producing communities of Akwa Ibom State.

vi. Future research should extend this investigation to include observational assessments of safety behaviour and PPE use to complement the knowledge-based data reported here.

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Voluntary Disclosures and Financial Reporting Quality of Quoted Commercial Banks in Nigeria

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Abstract

This study examined the effect of voluntary disclosures on the financial reporting quality of Nigerian commercial banks, focusing on earnings persistence as a proxy for reporting quality. Nigerian banks are important to the nation's financial stability, and transparency in their reporting is essential for fostering stakeholder trust and informed decision-making. Amid global financial scandals and rising demand for corporate accountability, voluntary disclosures have gained attention as a means to mitigate information asymmetry and improve transparency. However, inadequate voluntary disclosures in Nigerian banks may hinder stakeholders, including investors and regulators, from making informed assessments, thereby affecting reporting quality. The study investigated the influence of voluntary disclosures, specifically capital adequacy ratio (CAR), return on assets (ROA), net interest margin (NIM), and earnings per share (EPS), on earnings persistence in the sector. Ex-post facto research design was used. Data from 20 commercial banks listed on the Nigerian Exchange Group over a six-year period were also obtained. The Ordinary Least Squares (OLS) regression statistical technique was used to evaluate the relationship between these variables. The result of the analysis revealed that CAR and ROA significantly influenced earnings persistence, with CAR showing a positive effect (coefficient = 0.0290, p = 0.020) and ROA also showing a positive effect (coefficient = 0.1506, p = 0.014). In contrast, NIM had a negative significant effect, and EPS was not significant. The results revealed a positive correlation between voluntary disclosures and improved financial reporting quality, as

evidenced by more stable and persistent earnings. The study concluded that enhanced voluntary disclosures foster greater transparency, which can increase investors' confidence and improve the regulatory landscape. These findings suggest that encouraging voluntary disclosures could play a pivotal role in strengthening Nigeria's banking sector, with implications for regulatory frameworks, investors' decisions, and overall market efficiency. The study recommended that enhancing transparency in CAR disclosures and focusing on improving ROA reporting could boost earnings stability.

Keywords: voluntary disclosures, earnings persistence, financial reporting quality, capital adequacy ratio (CAR), return on assets (ROA)

Introduction

Voluntary disclosure involves providing information beyond what is required by Generally Accepted Accounting Principles (GAAP) and the Securities and Exchange Commission's rules, offering insights into a company's financial health, risk management, and corporate governance. It includes strategic information on products, competition, customers, financial information (such as earnings forecasts and stock prices), and non-financial information (environmental, social, governance, and sustainability performance). Voluntary disclosures are crucial for stakeholders, helping them make informed investment decisions by clarifying the financial and non-financial exposures and contingencies a company might face. They also reduce information asymmetry and enhance transparency in capital markets.

The adoption of International Financial Reporting Standards (IFRS) has increased disclosure requirements, raising the quality and relevance of disclosed information. This trend is significant in the banking sector, where stakeholders heavily rely on financial information for decision-making. Understanding the impact of voluntary disclosures such as corporate social responsibility, capital allowance ratio, and others on financial reporting quality is crucial for stakeholders to assess the transparency and accountability of Nigerian commercial banks. This increased focus on voluntary disclosures reflects the evolving regulatory landscape and the importance of transparency in the banking sector. Mandatory disclosures are the minimum information required by law, while voluntary disclosures provide additional valuable insights. The stakeholder's perception often leans towards the undue advantage of managers who may selectively disclose information, leading to information asymmetry and potential negative consequences.

Despite the importance of voluntary disclosures, there is limited research on their impact on the financial reporting quality of Nigerian commercial banks. This study addressed this gap by examining the relationship between voluntary disclosures and financial reporting quality over a six-year period, focusing on measures such as Earnings Persistence (EP), Capital Adequacy Ratio (CAR), Earnings Per Share (EPS), Net Income Margin (NIM), and Return on Assets (ROA). By shedding light on these dynamics, the study aims to provide valuable insights for regulators, policymakers, and other stakeholders in the Nigerian banking sector, contributing to the existing body of knowledge, policy decisions, and corporate practices.

Statement of the Problem

Globally, voluntary disclosures have been a controversial issue, and the level of compliance is still uncertain even when the yearning for financial information disclosure is increasingly needed by every stakeholder. For the benefits of the business environment, organizations are required to disclose the least levels of information, known as mandatory disclosures. Therefore, practically most organizations go along completely with those least levels of the mandatory disclosure even though it is neither sufficient nor appropriate to meet users' needs for corporate information. This increases the need for additional information requirements. This additional information is known as voluntary disclosure.

The separation of ownership and management of companies creates what are known as information asymmetries. Annual reports are usually used to reduce the information gap between the management and the investors. However, the financial statements do not provide sufficient information to users, which increases the information gap between information providers (managers) and information users (stakeholders and others). In addition, the current demands for information are greater and more diverse than in the past. This highlights the need for a wider range of information compared to what was previously sufficient. Thus, to reduce this problem, firms need to disclose more information voluntarily (Adeniyi & Olugbenga, 2019).

Recent decades have witnessed financial scandals that led to the collapse of long-standing companies. Extreme lapses in financial reporting quality have given rise to high-profile scandals that resulted not only in investor losses but also reduced confidence in the financial system. Financial statement users who were able to accurately assess financial reporting quality were better positioned to avoid losses. The problem of this study is the potential inadequacy of voluntary disclosures by commercial banks in Nigeria to meet the

increasing demand for information from stakeholders, leading to information asymmetry and a lack of transparency in financial reporting.

This issue may hinder stakeholders, including investors and regulators, from making informed decisions, ultimately affecting the overall financial reporting quality in the banking sector. The researchers believe that one of the major reasons for these collapses is the concealment and non-disclosure of relevant information, even though some failed companies had thought that they fully complied with the minimum levels of compulsory disclosure. This has resulted in a clamor for voluntary disclosures in the accounting reports of listed banks in Nigeria.

The banking sector plays a critical role in the Nigerian economy, and the quality of financial reporting by banks is essential for maintaining market confidence and facilitating informed decision-making by stakeholders. Lack of comprehensive understanding of voluntary disclosures in the banking sector has affected the quality of accounting reports, particularly in terms of their impact on key financial indicators such As Earnings Per Share (EPS), Net Interest Margin (NIM), and Capital Adequacy Ratio (CAR) (Samuel, 2019)**.** This study seeks to address the aforementioned issues by investigating the relationship between voluntary disclosures and financial reporting quality in Nigerian banks. By examining the effect of voluntary disclosures on key financial indicators such as capital adequacy ratio (CAR), return on assets (ROA), net interest margin (NIM), and earnings per share (EPS), the study aims to provide valuable insights into the effectiveness of current disclosure practices and their implications for financial reporting quality as proxied by the earnings persistence of listed commercial banks in Nigeria.

Objectives of the Study

The main objective of the study was to investigate the effect of voluntary disclosures on the quality of financial reports of listed commercial banks in Nigeria, proxied by earnings persistence. In order to achieve this, the specific objectives were to:

i. Determine the influence of voluntary disclosure of capital adequacy ratio (CAR) on earning persistence of listed commercial banks in Nigeria.

ii. Assess the influence of voluntary disclosure of return on assets (ROA) on earning persistence of listed commercial banks in Nigeria.

iii. Determine the effect of voluntary disclosure of net interest margin on earning persistence of listed commercial banks in Nigeria.

iv. Determine the influence of voluntary disclosure of earnings per share (EPS) on earning persistence of listed commercial banks in Nigeria.

Research Questions

The following research questions were formulated to direct the study.

i. What is the influence of voluntary disclosure of capital adequacy ratio (CAR) on earning persistence of listed commercial banks in Nigeria?

ii. What is the influence of voluntary disclosure of return on assets (ROA) on earning persistence of listed commercial banks in Nigeria?

iii. What is the effect of voluntary disclosure of net interest margin on earning persistence of listed commercial banks in Nigeria?

iv. What is the influence of voluntary disclosure of earnings per share (EPS) on earning persistence of listed commercial banks in Nigeria?

Hypotheses of the Study

The following hypotheses were stated in the null form.

H_{O1}: There is no significant influence of voluntary disclosure of capital adequacy ratio (CAR) on earning persistence of listed commercial banks in Nigeria.

H_{O2}: There is no significant influence of voluntary disclosure of return on assets (ROA) on earning persistence of listed commercial banks in Nigeria.

H_{O3}: There is no significant effect of voluntary disclosure of net interest margin on earnings. persistence of listed commercial banks in Nigeria.

H_{O4}: There is no significant influence of voluntary disclosure of earnings per share (EPS) on earning persistence of listed commercial banks in Nigeria.

Conceptual Review

The conceptual review described the framework and relevant concepts used in the study. These were discussed below.

The Banking Sector

The banks are central elements of a market economy. In more than one way, they facilitate business transactions by acting as depositor and lender for many actors in the domestic and international economy. The banking industry in Nigeria has grown in size in terms of assets in the last 62 years since the country's independence from British colonial rule and has

undergone large-scale reforms and transformation in the global economy. As money and finance play a vital role in the macroeconomic affairs of both advanced countries and less developed nations, the importance of money and finance brings the role and place of financial institutions as the main connecting link with the economy at large since they are intermediaries and have also remained an important medium of economic exchange (Samuel, 2019)**.**

In the total banking operations, commercial banks notably have the biggest share amidst other industry players such as microfinance banks, development banks, mortgage banks, and others. However, formerly the main function of the commercial banks was financing organized trade, commerce, and industry, now they also provide finance to agriculture, small-scale business, and small borrowers (Singh, 2011). Banks existed as depositories and loan advancers from which banking practice originated. The business of banking made early bankers ever since the goldsmith, who was recognized as a moneylender and cash collector.

An Overview of Voluntary Disclosure

Voluntary disclosure practice involves disclosing information beyond that stipulated in the regulatory frameworks. It constitutes more of the non-numerical part of the corporate report, and therefore, the clarity of this part is crucial to fully convey information (Adebisi & Adegun, 2016). Voluntary disclosure simply means providing much more information than is required by law. That is, disclosing information about corporate activities in addition to the minimum requirements (Boesso and Kumar, 2007). Voluntary disclosure increases transparency and accountability in annual financial reporting, hence attracting prospective investors and enabling all other users of these reports to make informed decisions. Companies that voluntarily disclose information enjoy the benefits of cheaper funds from capital markets, which in turn translate to better investment appraisals by managers.

Differences between Voluntary and Mandatory Accounting Information Disclosure

Information disclosure of listed companies is of great significance for the healthy development of the capital market. From the perspective of being controlled or not, information disclosure can be classified into mandatory and voluntary accounting information disclosures. There are major differences between these two types of disclosures in terms of concept, motive, and content. Mandatory accounting information disclosure refers to the content that is required to be disclosed in financial reports by

generally accepted accounting principles and other laws and regulations. Voluntary accounting information disclosure means the information is disclosed proactively, timely, and accurately and is beyond the requirements made by security regulators and the information in which the company owns partial autonomous rights. Disclosing only mandatory accounting information is likely to cause market failure due to the fact that the company is the exclusive provider of its information. Voluntary accounting information disclosure stems from economic globalization, and it will lead to global expansion of the capital market. Due to the pressure of competing for capital, enterprises have the motive of reporting voluntarily their corporate information so as to attract capital and improve their reputation and competitiveness (Ukpong & Essien, 2019).

Voluntary Disclosure Practices in Nigerian Commercial Banks

Voluntary disclosure practices in Nigerian commercial banks have been influenced by various factors, including regulatory requirements, corporate governance practices, and market pressures. Uwuigbe (2011) observed that Nigerian banks have increased their voluntary disclosure practices in response to regulatory requirements aimed at enhancing transparency and accountability. These disclosures often include information about financial performance, risk management practices, and corporate governance structures. Regulatory requirements, such as those imposed by the Central Bank of Nigeria (CBN) and the Securities and Exchange Commission (SEC), play a significant role in shaping voluntary disclosure practices in Nigerian banks. Though CBN requires banks to disclose certain information in their annual reports and financial statements, such as capital adequacy ratios and non-performing loan ratios (CBN, 2019), not all banks disclose this information. Similarly, the SEC requires listed banks to disclose information about corporate governance practices, board composition, and executive compensation, yet not all banks disclose this information.

Types of Voluntary Disclosures

Voluntary disclosures encompass a wide range of information that can provide stakeholders with valuable insights into the company's performance, strategy, risks, and governance practices. Several types of voluntary disclosures have been identified and classified based on their nature and purpose. One common classification is based on the content of the disclosure, which could be either financial or non-financial. Financial disclosures include information about the company's financial performance, such as revenue, expenses, profits, and cash flows. Non-financial disclosures, on the other hand,

cover a wide range of areas, including Environmental, Social, and Governance (ESG) issues, Corporate Social Responsibility (CSR) initiatives, and risk management practices (Adeyemi & Oluwatoyin, 2018).

Financial and nonfinancial disclosures are essential components of corporate reporting, providing stakeholders with comprehensive information about a company's financial health, performance, and sustainability practices. These disclosures are crucial for enhancing transparency, accountability, and stakeholders' trust. Financial disclosures encompass the reporting of financial information such as income statements, balance sheets, and cash flow statements. These disclosures are governed by accounting standards and regulations to ensure accuracy, comparability, and transparency. Financial disclosures influence investor decisions, market perceptions, and firm value (Barako, 2007; Adeniyi & Olugbenga, 2019).

Another classification is based on the medium of disclosure. Companies can disclose information through various channels, such as annual reports, financial statements, press releases, corporate websites, and social media. Each medium offers different advantages in terms of reach, timeliness, and interactivity, allowing companies to tailor their disclosures to different stakeholder groups. Disclosures can also be classified based on the timing of the disclosure. Forward-looking disclosures provide information about the company's future plans, strategies, and expectations. Historical disclosures, on the other hand, focus on past performance and events. Both types of disclosures are important for stakeholders to understand the company and make informed decisions (Okoye & Anao, 2020).

Measures of Voluntary Disclosure

Several indices and measures have been developed to quantify voluntary disclosures. According to Edogiawerie and David (2016), voluntary disclosures can take various forms, including narrative explanations, quantitative data, and non-financial information. The extent and nature of voluntary disclosures can vary significantly across firms and industries, and several measures have been developed to capture these differences. Edogiawerie and David (2016) identified the following as widely used measures of voluntary disclosures:

i. Content analysis: Content analysis is a widely used method for quantifying the extent and quality of voluntary disclosures. It involves systematically analyzing corporate reports, such as annual reports, sustainability reports, and corporate websites, to

identify the types and extent of voluntary disclosures. Content analysis can be qualitative, focusing on the types of information disclosed, or quantitative, measuring the frequency or extent of disclosures on specific topics or categories.

ii. **Index-Based Approach:** This approach utilizes several indices to measure the overall level of voluntary disclosure. It typically assigns scores or ratings based on the presence or absence of specific disclosure items. Examples include the disclosure index (DI), which counts the number of disclosed items, and the composite disclosure index (CDI), which assigns weights to different disclosure items based on their importance.

iii. **Self-constructed indices:** Researchers often develop self-constructed indices tailored to specific research objectives or contexts. These indices are based on theoretical frameworks or prior literature and aim to capture the multidimensional nature of voluntary disclosure. Self-constructed indices allow researchers to customize the measurement to fit the research question and enhance the validity of the findings.

iv. **Disclosure Scores:** Disclosure scores are composite measures that combine multiple disclosure items into a single score. These scores provide a holistic assessment of the overall level of disclosure, taking into account the diversity and depth of information provided. Disclosure scores can be used to compare disclosure practices across companies or industries and track changes in disclosure practices over time.

v. **Disclosure Quality Metrics:** In addition to measuring the extent of disclosure, the quality of disclosure is also assessed. Quality metrics evaluate the clarity, specificity, and relevance of the information disclosed. Common quality metrics include readability scores, which assess the complexity of the language used in disclosures, and relevance scores, which evaluate the level of detail of the disclosed information.

An Overview of Accounting Reports

Accounting reports are periodic statements that present the financial status of a company at a certain point in time, or over a stated period. It details the business transactions and operations. Accounting reports are also known as financial reports. A financial report is a formal record of the financial activities of a business, person, or entity. It is a document that contains all the relevant financial information about an organization presented in a structured manner and in a form easy to understand (Edogiawerie and David, 2016).

Reporting comprises the last stage of the accounting process. The content, amount, and format of the information that will be disclosed to the public by the accounting department are governed by the authorities who regulate the accountancy laws and regulations for that particular country (Fagbemi & Ojo, 2017). According to Francis et al. (2018), a lot of studies have indicated a substantial increase in discussions on annual reports, and some of these studies reveal poor and inconsistent information disclosures in accounts of companies.

According to Edogiawerie and David (2016), a good financial report must not only be capable of providing users with mandatory disclosures but also go the extra mile in providing voluntary information disclosures to meet the needs of the various categories of users. Providing information on which sound investment decision can be made is the goal of all disclosure requirements to reduce uncertainties and understand as much as possible the values of the company as can be inferred from its reports. Corporate financial reporting refers to any deliberate release of financial information, whether via informal or formal channels, voluntary or required, or in a qualitative or numerical form. Firms provide financial information to external users through various channels, including websites, press releases, interim reports, conferences, and annual reports.

Financial reporting plays two important roles in market-based economies. First, it reduces information asymmetry and enables capital providers to value businesses, thereby fostering the transparency that is necessary for an efficient capital market operation. This is known as the valuation role of accounting information. Secondly, financial reports enable external capital suppliers to assess management performance, and this is known as the stewardship role of accounting information (Pinnuck, 2012). Outsiders use accounting information for these two reasons. Whether the financial statements that are best for valuing businesses are also the basis for assisting shareholders and boards in hiring CEOs to reduce the agency conflict remains a crucial question.

An Overview of Financial Reporting Quality

Financial reporting quality is a crucial aspect of corporate governance and transparency, providing stakeholders with relevant information about a company's financial performance and position. It involves the preparation and presentation of financial statements, including the balance sheet, income statement, cash flow statement, and statement of changes in equity. Financial reporting is guided by accounting standards and principles to ensure consistency, comparability, and reliability of financial information.

According to Brown and Tarca (2019), financial reporting quality is essential for investors, creditors, and other stakeholders to make informed decisions. It provides a basis for assessing a company's financial health, profitability, and ability to meet its obligations. Financial reporting also plays a significant role in maintaining market confidence and fostering trust between companies and investors. In Nigeria, financial reporting is governed by the Financial Reporting Council (FRC) Act of 2011, which sets out the requirements for the preparation and presentation of financial statements. The Act requires companies to comply with International Financial Reporting Standards (IFRS) in preparing their financial statements, ensuring transparency and comparability of financial information.

Measures of Financial Reporting Quality

Several measures have been developed to assess financial reporting quality, each focusing on different aspects of the financial reporting process. These measures can be broadly categorized into accounting-based measures, market-based measures, and governance-based measures.

i. **Accounting-Based Measures:** These measures use financial statement data to assess the quality of financial reporting. Examples include measures of earnings quality, such as accruals quality, earnings persistence, and timely loss recognition. Accruals quality measures the extent to which reported earnings are driven by accruals rather than cash flows, with higher-quality earnings being more closely related to cash flows. Earnings persistence measures the ability of current earnings to predict future earnings, with higher persistence indicating higher quality. Earnings persistence can be mathematically represented using a simple formula (Brown and Tarca, 2019):

$$\text{Earnings Persistence (EP)} = \frac{\text{Net Income } t}{\text{Net Income } t-1}$$

where:
Net income (t) represents the net income for the current period.
Net Income t−1 represents the net income for the previous period.

This formula calculates the ratio of current net income to the net income from the previous period, providing a measure of how well the current earnings predict or persist into the next period. Higher values of earnings persistence indicate greater reliability and predictability of earnings over time.

ii. **Market-Based Measures:** Market-based measures use stock market data to assess the quality of financial reporting. One example is the market reaction to earnings announcements, where a positive market reaction indicates that the earnings announcement contains value-relevant information and is of high quality. Another example is the information of stock prices, where more informative stock prices indicate higher-quality financial reporting.

iii. **Governance-Based Measures:** Governance-based measures assess the quality of a company's corporate governance practices, which are closely linked to financial reporting quality. Examples include measures of board independence, audit committee effectiveness, and the presence of internal control mechanisms. Companies with strong governance practices are more likely to produce high-quality financial reports.

Voluntary Disclosures of Capital Adequacy Ratio (CAR) and Earnings Persistence

The Capital Adequacy Ratio (CAR) is a crucial measure of a bank's financial strength and stability, indicating its ability to absorb losses and meet its financial obligations. It is defined as the ratio of a bank's capital to its risk-weighted assets, with capital being divided into core capital and supplementary capital. CAR is a key component of regulatory requirements set by banking authorities to ensure banks have enough capital to cover potential losses and maintain financial stability (Matthew & Fakile, 2017). It reflects the bank's ability to absorb potential losses and meet its financial obligations, providing a buffer against insolvency. (Mudashiru & Raymond, 2021). Banks are required to maintain a minimum CAR to mitigate the risk of insolvency and protect depositors' funds. A higher CAR indicates a stronger financial position and better ability to withstand economic downturns or unexpected losses.

Voluntary Disclosures of Net Interest Margin and Earnings Persistence

Net Interest Margin (NIM) is a financial metric in the banking sector used to measure the difference between the interest income generated from loans, securities, and other interest-earning assets and the interest expenses paid on deposits and other interest-bearing liabilities. It is expressed as a percentage and is indicative of the bank's ability to generate profit from its core lending and deposit activities. In Nigeria, banks face various challenges that can impact their NIM, including regulatory changes, economic conditions, and competition (Owais, 2021). Voluntary disclosures play a significant role in how these challenges are managed and perceived by stakeholders. One way voluntary disclosures can

affect NIM is by enhancing transparency. Banks that provide detailed and timely disclosures about their interest rate risk management, funding sources, and loan portfolio quality can improve investor confidence. This increased transparency can lead to a lower cost of funds and better terms for borrowing, ultimately improving NIM.

Voluntary Disclosures of Earnings Per Share (EPS) and Earnings Persistence

Earnings Per Share (EPS) is a fundamental metric used by investors to evaluate a company's profitability and is calculated by dividing the company's net income by the number of outstanding shares. In the banking sector, EPS is a key indicator of financial performance and is influenced by various factors, including interest income, operating expenses, and provisions for loan losses.

Voluntary disclosures related to risk management practices, such as loan loss provisions and asset quality, provide investors with insights into a bank's ability to manage credit risk effectively. Effective risk management practices lead to lower provisions for loan losses, which boost net income and, consequently, EPS. Similarly, disclosures related to revenue-generating activities, such as interest income from loans and investments, can also impact EPS. Banks that effectively communicate their strategies for growing interest income, such as through loan portfolio diversification or effective investment management, can enhance investor confidence and potentially lead to higher EPS (Oyebisi & Adegun, 2015).

Theoretical Review

The theoretical framework for this study encompasses two main theories: agency theory and legitimacy theory.

Agency theory

Agency theory, which is an economic theory developed by Jensen and Meckling in 1976. In particular, this theory has been widely used by accounting researchers to explain and understand voluntary disclosure phenomena in many countries with a different social, political, and economic background. Jensen and Meckling (1976) describe an agency relationship as one in which the principal picks an agent and delegates power to the agent to act on behalf of the principal.

According to Healy and Palepu (2001), voluntary disclosure (non-mandatory disclosure) is expected to reduce agency costs, implying that the agency theory is most appropriate for this topic, as voluntary disclosure helps reduce agency costs and eliminates

any conflict of interest between management and owners, thereby optimizing their interests. This is consistent with Owais, 2021. When shareholders are not aware of critical information that management has access to, an agency issue might develop, resulting in information asymmetry between them due to the fact that managers can access information more than shareholders (Jensen & Meckling, 1976). Optimal contracts are one of the means of mitigating the agency problem as they help in bringing shareholders' interests in line with managers' interests (Healy & Palepu, 2001). In addition, voluntary disclosure is another means of mitigating the agency problem, where managers disclose more voluntary information, reducing the agency costs (Barako, 2007), and also to convince the external users that managers are acting in an optimal way.

Regulation is another means of mitigating the agency problem, as they require managers to fully disclose private information (Healy & Palepu, 2001). However, full disclosure is never guaranteed even in the presence of regulations. The absence of full disclosure is explained by the conflict that exists between the interests of managers and shareholders (Lev & Penman, 1990; Samuels, 1990). In addition, corporate reporting regulations are intended to provide investors with the minimum quantity of information that helps in the decision-making process (Mudashiru & Raymond, 2021). It has been suggested that one of the possible ways to decrease agency costs is to disclose more information concerning the management activities and the economic reality of the firm, and through such information, stakeholders and other investors can monitor management more appropriately (Okere et al., 2022). Agency theory suggests that voluntary disclosures can help reduce agency costs and align the interests of management with those of shareholders.

Legitimacy Theory

The legitimacy theory was developed by Dowling and Pfeffer in 1975 (Guthrie & Ward, 1989). Legitimacy theory exists when an established value system is congruent with the value system of the larger social system of which the establishment is a part. The legitimacy theory assumes that a company has no right to exist unless its values are being perceived as matching with that of the society at large where it operates (Dowling & Pfeffer, 1975; Lindblom, 1994; Magness, 2006).

The idea of the legitimacy theory resembles a social contract between the company and the society (Magness, 2006). Since the objective of accounting is to provide users with information that helps in decision-making, the theory has been integrated in accounting studies as a means of explaining what, why, when, and how certain items are addressed by

corporate management in their communication with outside audiences (Magness, 2006). Since the legitimacy theory is based on the society's perception, management is forced to disclose information that would change the external users' opinion about their company. The annual report has been detected as an important source of legitimacy (Matthew & Fakile, 2017). Legitimization can be seen in both the mandatory disclosures provided in financial statements because of regulations and voluntary disclosures provided in other sections of the annual report (Magness, 2006).

Legitimacy theory is founded on the notion that there is a social contract between an economic entity and the society in which it activates. This theory suggests that voluntary information disclosures are used as a device for economic entities to demonstrate that their activities are in line with the bounds and norms of their respective societies. According to the legitimacy-based arguments, voluntarily disclosing additional information in corporate annual reports is an effort to help alleviate public pressure or legitimize a company's actions. As predicted by legitimacy theory, managers of firms would voluntarily disclose more information on actions if they perceived that the specific actions were expected by the public in which their companies operate (Guthrie & Parker, 1989). Legitimacy theory posits that companies disclose information voluntarily to maintain their legitimacy in the eyes of the public.

Empirical Review

In Kenya, Mutiva et al., (2017) investigated the link between voluntary disclosure and financial performance. From 2011 to 2013 and found a strong positive relationship between voluntary disclosure and financial performance. A study by Musyoka (2017) revealed that financial policy disclosure, financial liquidity disclosure, research, and development disclosure have a significant effect on firm performance, while investment policy disclosure and sales growth disclosure have no significant effect on firm performance.

A study by Ukpong and Essien (2019) concluded that voluntary disclosures influence investors' decision-making to a great extent. Oyebamiji (2020) concluded that financial disclosure and earnings quality performance are independent of each other, and, therefore, they are mutually exclusive and uncorrelated. Dada and Adeniji (2021), in their study, revealed that India and Asian Pacific regions ranked high among the developing nations in the level of financial information disclosure compliance, while Nigeria, after the adoption of International Financial Reporting Standards (IFRS), has shown some levels of mandatory information disclosure. The result by Dahiyat and Al-Balqa (2020) indicated a positive correlation between a company's size, age, and profitability on one hand and

between the quality of voluntary disclosure on the other hand. In addition, the results indicated a weak and insignificant relation between the assets in place and financial leverage and the level of voluntary disclosure quality.

Qamruzzaman et al. (2021*)* evaluated the potential impact of voluntary information disclosure on the value of firms listed on the Dhaka Stock Exchange for the period 2017–2019 and found a positive and significant relationship between voluntary disclosure relating to financial statistics, social responsibility information, and corporate governance and the firms' value as measured by Tobin's Q. Okere et al. (2022) examined the relationship between financial performance and voluntary disclosure of listed deposit money banks in Nigeria and found a positive significant relationship between financial performance and the voluntary disclosure of deposit money banks in Nigeria. Matthew and Fakile (2017) carried out a study on voluntary disclosure and financial performance of commercial banks in Nigeria and found a positive relationship between voluntary disclosure of capital adequacy ratio (CAR) and financial performance of commercial banks in Nigeria.

A study on voluntary disclosure and financial performance of listed deposit money banks in Nigeria, conducted by Abdulganiyu and Adeyemi (2015), showed a positive relationship between voluntary disclosure and financial performance of listed deposit money banks in Nigeria. Saibu and Akinola (2019) found that a positive relationship exists between voluntary disclosure of return on assets and financial performance of deposit money banks in Nigeria.

Gap in Literature

Most of the studies reviewed were mainly on voluntary disclosure and performance, and very few were on voluntary disclosure and financial reporting quality. The studies reviewed used different proxies for measuring financial reporting quality and voluntary disclosure. Consequently, the results obtained were mixed, with most of them being positive depending on the variables used. This study aimed to fill a significant gap in the existing literature by specifically examining the relationship between voluntary disclosures and the quality of financial reports of listed commercial banks in Nigeria, specifically using earnings persistence as a proxy for financial reporting quality. While previous studies have investigated the impact of voluntary disclosure on various financial performance indicators, such as earnings management and financial performance, there was limited research that focused on the direct relationship between voluntary disclosures with

reference to earnings persistence as a measure of quality of financial reports, especially in the commercial banks.

Conceptual Specification of model

The Conceptual specification of model is developed by the researcher as shown in the figure below

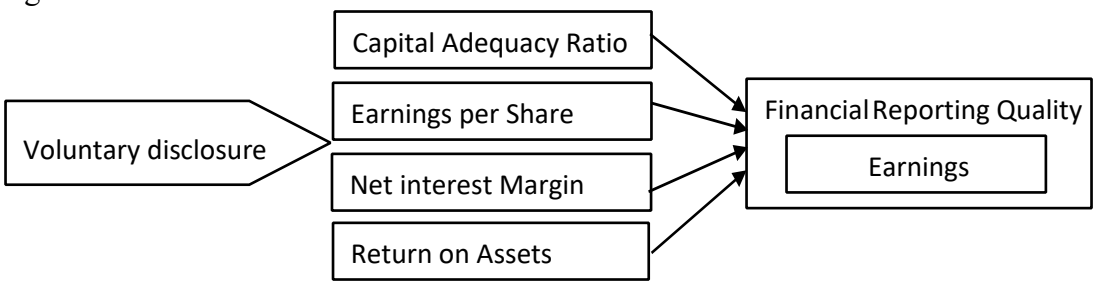

Figure 1: Conceptual Model of the Study Source: Developed by the Researcher (2025)

Methodology

An ex-post facto research design involving a descriptive approach was adopted for this study. From a population of 24 quoted firms, 20 were purposively selected based on listing status. The 20 banks chosen were those with complete financial data for the period of the study. The data were collected from financial reports review and internet surfing, focusing on the financial statements of selected commercial banks in Nigeria. Specifically, data on both dependent and independent variables were gathered from the financial statements.

Empirical Specification of Model

$EP = b0 + b_1CAR + b_2EPS + b_3NIM + b_4ROA + e$ Equation 3.1

Where:

EP = Earnings Persistence
b0 = Constant
CAR = Capital Adequacy Ratio
EPS = Earnings Per Share
NIM = Net Interest Margin
ROA = Return on Assets
$b_1 \ldots b_4$ = Coefficients of the independent variables
e = Error Factor

Description of variables

Table 1: The dependent and independent variables and Apriori expected signs

Variables	Types	Description	Apriori Expectation
Earnings persistence	Dependent	The ratio of current net income to the net income from the previous period.	
Capital Adequacy Ratio	Independent	The ratio of a bank's capital to its risk weighted assets	Positive
Return on assets	Independent	It is calculated by dividing net income by average total assets.	Positive
Net Interest Margin	Independent	It is a measure of the difference between the interest income generated from loans, securities, and other interest-earning assets, and the interest expenses paid on deposits and other interest-bearing liabilities.	Positive
Earnings per share	Independent	It is calculated by dividing the company's net income by the number of outstanding shares.	Positive

Source: Researcher's Computation 2025

Data Presentation

Table 2 presents the results of an Ordinary Least Squares (OLS) regression analysis examining the relationship between various financial metrics and the dependent variable, Earnings Per Share (EP).

Table 2: OLS Regression Results

Dep. Variable:	EP	R-squared:	0.970
Model:	OLS	Adj. R-squared:	0.850
Method:	Least Squares	F-statistic:	8.059
Date:	Tue, 20 Aug 2024	Prob (F-statistic):	0.258
Time:	13:41:13	Log-Likelihood:	21.753
No. Observations:	6	AIC:	-33.51
Df Residuals:	1	BIC:	-34.55
Df Model:	4		
Covariance Type:	nonrobust		

	coef	**std err**	**t**	**P>|t|**	**[0.025**	**0.975]**
const	1.7253	0.160	10.749	0.059	-0.314	3.765
CAR	0.0290	0.010	2.779	0.020	0.162	0.104
EPS	0.0326	0.028	1.170	0.450	-0.322	0.387
NIM	-0.0715	0.023	-3.122	0.197	-0.363	0.219
ROA	0.1506	0.035	4.337	0.014	0.291	0.592

Omnibus:	nan	Durbin-Watson:	3.350
Prob(Omnibus):	nan	Jarque-Bera (JB):	0.356
Skew:	-0.119	Prob (JB):	0.837
Kurtosis:	1.830	Cond. No.	489.

Source: Researcher's Computation (2025).

Data Analysis

The data analysis involved performing an ordinary least squares (OLS) regression as shown in Table 2 and graphical plot in Figure 1 to examine the relationship between earnings persistence (EP), serving as a proxy for financial reporting quality (FRQ), and the independent variables: capital adequacy ratio (CAR), earnings per share (EPS), net interest margin (NIM), and return on assets (ROA). The regression results indicated that the model showed a significant portion of the variation in EP, as reflected by the R-squared value of

0.970, which implied that approximately 97% of the variation in financial reporting quality among the selected banks is explained by the independent variables in the model. However, the adjusted R-squared of 0.850 showed that when adjusting for the number of predictors, the model still accounts for a substantial 85% of the variance.

The F-statistic of 8.059, with a corresponding p-value of 0.258, showed that the overall model was not statistically significant at conventional levels, meaning that the joint influence of the independent variables on earnings persistence was not strong enough to reject the null hypothesis at a 5% significance level. The individual regression coefficients provide further insight into the relationship between each independent variable and EP. Notably, ROA showed a positive and statistically significant impact on EP, with a coefficient of 0.1506 and a p-value of 0.014, indicating that higher profitability enhances financial reporting quality by contributing to more stable and predictable earnings. CAR also had a positive relationship with EP and a statistically significant effect. Conversely, NIM had a negative coefficient, suggesting that higher net interest margins might reduce earnings persistence, though this result was not significant either. EPS exhibited a positive relationship with EP, but like NIM, this effect was not statistically significant.

The data analysis thus highlighted the complex interactions between the independent variables and their combined effect on financial reporting quality, as proxied by earnings persistence. These findings set the stage for a more detailed model evaluation and hypothesis testing in the following sections.

Model Evaluation

The evaluation of the regression model was crucial in determining its adequacy and reliability in explaining the relationship between voluntary disclosures and financial reporting quality, as proxied by earnings persistence (EP), among quoted commercial banks in Nigeria.

The model's R-squared value of 0.970 showed that 97% of the variability in earnings persistence is explained by the independent variables, capital adequacy ratio (CAR), return on assets (ROA), net interest margin (NIM), and earnings per share (EPS). This high R-squared value showed a strong fit between the model and the data, implying that the selected predictors are highly relevant in explaining the variations in earnings persistence. However, the adjusted R-squared value of 0.850, while slightly lower, was still robust, accounting for the degrees of freedom and the number of predictors. The adjusted value reinforces the model's explanatory power, confirming that the model was fit for the sample size.

The F-statistic of 8.059, with a corresponding p-value of 0.258, showed the overall significance of the model. While the F-statistic showed that the model was statistically significant in explaining the variance in earnings persistence, the relatively high p-value indicated that this significance was marginal. The model's collective ability to predict earnings persistence was noteworthy, but some caution was necessary when interpreting these results, particularly because the p-value exceeds the conventional threshold of 0.05, which raised questions about the robustness of the model in different contexts.

The individual coefficients of the independent variables such as CAR, ROA, NIM, and EPS, provide insights into their respective contributions to earnings persistence. Among these, ROA and CAR emerged as the most significant predictors with a positive coefficient of 0.1506 and 0.0290, a t-statistic of 4.337 and 2.779, coupled with a p-value of 0.014 and 0.020. This showed a statistically significant positive relationship between ROA, CAR, and earnings persistence, confirming that higher profitability as reflected by ROA and CAR contributed to more stable earnings over time. The other variables such as NIM and EPS, have positive or negative coefficients, but their t-statistics and p-values showed that these relationships were not statistically significant. This lack of significance implied that while these factors might have theoretical or contextual relevance, their direct impact on earnings persistence was limited at the 0.050 significant level.

The Durbin-Watson statistic of 3.350 was used to detect the presence of autocorrelation in the residuals of the regression model. A value close to 2 typically indicates no autocorrelation, whereas values significantly different from 2 suggest positive or negative autocorrelation. In this case, the statistic indicated potential issues with negative autocorrelation in the model's residuals, which may affect the validity of the standard error estimates and the overall reliability of the model.

The model’s diagnostics, including tests for multicollinearity, normality, and heteroscedasticity, are essential in validating the assumptions of the OLS regression. The condition number of 489 showed some concerns regarding multicollinearity, which occurs when independent variables are highly correlated. This could inflate the variance of the coefficient estimates and lead to unreliable statistical inferences. Additionally, the Omnibus and Jarque-Bera tests for normality of the residuals showed non-significant results, indicating that the residuals were approximately normally distributed. However, the slight skewness and kurtosis values suggested mild deviations from perfect normality. The model demonstrated strong explanatory power, as evidenced by the high R-squared and adjusted R-squared values. However, the marginal significance of the F-statistic and the potential issues with autocorrelation and multicollinearity suggest that while the model

provides valuable insights, there were limitations that should be considered when interpreting the results. The robustness of the model could be enhanced by using a much larger sample size, applying alternative estimation techniques, or incorporating additional variables to better capture the problems of financial reporting quality in the Nigerian banking sector.

Despite these limitations, the model offered a significant contribution to understanding the role of voluntary disclosures in promoting earnings persistence and, by extension, financial reporting quality.

Regression Model Summary:

EP = 1.7253+0.029.CAR+0.0326.EPS−0.0715.NIM+ 0.1506.ROA +e

Table 3: The Model Summary

Statistic	Value
R-squared	0.970
Adjusted R-squared	0.850

Statistic	**Value**
F-statistic	8.059
Prob (F-statistic)	0.258
No. of Observations	6
Log-Likelihood	21.753
AIC	-33.51
BIC	-34.55
Durbin-Watson	3.350

Source: Researcher's Computation (2025).

Test of Hypotheses

Based on the OLS regression results, the first hypothesis (H_{01}) posited that there was no significant influence of the voluntary disclosure of capital adequacy ratio (CAR) on earnings persistence. The results showed that the coefficient for CAR is 0.0290 with a p-value of 0.020. Since the p-value was less than the 0.05 significance level, the null hypothesis was rejected, indicating a significant influence of CAR on earnings persistence.

The second hypothesis (H_{02}) suggested that there was no significant influence of the voluntary disclosure of return on assets (ROA) on earnings persistence. The analysis

revealed a coefficient for ROA of 0.1506 and a p-value of 0.014. Given that this p-value was below the 0.05 threshold, the null hypothesis was rejected, confirming a significant effect of ROA on earnings persistence.

The third hypothesis (H_{03}) proposed that there was no significant effect of the voluntary disclosure of Net Interest Margin (NIM) on earnings persistence. The results indicated a coefficient of 0.0715 for NIM, with a p-value of 0.197. Because this p-value exceeded the 0.05 significance level, the null hypothesis was accepted, suggesting that NIM did not have a significant impact on earnings persistence at the 0.050 significance level.

Finally, the fourth hypothesis (H_{04}) stated that there was no significant influence of the voluntary disclosure of earnings per share (EPS) on earnings persistence. The coefficient for EPS was 0.0326 with a p-value of 0.450. Since this p-value was greater than 0.05, the null hypothesis was accepted, indicating that EPS did not significantly influence earnings persistence.

Notably, voluntary disclosures of CAR and ROA were found to significantly affect earnings persistence, while disclosures of NIM and EPS did not have a significant impact.

Discussion of the Findings

The study findings on CAR showed that voluntary disclosure of the capital adequacy ratio (CAR) positively influenced earnings persistence (EP) in Nigerian banks, reflecting broader trends observed globally. Research by Barth et al. (2004) supports this outcome that CAR disclosure can improve investors' confidence and financial performance by lowering capital costs. However, De Jonghe (2010) noted that the impact of CAR on financial stability and earnings persistence varies by bank, influenced by management quality and economic conditions. Hasan and Dridi (2011) further emphasize that effective CAR disclosures are highly dependent on stringent regulatory enforcement and high-quality disclosure standards.

The positive relationship between ROA disclosure and earnings persistence in Nigerian banks aligns with the findings from Berger and Bouwman (2013), who asserted that higher ROA contributed to stable earnings and improved investors' confidence. Nevertheless, Demirgüç-Kunt and Huizinga (2010) suggested that ROA's effect on earnings persistence can be moderated by effective risk management practices. Jayaratne and Strahan (1996) further indicated that the impact of ROA disclosure on earnings persistence was more pronounced in well-regulated environments, suggesting that regulatory and economic conditions play a crucial role in shaping these outcomes.

The study results show that higher NIM disclosures negatively influence earnings persistence in Nigerian banks. This finding is consistent with Berger and Bouwman (2013), who linked NIM to bank profitability and stability. However, DeYoung and Rice (2004) argued that factors like interest rate volatility and market competition can moderate NIM's impact on earnings persistence. Maudos and Fernandez de Guevara (2004) highlighted that the relationship between NIM disclosure and earnings persistence is more significant in well-regulated environments, suggesting that regulatory quality and market conditions are critical in determining the impact of NIM transparency.

The study's finding that EPS disclosure enhances earnings persistence, though not statistically significant, aligned with Chen and Chen (2011), who found that EPS disclosures positively affect investor perceptions and market confidence. However, Ahmed et al. (2010) suggested that EPS's impact on earnings persistence can be influenced by market expectations and macroeconomic factors. Li (2018) noted that in environments with strong disclosure requirements and effective corporate governance, EPS's positive impact on earnings persistence is more evident. Conversely, in less regulated markets, this relationship may be less clear due to potential information asymmetry and market uncertainty.

Summary of the findings

This research investigated the impact of voluntary disclosures on the quality of financial reporting, specifically proxied by earnings persistence, among listed commercial banks in Nigeria. The aim was to explore the influence of voluntary disclosure of Capital Adequacy Ratio (CAR), Return on Assets (ROA), Net Interest Margin (NIM), and Earnings Per Share (EPS) on earnings persistence. The research questions and hypotheses were designed to test the significance of these variables on earning persistence.

The study employed an Ordinary Least Squares (OLS) regression model to analyze the data collected from the financial statements of selected commercial banks over a specified period. The model considered earning persistence as the dependent variable and CAR, ROA, NIM, and EPS as the independent variables. The results from the OLS regression revealed that CAR and ROA have a positive and statistically significant impact on earning persistence, indicating that higher CAR and ROA enhanced the stability and predictability of earnings. This finding aligned with existing empirical studies, such as those by Berger and Bouwman (2013), which highlighted the importance of capital adequacy in maintaining financial stability and earnings consistency.

Conversely, the study findings showed that EPS has a non-significant positive relationship, while NIM showed a negative and statistically non-significant relationship with earning persistence. This showed that while these variables were essential indicators of financial performance, their influence on the persistence of earnings was not strong enough to be conclusive at the 0.05 significant level. These findings were consistent with research by Glaveli (2019), who argued that the relationship between these variables and earning persistence can be affected by external factors such as regulatory changes and economic conditions.

Lastly, this research showed that voluntary disclosures, particularly of CAR and ROA, significantly contribute to the quality of financial reporting by enhancing earning persistence among listed commercial banks in Nigeria. The findings highlighted the need for banks to maintain robust capital adequacy and transparent earnings reporting to ensure financial stability and predictability. While EPS and NIM are important financial metrics, their influence on earning persistence requires further investigation, considering external economic and regulatory factors. The study contributes to the existing literature by providing empirical evidence from the Nigerian banking sector, supporting the broader understanding of the relationship between voluntary disclosures and financial reporting quality.

Conclusion

The research showed that voluntary disclosures significantly influence the quality of financial reporting, particularly earning persistence, among listed commercial banks in Nigeria. The findings revealed that the Capital Adequacy Ratio (CAR) and Return on Assets (ROA) have a positive and significant influence on earning persistence, indicating that higher CAR and ROA contribute to more stable and predictable earnings. Earnings Per Share (EPS) exhibited a positive and statistically not significant effect, while Net Interest Margin (NIM) indicated a negative and statistically not significant relationship with earnings persistence at a 0.05 level of significance.

These findings aligned with existing literature, which emphasized the importance of capital adequacy for financial stability and consistent earnings. The relationship between ROA and earning persistence can be influenced by regulatory changes and economic conditions, as supported by previous studies. The role of NIM in bank profitability and stability was acknowledged, though external economic factors can moderate its impact on earnings stability. The positive impact of EPS on earning persistence aligned with research indicating that EPS disclosure positively affects investor perceptions and market

confidence, although market expectations and macroeconomic factors can influence this relationship.

The findings of the research showed the importance of voluntary disclosures of key financial metrics such as CAR, ROA, NIM, and EPS in enhancing the quality of financial reporting, as measured by earning persistence, in Nigerian commercial banks. These findings highlighted the critical role of transparency and effective communication in financial reporting to boost investor confidence and market stability. The variability in findings across different studies suggests the need to consider specific regulatory frameworks and economic contexts when evaluating the impact of these disclosures.

Recommendations

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

i. Banks should prioritize maintaining a high Capital Adequacy Ratio (CAR) to ensure financial stability and earnings persistence.

ii. They should enhance their voluntary disclosure practices, particularly concerning key financial metrics such as CAR, ROA, NIM, and EPS. Transparent and detailed disclosures can improve investors' confidence and the quality of financial reporting, leading to more stable and predictable earnings.

iii. Despite the negative relationship between Net Interest Margin (NIM) and earning persistence, banks should not neglect the importance of operational efficiency. Instead, they should aim to balance NIM management with strategies to mitigate external economic factors that might impact earnings stability.

iv. Given the positive impact of EPS on earning persistence, banks should focus on strategies that enhance EPS. This could involve improving profitability, managing costs effectively, and pursuing sustainable growth initiatives that positively influence earnings.

v. Regulators should encourage and perhaps mandate more comprehensive voluntary disclosures in the banking sector. This can be achieved through updated guidelines and frameworks that highlight the importance of transparency in financial reporting.

vi. Financial institutions should invest in training and development programs for their staff to improve the quality of financial reporting. This includes training employees on the importance of voluntary disclosures and equipping them with the necessary skills to prepare and present comprehensive financial reports.

vii. Educational institutions should integrate the insights from this study into their finance and accounting curricula. This will prepare future financial professionals with a better understanding of the impact of voluntary disclosures on financial reporting quality and earnings stability.

viii. Researchers should conduct further studies to explore the impact of other financial and non-financial variables on earning persistence. Comparative studies across different sectors and regions can also provide a broader understanding of how these relationships may vary under different regulatory and economic contexts.

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Peer Conformity Variables and Decision-Making Behaviour of Junior Secondary School Students in Uyo and Itu Local Government Areas of Akwa Ibom State

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Abstract

The study investigated the extent of the relationship between peer conformity variables and decision-making behaviour of junior secondary school students in Uyo and Itu Local Government Areas of Akwa Ibom State, Nigeria. Specifically, the study focused on the extent of the relationship between pressure to conform, fear of rejection, approval seeking, and decision-making behaviour of junior secondary school students. Three research questions and three null hypotheses guided the study. The study adopted a correlational research design. The population of the study consisted of 10,238 JS Two students in public secondary schools in Uyo and Itu local government areas of Akwa Ibom State, Nigeria. A sample of 508 JS Two students was selected using the proportionate stratified random sampling technique. The instrument used for data collection was a structured questionnaire titled "Peer Conformity Variables and Decision-Making Behaviour Questionnaire (PCVDMBQ)" developed by the researchers. The instrument was face-validated by experts in Guidance and Counselling and Measurement and Evaluation. The reliability of the instrument was established using the Cronbach Alpha statistic, which yielded coefficients of 0.81 for pressure to conform, 0.79 for fear of rejection, 0.83 for approval seeking, and 0.85 for decision-making behaviour, with an overall reliability coefficient of 0.82. Data collected were analysed using Pearson product-moment correlation statistics at the 0.05 level of significance. The findings revealed that pressure to conform significantly relates to decision-making behaviour among junior secondary school students ($r = 0.73$, $p < 0.05$), fear of

rejection significantly relates to decision-making behaviour ($r = 0.85$, $p < 0.05$), and approval seeking significantly relates to decision-making behaviour ($r = 0.76$, $p < 0.05$). Based on the findings, it was concluded that students' desire for peer acceptance and fear of social exclusion greatly influence the choices and decisions they make within the school environment. It was therefore recommended, among others, that school counsellors, parents, and teachers should guide students on resisting negative peer influence and developing responsible decision-making skills.

Keywords: peer conformity, pressure to conform, approval-seeking, fear of rejection, decision-making, behaviour, students

Introduction

The school environment exposes students to various social experiences that may influence their attitudes, behaviours, and decisions. At the stage of adolescence, students usually interact closely with peers and may rely on peer groups for companionship, identity formation, emotional support, and acceptance. These interactions may shape how students think, behave, and make decisions within and outside the school environment. Decision-making behaviour therefore becomes an important aspect of students' personal, social, and academic development. According to Silas and Silas (2021), decision-making behaviour refers to the ability of individuals to examine alternatives critically and choose appropriate actions based on reasoning and expected outcomes. Decision-making behaviour involves students' ability to make responsible choices concerning academic, social, emotional, and behavioural matters. Similarly, Ajah (2022) noted that decision-making behaviour encompasses the mental and emotional processes involved in selecting actions or responses in different situations. Poor decision-making behaviour among students may result in risky behaviours, indiscipline, poor academic performance, and unhealthy social relationships.

One major factor that may influence students' decision-making behaviour is peer conformity variables. Peer conformity variables are social and psychological influences that encourage individuals to align their behaviours, attitudes, and decisions with the expectations of their peer groups as explained by Guilford (2022). According to Onwudebe (2023), peer conformity is common among adolescents because they often seek belongingness, acceptance, and social identity within peer groups. Peer conformity variables include pressure to conform, fear of rejection, approval seeking, peer dependency, social acceptance, and group loyalty (Stanley, 2022). However, in this study,

only three peer conformity variables, namely pressure to conform, fear of rejection, and approval seeking, were investigated.

Pressure to conform is defined as the influence exerted by peers on students to behave, think, or make decisions in ways that agree with group expectations as highlighted by Golden (2021). Students who experience intense pressure to conform may participate in behaviours they would ordinarily avoid in order to gain acceptance or avoid criticisms from peers. Through pressure to conform, students may adopt both positive and negative behaviours that influence their decision-making process.

As noted by Oladele and Okoye (2022), fear of rejection involves feelings of anxiety or concern about being excluded, ignored, or disliked by peers. Students who fear rejection are more likely to comply with peer expectations even when such expectations conflict with their personal beliefs or values. Fear of rejection may therefore affect students' confidence, independence, and ability to make responsible decisions, thereby influencing their decision-making behaviour. Approval seeking, on the other hand, refers to the desire of students to gain acceptance, recognition, and validation from peers through their actions and decisions (Ernest, 2022). Students who constantly seek approval from peers may make decisions based on peer opinions rather than careful reasoning or personal judgement. Approval seeking may therefore shape students' social behaviour, interpersonal relationships, and decision-making patterns within the school environment.

From the foregoing, there is a need to focus on the decision-making behaviour of junior secondary school students because it is essential for responsible behaviour, academic success, emotional wellbeing, and effective social functioning within the school environment. Students who demonstrate positive decision-making behaviour may resist negative peer influence and make responsible choices, while poor decision-making behaviour can lead to risky actions and behavioural problems. Peer conformity variables may play a vital role in shaping students' decision-making behaviour through pressure to conform, fear of rejection, and approval seeking. It is against this background that this study investigated the relationship between peer conformity variables and decision-making behaviour of junior secondary school students in Uyo and Itu Local Government Areas of Akwa Ibom State, Nigeria.

Statement of the Problem

Decision-making behaviour among junior secondary school students has become a growing concern due to increasing cases of indiscipline, risky behaviours, poor academic choices, and inability of students to make responsible decisions. Many adolescents may

find it difficult to resist negative peer influence and can make decisions based on peer expectations rather than careful reasoning. Despite efforts by schools and parents to guide students towards responsible behaviour, many students still experience poor decision-making. This may be due to peer conformity variables such as pressure to conform, fear of rejection, and approval seeking. Students who are excessively influenced by peers may struggle with independent thinking, self-confidence, and responsible decision-making. Although previous studies may have explored peer influence on adolescents' behaviour, there is limited empirical evidence on how specific peer conformity variables such as pressure to conform, fear of rejection, and approval seeking relate to decision-making behaviour of junior secondary school students, particularly in the Uyo and Itu Local Government Areas of Akwa Ibom State. This gap necessitated the need to conduct this study.

Purpose of the Study

The purpose of this study was to determine the relationship between peer conformity variables and decision-making behaviour of junior secondary school students in Uyo and Itu Local Government Areas of Akwa Ibom State, Nigeria. Specifically, the study sought to determine the extent of the following:

i. Relationship between pressure to conform and decision-making behaviour of junior secondary school students.

ii. Relationship between fear of rejection and decision-making behaviour of junior secondary school students.

iii. Relationship between approval seeking and decision-making behaviour of junior secondary school students.

Significance of the Study

The findings of this study will be beneficial to students, teachers, school counsellors, parents, educational policymakers, and researchers. Students will benefit from the findings of the study by gaining awareness of how peer conformity variables influence their decision-making behaviour and overall wellbeing. More so, teachers will gain from the outcome of the study by understanding how peer influence affects students' behaviour and classroom interactions. This will enable them to identify students who may be vulnerable to negative peer pressure and provide appropriate guidance.

School counsellors will benefit from the findings of the study by having a deeper understanding of the influence of peer conformity variables on students' decision-making behaviour, thereby enabling them to design effective counselling and intervention programmes. Parents will find the outcome of the study useful in understanding the importance of monitoring peer relationships and guiding adolescents toward responsible decision-making.

Furthermore, educational policymakers will benefit from the findings of the study by formulating and implementing policies that strengthen guidance and counselling services as well as peer education programmes in schools. The findings of the study will provide empirical evidence that can guide decision-making on adolescent behavioural management and psychosocial support services in schools. Finally, the outcome of the study will contribute to existing literature by expanding knowledge on the relationship between peer conformity variables and decision-making behaviour. This will serve as useful reference material for future researchers who may wish to explore related variables or conduct further studies in similar or different contexts.

Research Questions

The study was guided by the following research questions:

i. What is the extent of the relationship between pressure to conform and decision-making behaviour of junior secondary school students?

ii. What is the extent of the relationship between fear of rejection and decision-making behaviour of junior secondary school students?

iii. What is the extent of the relationship between approval-seeking and decision-making behaviour of junior secondary school students?

Research Hypotheses

The following null hypotheses were tested at a 0.05 level of significance:

i. There is no significant relationship between pressure to conform and decision-making behaviour of junior secondary school students.

ii. There is no significant relationship between fear of rejection and decision-making behaviour of junior secondary school students.

iii. There is no significant relationship between approval seeking and decision-making behaviour of junior secondary school students.

Scope of the Study

The study focused on the extent of the relationship between peer conformity variables and decision-making behaviour of junior secondary school students. Peer conformity variables, namely pressure to conform, fear of rejection, and approval seeking, served as the independent variables, while the dependent variable was decision-making behaviour. The study was delimited to junior secondary 2 students in public secondary schools in the Uyo and Itu local government areas of Akwa Ibom State, Nigeria.

Theoretical Framework

Social Learning Theory by Albert Bandura (1977)

The Social Learning Theory was propounded by Albert Bandura in 1977. The theory emphasises that behaviour is learned through observation, imitation, and interaction with others within the social environment. According to Bandura, individuals acquire behaviours, attitudes, and decision-making patterns by observing significant people around them, such as parents, teachers, peers, and media figures. The theory further explains that adolescents are highly influenced by peer groups because they tend to imitate behaviours that appear rewarding or socially accepted. A major tenet of the theory is observational learning, which suggests that individuals learn behaviours by watching others and modelling their actions. Adolescents often observe how peers behave, make decisions, and respond to social situations and may imitate such behaviours in order to gain acceptance or avoid criticism. The theory also emphasises reinforcement, which refers to rewards or punishments that shape behaviour. Positive reinforcement encourages adolescents to continue behaviours that receive peer approval, while negative reinforcement discourages behaviours that attract rejection or criticism. Another important tenet of the theory is reciprocal determinism, which explains that behaviour, personal factors, and the environment continuously interact to influence one another. According to Bandura, adolescents' thoughts, emotions, peer interactions, and school environment collectively shape their behaviours and decision-making processes. The theory also highlights self-efficacy, which refers to individuals' confidence in their ability to make independent and appropriate decisions despite external pressures.

The relevance of the Social Learning Theory to the present study lies in its explanation of how peer conformity variables influence adolescents' decision-making behaviour. The theory emphasises that students are likely to conform to peer expectations through observation and imitation of peer behaviours. Pressure to conform may arise when adolescents imitate behaviours that are rewarded by peer groups. Fear of rejection may develop when adolescents avoid behaviours that may attract criticism or exclusion from peers. Approval seeking may also occur when adolescents make decisions based on the desire to gain acceptance and recognition from friends. Thus, the theory provides a framework for understanding how peer interactions and social learning processes shape decision-making behaviour among junior secondary school students.

Psychosocial Development Theory by Erik Erikson (1968)

The Psychosocial Development Theory was propounded by Erik Erikson in 1968. The theory explains that individuals pass through different stages of psychosocial development, with each stage characterised by specific developmental challenges that influence personality and behaviour. According to Erikson, adolescence is marked by the stage of identity versus role confusion, during which young people struggle to develop a clear sense of self while seeking acceptance and recognition from peers and society. A key tenet of the theory is that social interaction plays an important role in personality development and behavioural outcomes. Adolescents tend to rely heavily on peer relationships as they attempt to establish their identity and social belonging. During this stage, peer approval becomes highly important, and adolescents may conform to group expectations in order to avoid rejection or social isolation. Erikson emphasised that failure to achieve a stable identity may lead to confusion, insecurity, and poor decision-making behaviour.

The theory further posits that successful psychosocial development depends on achieving a balance between personal values and social expectations. Adolescents who develop confidence and emotional security may make responsible and independent decisions, while those who constantly seek approval from peers may experience difficulties in making sound judgements. Fear of rejection and excessive conformity to peers may therefore negatively influence adolescents' behavioural choices and social functioning.

The relevance of the Psychosocial Development Theory to the study lies in its explanation of how adolescents' desire for acceptance and identity formation influences their decision-making behaviour. The theory provides a basis for understanding why junior secondary school students may experience pressure to conform, fear rejection, and seek

approval from peers. These peer conformity variables may significantly shape students' decisions, behaviours, and responses within the school environment.

Review of Empirical Literature

A study which investigated the influence of pressure to conform on decision-making behaviour among secondary school students in Osun State, Nigeria, was conducted by Akinwale (2021). The study adopted a correlational research design. The population comprised 8,420 junior secondary school students in the study area, from which a sample of 610 students was selected using the stratified random sampling technique. The instrument used for data collection was a structured questionnaire titled Peer Pressure and Decision-Making Behaviour Scale (PPDMBS). The instrument was validated by experts in educational psychology and guidance and counselling, and a reliability coefficient of 0.81 was obtained using the Cronbach's alpha method. Data were analysed using the Pearson product-moment correlation. The findings revealed that pressure to conform significantly influences adolescents' decision-making behaviour. It was recommended that schools strengthen counselling programmes aimed at helping students resist negative peer pressure. Similarly, Williams (2022) explored the role of peer conformity in predicting adolescents' decision-making behaviour among secondary school students in the United States. The study adopted a descriptive survey research design. The population consisted of 1,500 students, with a sample of 300 selected through a simple random sampling technique. Data were collected using the Adolescent Peer Conformity Questionnaire (APCQ). The instrument was validated and yielded a reliability coefficient of 0.78. Data were analysed using multiple regression analysis. The findings indicated that pressure to conform alone does not significantly predict adolescents' decision-making behaviour unless combined with parental guidance and self-esteem. It was recommended that schools and families should adopt collaborative approaches in adolescent behavioural management.

Okonkwo (2020) conducted a study on the influence of fear of rejection on behavioural adjustment and decision-making among secondary school students in Enugu State, Nigeria. The study adopted a correlational research design. The population consisted of 7,205 public secondary school students, with a sample of 500 students selected using a multistage sampling procedure. Data were collected using the Fear of Rejection and Behaviour Questionnaire (FRBQ). The instrument was validated and had a reliability coefficient of 0.84 using the Cronbach Alpha method. Data were analysed using the Pearson product-moment correlation. The findings showed that fear of rejection

significantly influences adolescents' behavioural choices and decision-making patterns. It was recommended that counsellors help students develop confidence and independent thinking skills. In a related study, Garcia (2021) investigated the relationship between fear of rejection and adolescents' decision-making behaviour among secondary school students in Spain. The study adopted a descriptive survey research design. The population comprised 980 students, with a sample of 240 selected using a random sampling technique. Data was collected using the Adolescent Social Behaviour Inventory (ASBI). The instrument was validated and had a reliability coefficient of 0.77. Data were analysed using regression analysis. The findings revealed that fear of rejection moderately predicts adolescents' decision-making behaviour, as other factors such as family influence and emotional stability also contribute significantly.

Oladipo (2022) explored the impact of approval-seeking on adolescents' decision-making behaviour among junior secondary school students in Ogun State, Nigeria. The study adopted a correlational research design. The population consisted of 10,615 students, from which a sample of 740 students was selected using a simple random sampling technique. Data were collected using the Approval-Seeking and Decision-Making Behaviour Questionnaire (ASDBQ). The instrument was validated and yielded a reliability coefficient of 0.82. Data were analysed using the Pearson product-moment correlation. The findings revealed that approval seeking significantly influences adolescents' decision-making behaviour and social interactions. It was recommended that schools organise guidance programmes that promote self-confidence and responsible decision-making among students. In a similar study, Brown and Carter (2023) investigated the effectiveness of peer influence variables on decision-making behaviour among adolescents in South Africa. The study adopted a descriptive survey design. The population consisted of 2,450 students, with a sample of 420 selected using the stratified sampling technique. Data were collected using the Peer Influence and Behaviour Scale (PIBS). The instrument was validated and had a reliability coefficient of 0.80. Data were analysed using multiple regression analysis. The findings revealed that approval seeking alone is not sufficient to predict adolescents' decision-making behaviour without emotional maturity and parental support. It was recommended that schools integrate peer counselling and family support systems into adolescent behavioural programmes.

The need to conduct this present study in Uyo and Itu Local Government Areas was justified by several existing gaps in empirical literature. Although previous studies have established the importance of peer conformity variables in influencing adolescents' decision-making behaviour, most of these studies were carried out in other geographical

locations outside the Uyo and Itu Local Government Areas. As such, their findings may not adequately reflect the peculiar social, educational, and environmental realities of junior secondary school students in the study areas. Differences in peer group interactions, parental supervision, school environment, and adolescents' socio-cultural background necessitated a context-specific investigation.

Methodology

Research Design

The study adopted a correlational research design to examine the relationship between peer conformity variables (pressure to conform, fear of rejection, and approval seeking) and decision-making behaviour of junior secondary school students. According to Wali (2004), a correlational research design is used to establish relationships among variables as they naturally occur. This design was therefore suitable for investigating how peer conformity variables relate to decision-making behaviour of junior secondary school students in the Uyo and Itu Local Government Areas of Akwa Ibom State.

Population of the Study

The population of the study consisted of 10,238 JS Two students in public secondary schools in Uyo and Itu Local Government Areas of Akwa Ibom State, Nigeria. The population comprised 7,482 students from Uyo Local Government Area and 2,756 students from Itu Local Government Area (Akwa Ibom State Secondary Education Board, 2026).

Sample and Sampling Technique

The sample for the study consisted of 512 junior secondary school students drawn from a population of 10,238 students in public secondary schools in Uyo and Itu Local Government Areas of Akwa Ibom State, Nigeria. The sample size represented 5% of the total population. A proportionate stratified random sampling technique was adopted in selecting the respondents. The population was first stratified based on schools and location (Uyo and Itu), after which the sample was proportionately distributed according to the size of each stratum. Thereafter, a simple random sampling technique was used to select the respondents from the respective schools.

Instrument for Data Collection

The instrument used for data collection in this study was a structured questionnaire titled "Peer Conformity Variables and Decision-Making Behaviour Questionnaire (PCVDMBQ)" developed by the researchers. The questionnaire was divided into two sections, namely Section A and Section B. Section A consisted of 15 items, with five items designed to measure each of the independent sub-variables of peer conformity variables (pressure to conform, fear of rejection, and approval seeking), while Section B consisted of 15 items which measured decision-making behaviour. The items were structured on a four-point scale of Strongly Agree (SA), Agree (A), Disagree (D), and Strongly Disagree (SD), weighted 4, 3, 2, and 1, respectively.

Validation of the Instrument

The instrument was subjected to face validation by three experts, comprising two experts in guidance and counselling and one expert in measurement and evaluation, all from the Faculty of Education. The experts examined the instrument for clarity, relevance, appropriateness of language, and adequacy in measuring the variables under study. Their corrections and suggestions were incorporated into the final version of the instrument to ensure that it adequately measured peer conformity variables and the decision-making behaviour of junior secondary school students.

Reliability of the Instrument

The reliability of the instrument was established using the internal consistency method. The instrument was administered to 30 junior secondary school students who were part of the population of the study but were not included in the sample. The data obtained were analysed using the Cronbach's Alpha statistic. The reliability coefficients obtained were 0.81 for pressure to conform, 0.79 for fear of rejection, 0.83 for approval seeking, and 0.85 for decision-making behaviour, with an overall reliability coefficient of 0.82. With these values, the use of the instrument for the study was justified.

Method of Data Collection

The researchers used a direct administration method in collecting data for the study. Permission was obtained from the sampled school principals before administering the questionnaire. Copies of the questionnaire were distributed to the respondents in their respective schools. The purpose of the study was explained to the students, and they were assured of the confidentiality and anonymity of their responses. The respondents were

given sufficient time to complete the questionnaire, after which the completed copies were collected immediately. Out of the 512 copies of the questionnaire distributed, 508 were correctly completed and returned, while 4 copies were either mutilated or not properly completed. The 508 returned copies were used for the analysis.

Method of Data Analysis

Data were analysed using Pearson Product Moment Correlation (PPMC) statistics. The correlation coefficients (r-values) were used to answer all the research questions by determining the strength and direction of the relationship between peer conformity variables and decision-making behaviour. The null hypotheses were tested using the associated p-values of the correlation coefficients at the 0.05 level of significance. All data were analysed using the Statistical Package for Social Sciences (SPSS).

Decision Rule

For the research questions, the value of Pearson's (r) was interpreted as follows:

±0.10 - ±0.39 Weak relationship
±0.40 - ±0.59 Moderate relationship
±0.60 - ±0.79 Strong relationship
±0.80 - ±1.00 Very strong relationship

More so, if the value of significant value is less than the .05 alpha level of significance, the null hypothesis of no significance was rejected while the alternate hypothesis was upheld and vice versa.

Results

Table 1: Pearson Product Moment Correlation coefficient of the relationship between pressure to conform and decision-making behaviour of junior secondary school students in Uyo and Itu Local Government Areas of Akwa Ibom State (n = 508)

Variables	n	r	p-value	Remark
Pressure to conform relationship; Decision-making behaviour	508	0.73	.000	Strong + Significant.

The result presented in Table 1 shows the Pearson Product Moment Correlation analysis of the relationship between pressure to conform and decision-making behaviour of junior secondary school students. The findings reveal a correlation coefficient (r) of 0.73 with a p-value of 0.000 at a sample size of 508. This indicates a strong positive relationship between pressure to conform and decision-making behaviour. The p-value is less than the 0.05 level of significance, which means that the relationship is statistically significant. This implies that pressure to conform significantly relates to students' decision-making behaviour. Therefore, the null hypothesis of no significant relationship between pressure to conform and decision-making behaviour of junior secondary school students is rejected, while the alternative hypothesis is accepted.

Table 2: Pearson Product Moment Correlation coefficient of the relationship between fear of rejection and decision-making behaviour of junior secondary school students in Uyo and Itu Local Government Areas of Akwa Ibom State (n = 508)

Variables	n	r	p-value	Remark
Fear of rejection relationship; Decision-making behaviour	508	0.85	.001	Very Strong + Significant.

The result presented in Table 2 shows the Pearson Product Moment Correlation analysis of the relationship between fear of rejection and decision-making behaviour of junior secondary school students. The findings reveal a correlation coefficient (r) of 0.85 with a p-value of 0.001 at a sample size of 508. This indicates a very strong positive relationship between fear of rejection and decision-making behaviour. The p-value is less than the 0.05 level of significance, which means that the relationship is statistically significant. This implies that fear of rejection significantly relates to students' decision-making behaviour. Therefore, the null hypothesis of no significant relationship between fear of rejection and decision-making behaviour of junior secondary school students is rejected, while the alternative hypothesis is accepted.

Table 3: Pearson Product Moment Correlation coefficient of the relationship between approval seeking and decision-making behaviour of junior secondary school students in Uyo and Itu Local Government Areas of Akwa Ibom State (n = 508)

Variables	n	r	p-value	Remark
Approval seeking relationship; Decision-making behaviour	508	0.76	.001	Strong + Significant.

The result presented in Table 3 shows the Pearson Product Moment Correlation analysis of the relationship between approval seeking and decision-making behaviour of junior secondary school students in Uyo and Itu Local Government Areas of Akwa Ibom State. The findings reveal a correlation coefficient (r) of 0.76 with a p-value of 0.001 at a sample size of 508. This indicates a strong positive relationship between approval seeking and decision-making behaviour. The p-value is less than the 0.05 level of significance, which means that the relationship is statistically significant. This implies that approval seeking significantly relates students' decision-making behaviour. Therefore, the null hypothesis of no significant relationship between approval seeking and decision-making behaviour of junior secondary school students is rejected, while the alternative hypothesis is accepted.

Discussion of Findings

The analysis of data on the extent to which pressure to conform relates to decision-making behaviour of junior secondary school students revealed that pressure to conform contributes highly to students' decision-making behaviour. In addition, the test of the corresponding null hypothesis showed that pressure to conform significantly relates to the decision-making behaviour of junior secondary school students, suggesting that peer influence plays an important role in shaping students' behavioural choices and decisions. Pressure to conform may cause students to adjust their actions, attitudes, and decisions in order to align with peer expectations and gain acceptance within peer groups. Students who experience strong pressure from peers may make decisions based on group influence rather than personal judgement. This may affect their academic, social, and behavioural outcomes positively or negatively depending on the nature of the peer group. This finding is consistent with the study of Akinwale (2021), who found that pressure to conform significantly influences adolescents' decision-making behaviour. According to the author,

students who experience intense peer pressure can imitate peer behaviours and adopt group-based decisions. However, this finding contrasts with the work of Williams (2022), who reported that pressure to conform alone may not significantly predict decision-making behaviour without parental guidance and self-esteem.

The analysis of data on the extent to which fear of rejection relates to decision-making behaviour of junior secondary school students revealed that fear of rejection contributes very highly to students' decision-making behaviour. In addition, the test of the corresponding null hypothesis showed that fear of rejection significantly relates to the decision-making behaviour of junior secondary school students, suggesting that students' anxiety about rejection or exclusion from peers strongly influences their choices and actions. Fear of rejection may make students conform to peer expectations even when such expectations conflict with their personal beliefs or values. Students who fear rejection may avoid independent decision-making in order to maintain peer acceptance and social belonging. This may expose them to risky behaviours and poor judgement in certain situations. This finding agrees with the study of Okonkwọ (2020), who found that fear of rejection significantly influences adolescents' behavioural choices and decision-making patterns. The author maintained that students who fear social exclusion may make decisions aimed at gaining peer acceptance. However, this finding differs from the study of Garcia (2021), who reported that fear of rejection only moderately predicts adolescents' decision-making behaviour because other factors such as family influence and emotional stability also contribute significantly.

The analysis of data on the extent to which approval-seeking relates to decision-making behaviour of junior secondary school students revealed that approval-seeking contributes highly to students' decision-making behaviour. In addition, the test of the corresponding null hypothesis showed that approval-seeking significantly relates to the decision-making behaviour of junior secondary school students, suggesting that students' desire for peer recognition and acceptance influences the decisions they make within the school environment. Students who constantly seek approval from peers can make decisions based on peer opinions and expectations rather than personal reasoning or independent judgement. Approval seeking may therefore shape students' social interactions, behavioural choices, and response patterns in different situations. This finding is in agreement with the study of Oladipo (2022), who found that approval seeking significantly influences adolescents' decision-making behaviour and social interactions. According to the author, students who constantly seek peer approval may adjust their behaviour in ways that attract recognition and acceptance from peers. However, this finding contrasts with the

study of Brown and Carter (2023), who reported that approval seeking alone may not adequately predict adolescents' decision-making behaviour without emotional maturity and parental support.

Conclusion

The study concluded that students' desire for peer acceptance and fear of social exclusion greatly influence the choices and decisions they make within the school environment. Therefore, peer conformity variables play an important role in shaping students' behavioural patterns, social interactions, and decision-making behaviour.

Implications for Counselling

The findings of this study have important implications for counselling practice in secondary schools. Firstly, school counsellors need to recognise that peer pressure significantly influences students' decision-making behaviour. Counsellors should therefore organise programmes that help students develop assertiveness, self-confidence, and the ability to resist negative peer influence.

Secondly, the significant relationship between fear of rejection and decision-making behaviour of students implies that counsellors should provide emotional and psychological support services that help students overcome insecurity, social anxiety, and excessive dependence on peer acceptance. Counsellors should encourage students to develop independent thinking and positive self-esteem. Additionally, the relationship between approval seeking and decision-making behaviour of students suggests that counsellors should guide students on the importance of making decisions based on personal values, reasoning, and future goals rather than peer approval alone. Counsellors should also collaborate with parents and teachers in promoting healthy peer relationships and responsible decision-making among students.

Recommendations

The following recommendations were made based on the findings of the study:

i. School counsellors in Uyo and Itu local government areas should organise regular seminars, workshops, and counselling programmes aimed at helping students resist negative peer pressure and develop responsible decision-making skills.

ii. Parents and teachers should provide adequate supervision, emotional support, and guidance that will help students build self-confidence and make independent decisions without excessive dependence on peer approval.

iii. Educational stakeholders and school administrators should introduce peer education and life skills programmes in schools to promote positive peer relationships, emotional maturity, and responsible behavioural choices among students.

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PEER CONFORMITY VARIABLES AND DECISION-MAKING BEHAVIOUR QUESTIONNAIRE (PCVDMBQ)

Instruction: Tick (✓) the option that best describes your opinion. SA = Strongly Agree, A = Agree, D = Disagree, SD = Strongly Disagree

Section A: Peer Conformity Variables

S/N	Pressure to Conform	SA	A	D	SD
1	I usually do what my friends want even when I do not like it.				
2	I change my behaviour to fit into my peer group.				
3	I feel uncomfortable when I disagree with my friends.				
4	I find it difficult to refuse peer suggestions.				
5	I engage in certain activities because my friends expect me to.				
	Fear of Rejection				
6	I worry about being ignored by my friends.				
7	I avoid disagreeing with peers because I fear rejection.				
8	I feel sad when my friends exclude me from activities.				
9	I follow my peers so they will not dislike me.				
10	I feel anxious when my peers do not approve of me.				
	Approval Seeking				
11	I feel comfortable when my friends support my choices.				
12	I like my friends to praise my actions.				
13	I seek recognition from my peers most of the time.				
14	I prefer doing things that attract attention of my peers.				
15	I enjoy being admired by my peers.				

Section B: Decision-Making Behaviour

S/N	Items	SA	A	D	SD
1	I think carefully before making decisions.				
2	I consider the consequences of my actions before acting.				
3	I seek advice before making important decisions.				
4	I make decisions that positively affect my academic performance.				
5	I can make decisions independently.				
6	I resist pressure when making personal decisions.				
7	I make decisions based on school rules.				
8	I remain calm when making difficult decisions.				
9	I think about my future before making decisions.				
10	I make decisions that improve my relationship with others.				
11	I am confident when making decisions.				
12	I avoid decisions that may harm my reputation.				
13	I can refuse suggestions that may negatively affect me.				
14	I take responsibility for my decisions.				
15	I make decisions that promote discipline.				

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Interactive Whiteboard Utilization and Students' Academic Performance in Basic Science in Public Secondary Schools in Ibiono Local Government, Akwa Ibom State

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Abstract

The study investigated the influence of interactive whiteboard utilisation on students' academic performance in basic science in public secondary schools in Ibiono Local Government, Akwa Ibom State. This study adopted a quasi-experimental research design to determine the influence of interactive whiteboard utilisation on students' academic performance in basic science in public secondary schools in Ibiono Local Government, Akwa Ibom State. The population of the study consisted of all 1503 public senior secondary school students in the Ibiono Ibom Local Government Area of Akwa Ibom State during the 2025/2026 academic year. The sample size of the study consisted of 120 basic science students drawn from two coeducational schools through a purposive sampling technique. The instrument Basic Science Performance Test (BSPT) was used for the collection of data. The instrument was validated by three experts, two from the Department of Science Education and one from the Psychological Foundation of Education. The reliability of the instrument was calculated using Kudder-Richardson 20, and the overall reliability coefficient stood at 0.88, which was deemed adequate for the study. Mean and standard deviation were used to answer the research questions, while analysis of covariance (ANCOVA) was used to test the null hypotheses. All the hypotheses were tested at .05 levels of significance. The study indicated

that there is a significant difference in academic performance of students taught using interactive whiteboard utilisation and those taught without it in basic science in public secondary schools in Ibiono Local Government, Akwa Ibom State. The study recommended that interactive whiteboards should be used more in the teaching and learning of basic science concepts to improve students' academic performance. The use of an interactive whiteboard in teaching and learning basic science will help the students to appreciate the concept being taught better and improve on their performance and interest.

Keyword: Interactive whiteboard utilisation, students' academic performance, gender and basic science.

Introduction

The poor academic performance of students in basic science has generated a lot of issues in nearly all educational institutions, particularly in Akwa Ibom State. The basic sciences are defined as the scientific disciplines of mathematics, physics, chemistry, and biology. They are called 'basic sciences' because they provide a fundamental understanding of natural phenomena and the processes by which natural resources are transformed (Aminu and Abubakar 2023). The study of basic science helps students to understand the living systems and life processes. This knowledge helps students to have better ways to predict, prevent, diagnose, and treat disease (Alao, 2018). Through basic science, students are trying to answer fundamental questions about how life works (Aminu and Abubakar, 2023). Basic science is one of the subjects offered in Nigerian schools, which is a prerequisite for further studies at higher institutions of learning, such as medicine, biochemistry, anatomy, physiology and agriculture, among others. Despite the importance of basic science, students' academic performance has been poor in the subject, and most basic science teachers have not undergone professional development to acquire competencies for effective lesson delivery. There is a need for teachers to improve the quality of teaching through professional development that will equip them with the contemporary method for teaching basic science, especially at secondary school levels, to enhance students' academic performance.

The contemporary methods for teaching and learning science which are capable of achieving the objectives of the school and society and increasing students' academic performance are those which emphasise effective use of innovative instructional aids and methods like projectors, interactive whiteboards, videotapes, film strips, cooperative

learning and the guided inquiry method, among others (Alao, 2018; Bati and Workneh, 2021). Academic performance is the outcome of education, as it indicates the extent to which the student, teacher, and curriculum in the educational institution have achieved the predetermined educational goals. Academic performance is the academic achievement of students in school subjects as measured by the results of examinations or tests given (Engel, 2022). Academic performance is generally used to determine how well an individual is able to assimilate, retain, recall and communicate his knowledge of what has been learnt.

Students' academic performance over the year has been dwindling, and the poor academic performance despite the importance of basic sciences. Aliyu (2023) reported that many factors, such as lack of teaching aids, teacher knowledge of subject matter, students' interest in learning, learning environment, teaching strategies and learning resources employed by the teacher. Mildrid (2021) also pointed out that the poor academic performance of students in basic science could be attributed to many factors, among which lack of teaching aids like interactive whiteboards is considered a major factor.

An interactive whiteboard is a teaching aid that helps in the teaching and learning of basic science. An electronic device. An interactive whiteboard is an electronic teaching aid designed for teachers to convey facts and ideas to the students in the classroom (Adams and Onwadi 2020). Interactive whiteboards help to develop proper images where students see, hear, taste, smell and understand properly. Teaching using an interactive whiteboard provides students with a complete example for conceptual thinking, creates an environment of interest for the students, increases the vocabulary of students and makes learning permanent. It also provides direct experience to the students (Bati and Workneh, 2021). According to Thompson (2023), the use of a whiteboard in the teaching and learning process creates a rich learning environment in terms of writing and explaining, increases the quality of education, and improves student academic performance and class participation.

Effective use of an interactive whiteboard in teaching and learning basic science enables students to learn better by having information presented through multiple modalities, especially through visual means (Mayer, 2023). Whiteboards are one of the teaching aids that enable the teachers to present facts to the students for effective learning (Bell, 2020). The use of interactive whiteboards, an innovative teaching tool, helps to engage students in the lesson content, learning process and academic performance. Odehe (2020) reported that the purpose of utilising an interactive whiteboard in the teaching and learning of basic science is to assist the teacher with presentation, transmission of educational content to the students for easy understanding and enhancement of academic

performance. According to Adeola (2020), students taught using an interactive whiteboard performed significantly better than those taught without an interactive whiteboard.

The use of an interactive whiteboard in teaching and learning basic science helps in enhancing students' academic performance, achievement of educational goals, acquisition of educational knowledge and understanding of basic science concepts (Tuma, 2021). Interactive whiteboard usage in teaching and learning basics helps to motivate students to learn, develop creativity, enhance prior knowledge and encourage the process of understanding (Dudar *et al.,* 2021). It also assists in decoding, organising and synthesising educational content; logical thinking; reasoning; communication; and interaction to improve students' academic performance. The use of an interactive whiteboard also contributes to students' development and acquisition of different skills as well as retention of desirable knowledge, skills and attributes. Comparing an interactive whiteboard with an ordinary blackboard, Marzano (2019) reported that the use of a whiteboard helps to enhance students' academic performance and arouse students' interest during the teaching of basic science.

Integrating an interactive whiteboard with more technologically enhanced classroom tools is one of the most recent trends in education. Interactive whiteboards which combine a whiteboard with a projector, desktop or laptop computer and a touch-sensitive surface are becoming common (Masley, 2025). As many as 15% of all classrooms are more equipped with some type of interactive whiteboard. This teaching tool is incorporated into the teaching and learning process to provide unlimited possibilities to enhance students' academic performance, teaching and learning. According to Kent (2017), interactive whiteboards promote intellectual quality within the classroom and ensure that lessons are relevant and significant to students, linking teaching, learning and assessment together.

The importance of a whiteboard cannot be overemphasised; it helps students to participate in the classroom and arouse and also simulate student interest to learn effectively in the classroom. According to Kent (2017), when the whiteboard is properly used in lessons, it helps to enhance student academic performance in schools. Whiteboards also provide ease of presentation (John, 2024). A teacher can easily deliver the subject by writing on the board because students cannot like oral presentations without some writing being done. Whiteboards enable the student to understand the topic being learnt. An interactive whiteboard, according to Benjamin (2020), enables the teacher to embrace the students' world and teaching within this context by drawing clear connections with prior knowledge, experiences and interests, and this can be achieved easier through the digital

tools that are available on an interactive whiteboard. Effective use of interactive whiteboards helps in enhancing students' academic performance irrespective of gender.

Gender, according to Saidu (2018), is a term used in describing behaviours and attributes expected of an individual on the basis of being born as either male or female. Gender differences in academic performance in basic science have been a long-debated issue. Various studies have shown male students performed better than their female counterparts. Oliver (2020) found male students performed better than female students in basic science irrespective of teaching methods used by the teacher. Nzewi (2019) and Adeola (2020) reported that male and female students performed equally in basic science subjects when taught using an interactive whiteboard and also given equal opportunities and facilities. Ashid (2019) found that teaching using an interactive whiteboard helps to enhance students' academic performance and retention irrespective of gender. Based on this background, the present study investigated the influence of interactive whiteboard utilisation on students' academic performance in basic science in public secondary schools in Ibiono Local Government, Akwa Ibom State.

Statement of Problem

The use of teaching aids plays a pivotal role in students' performance at any level of education. Over the years, there has been a public outcry by the students in basic science due to poor teaching of the concept and academic performance. The problem of poor performance of students in basic science has been blamed on poor teaching as a major factor. This has been attributed to many reasons, among which are the way and manner basic science teachers are handled and presented, evidenced in the inability of the teachers to provide for the specific learning needs of individual students. This leads to poor academic performance of students in basic science. The researcher observed that persistent use of an ordinary whiteboard and conveying instructions to a large class size in basic science without any recourse to effective use of an interactive whiteboard, despite the instructional value, is one of the major reasons affecting students' academic performance in the subject. The problem of this study, posed as a question, is could lack of utilisation of a whiteboard lead to students' poor academic performance in basic science? Based on this background, the present study therefore investigated the influence of interactive whiteboard utilisation on students' academic performance in basic science in public secondary schools in Ibiono Local Government, Akwa Ibom State.

Purpose of the Study

The primary purpose of the study was to investigate the influence of interactive whiteboard utilisation on students' academic performance in basic science in public secondary schools in Ibiono Local Government, Akwa Ibom State. The specific objectives are the following:

1. To determine the difference between the academic performance of basic science students when taught using an interactive whiteboard and those taught without an interactive whiteboard
2. To determine the difference between the academic performance of male and female basic science students when taught using an interactive whiteboard and those taught without an interactive whiteboard

Research questions

The following research questions were raised for the study:

1. What is the difference between the academic performance of basic science students taught using an interactive whiteboard and those taught without an interactive whiteboard in public secondary schools in Ibiono Local Government, Akwa Ibom State?
2. What is the difference between the academic performance of male and female basic science students taught using an interactive whiteboard and those taught without an interactive whiteboard in public secondary schools in Ibiono Local Government, Akwa Ibom State?

Research Hypotheses

The following hypotheses were formulated at the 0.05 level of significance for the study:

1. There is no significant difference between the academic performance of basic science students taught using an interactive whiteboard and those taught without an interactive whiteboard in public secondary schools in Ibiono Local Government, Akwa Ibom State.
2. There is no significant difference between the academic performance of male and female basic science students taught using an interactive whiteboard and those taught without an interactive whiteboard in public secondary schools in Ibiono Local Government, Akwa Ibom State.

Research Method

Design of the Study

This study adopted a pre-test post-test control group quasi-experimental research design to determine the influence of interactive whiteboard utilisation on students' academic performance in basic science in public secondary schools in Ibiono Local Government, Akwa Ibom State.

Population of the study

The target population of the study consisted of all 1503 public senior secondary school students in the Ibiono Ibom Local Government Area of Akwa Ibom State during the 2025/2026 academic year. The choice of this level of students was considered appropriate for the study because it is expected that these students have spent about five years in the school and are mature enough to think and make judgements and they would be able to answer questions related to the study.

Sample and Sampling Techniques

The sample size of the study consisted of 120 students drawn from two coeducational schools through a purposive sampling technique. The two educational after selecting the two co-educational secondary schools, the population of JSS2 basic science students was identified in their intact classes. A purposive sampling technique was used to select the sample size of 60 students from each of the two co-educational public secondary schools, making a total of 120 students for the study. The instrument Basic Science Performance Test (BSPT) was used for the collection of data in this study. This instrument contained twenty questions with the options A – D on whiteboard utilisation.

Validation of the instrument

The content of the instrument, the Basic Science Performance Test (BSPT), was validated by three experts, two from the department of science education and one from the psychological foundation of education, both in the Faculty of Education, University of Uyo, to scrutinise and assess the items and make corrections. These experts assessed the suitability of the instrument to ascertain whether or not the test items were congruent to the objective of the study.

Reliability of the Instrument

The reliability of the instruments, the Basic Science Performance Test (BSPT), was established using the trial testing method. The instruments were administered to 30 students who were not part of the actual study. The scores obtained from the tests were used to determine the reliability coefficients of the study using Kuder-Richardson 20, and the overall reliability coefficient stood at 0.88, which was deemed adequate for the study.

Experimental Procedure

The researcher collected an introductory letter from the departments in order to inform the principals of the schools selected for the study. An approval to conduct the research was duly given by the principal of the schools. For the purpose of data collection, the following procedures were followed:

Training of the research assistants

A one-week training programme was organised for the basic science teachers in the sampled schools to assist in the study. These basic science teachers were trained on how to teach using an interactive whiteboard. For the experimental and control groups, the researcher chose to supervise the regular class teachers of the experimental and control groups on how to use the mock teaching exercise and lesson plan prepared by the researcher. The researcher kept monitoring the research assistants (teachers) to ensure that they did not deviate from the procedure of instruction given to them. The basic science teachers in both the experimental and control groups were allowed to teach for 30 minutes to test their competence in teaching using an interactive whiteboard before carrying out the treatment on the subjects (experimental and control groups). The experiment lasted for two weeks. After the treatment, a posttest was administered to both the experimental and control groups in the two schools at the end of the two weeks, groups each with the same items as in the pretest. This was helpful to determine the mean score of the groups. After this test, results were collected for analysis.

Method of Data Analysis

Mean and standard deviation were used to answer the research questions, while analysis of covariance (ANCOVA) was used to test the null hypotheses. All the hypotheses were tested at .05 levels of significance.

Decision Rule: In testing the null hypotheses, if the calculated P-values at 0.05 significant levels are greater than the critical t-values, the null hypotheses are rejected; otherwise, they are retained.

Results

Research Question 1: What is the difference between academic performance of basic science students taught using interactive whiteboard and those taught without interactive white board in public secondary schools in Ibiono Local Government, Akwa Ibom State?

Table 1: Mean and Standard Deviation of difference between academic performance of basic science students taught using interactive white board and those taught without interactive white board in public secondary schools in Ibiono Local Government, Akwa Ibom State

Instructional Materials	N	Pretest Mean	Pretest SD	Posttest Mean	Posttest SD	Gain scores
Interactive white board	40	8.37	2.22	17.51	4.37	9.14
Without interactive white board	60	8.27	2.18	15.68	2.74	7.41

The result presented in Table 1 shows that the pretest mean scores of students taught using an interactive whiteboard and without an interactive whiteboard were 8.37 and 8.27 with the standard deviation of 2.22 and 2.18, respectively, indicating that all students were at the same cognitive level before treatment. On the other hand, the posttest mean scores of students taught flowering plants using an interactive whiteboard and without an interactive whiteboard were 17.51 and 17.69 with the standard deviations of 4.37 and 2.74, respectively, with the gain scores of 9.14 for the interactive whiteboard and 7.41 for without the interactive whiteboard, indicating that a difference exists between the academic performance of basic science students taught using an interactive whiteboard and those taught without an interactive whiteboard. This implies that an interactive whiteboard is effective in enhancing students' academic performance.

Research Question 2: What is the difference between the academic performance of male and female basic science students taught using an interactive whiteboard and those taught

without an interactive whiteboard in public secondary schools in Ibiono Local Government, Akwa Ibom State?

Table 2: Mean and Standard Deviation of academic performance of male and female basic science students taught using interactive white board and those taught without interactive white board in public secondary schools in Ibiono Local Government, Akwa Ibom State

Gender		Pretest			Posttest		
		N	Mean	SD	Mean	SD	Gain scores
Interactive whiteboard	Male	18	7.70	1.78	12.50	3.22	4.80
	Female	23	6.60	2.72	12.90	3.85	6.30
Without Interact whiteboard	Male	25	6.70	1.20	9.50	4.10	2.80
	Female	35	6.66	1.22	8.90	4.55	2.24

The result presented in Table 2 shows that the pre-test performance mean scores of male and female students taught using an interactive whiteboard were 7.70 and 6.60, respectively, with the standard deviation of 1.78 for males and 2.72 for females. Also, the pre-test performance mean scores of male and female students taught without an interactive whiteboard were 6.70 and 6.66, respectively, with the standard deviation of 1.20 for males and 2.22 for females, indicating that male students performed better than the female students before treatment. However, the posttest performance mean scores for male and female students taught using an interactive whiteboard were 12.50 and 12.90, with the standard deviations of 3.22 and 3.85, respectively, and performance gain scores of 4.80 for male and 6.30 for female students. The posttest performance mean scores for male and female students taught without an interactive whiteboard were 9.50 and 8.90, with the standard deviations of 4.10 and 4.55, respectively, and performance gain scores of 2.80 for male and 2.20 for female students. The result indicated that differences exist between the academic performance of male and female basic science students taught using an interactive whiteboard and those taught without an interactive whiteboard. This indicates that interactive whiteboards have relative effects on both male and female students' academic performance in basic science.

Research Hypothesis 1: There is no significant difference between the academic performance of basic science students when taught using an interactive whiteboard and those taught without an interactive whiteboard in public secondary schools in Ibiono Local Government, Akwa Ibom State.

Table 3: Summary of Analysis of Covariance (ANCOVA) of the difference between academic performance of basic science students when taught using interactive white board and those taught without interactive white board in public secondary schools in Ibiono Local Government, Akwa Ibom State

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Decision at p<.05 alpha
Corrected model	4162.217	1	4162.217	59.00	.000	S
Intercept	42.022	1	42.022	.60	.000	S
Pretest	8.235	1	8.235	.12	.000	S
Treatment *	472.099	1	472.009	9.10	.000	S
Error	5290.65	102	51.86	-	-	-
Total	266849.00	116	-	-	-	-
Corrected Total	9997.88	120	-	-	-	-

a. R Squared = .470 (Adjusted R Squared = .456)

The result presented in Table 3 above revealed that the F-value of 9.10 obtained at 1 and 116 degrees of freedom had an associated p-value of 0.000, which is less than the 0.05 alpha level. Therefore, the null hypothesis is rejected; hence, there is a significant difference between the academic performance of basic science students when taught using an interactive whiteboard and those taught without an interactive whiteboard in public secondary schools in Ibiono Local Government, Akwa Ibom State.

Research Hypothesis 2 There is no significant difference between the academic performance of male and female basic science students when taught using an interactive whiteboard and those taught without an interactive whiteboard in public secondary schools in Ibiono Local Government, Akwa Ibom State

Table 4: Summary of Analysis of Covariance (ANCOVA) of difference between difference between academic performance of male and female basic science students when taught using interactive white board and those taught without interactive white board in public secondary schools in Ibiono Local Government, Akwa Ibom State

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Decision at p<.05 alpha
Pretest(Covariate)	4162.210	1	4162.210	96.51	.000	S
Treatment	43.125	1	43.125	.60	.443	s
Gender	6.211	1	8.211	.12	.734	s
Treatment *	423.00	1	483.00	9.32	.780	s
Error	5280.60	102	51.77	-	-	-
Total	266849.00	116	-	-	-	-
Corrected Total	9997.88	120	-	-	-	-

a. R Squared = .470 (Adjusted R Squared = .456)

The result is presented in Table 4. Above revealed that the F-value of 9.32 obtained at 1 and 116 degrees of freedom had an associated p-value of 0.780, which is greater than the 0.05 alpha level. Hence, the null hypothesis is accepted; there is a significant difference between the academic performance of male and female basic science students when taught using an interactive whiteboard and those taught without an interactive whiteboard in public secondary schools in Ibiono Local Government, Akwa Ibom State.

Discussion of Findings

The result presented in Table 1 indicated that a difference exists between the academic performance of basic science students taught using an interactive whiteboard and those taught without an interactive whiteboard. The study also indicated that an interactive whiteboard is effective in enhancing students' academic performance. The corresponding hypothesis in Table 3 showed that there is a significant difference between the academic performance of basic science students when taught using an interactive whiteboard and those taught without an interactive whiteboard in public secondary schools in Ibiono Local Government, Akwa Ibom State. This result may be due to the fact that an interactive

whiteboard is effective in enhancing students' academic performance in basic science. This finding is in line with the finding of Odehe (2020), who reported that the purpose of utilising an interactive whiteboard in the teaching and learning of basic science is to assist the teacher with presentation, transmission of educational content to the students for easy understanding and enhancement of academic performance. According to Adeola (2020), students taught using an interactive whiteboard performed significantly better than those taught without an interactive whiteboard. According to Kent (2017), when the whiteboard is properly used in lessons, it helps to enhance student academic performance in schools. Interactive whiteboards also provide ease of presentation. A teacher can easily deliver the subject by writing on the board because students cannot like oral presentations without some writing being done.

The result presented in Table 2 indicated that a difference exists between the academic performance of male and female basic science students taught using an interactive whiteboard and those taught without an interactive whiteboard. The result also indicated that interactive whiteboards have relative effects on both male and female students' academic performance in basic science. The corresponding hypothesis in Table 4 shows that there is a significant difference between the academic performances of male and female basic science students when taught using an interactive whiteboard and those taught without an interactive whiteboard in public secondary schools in Ibiono Local Government, Akwa Ibom State. The finding is in line with the finding of Nzewi (2019) and Adeola (2020), who reported that male and female students performed equally in basic science subjects when taught using an interactive whiteboard and also given equal opportunities and facilities. Ashid (2019) found that teaching using an interactive whiteboard helps to enhance students' academic performance and retention irrespective of gender. Teaching using an interactive whiteboard provides students with a complete example for conceptual thinking, creates an environment of interest for the students, increases the vocabulary of students and makes learning permanent. It also provides direct experience to the students. According to Thompson (2023), the use of a whiteboard in the teaching and learning process creates a rich learning environment in terms of writing and explaining, increases the quality of education, and improves student academic performance and class participation.

Conclusion

Based on the finding of the study, it is concluded that interactive whiteboard utilisation has significant influence on students' academic performance in basic science in public

secondary schools in Ibiono Local Government, Akwa Ibom State. This is so because it was concluded that students taught using interactive white board performed significantly better than those taught without interactive white board irrespective of gender. This implies that differences exist between the academic performance of male and female basic science students taught using an interactive whiteboard and those taught without an interactive whiteboard.

Recommendations

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

1. An interactive whiteboard should be used more in the teaching and learning of basic science to improve students' academic performance. This is because the use of an interactive whiteboard in teaching and learning basic science will help the students to appreciate the concept being taught better and improve on their performance and interest.
2. School administrators should organise seminars for both teachers and students on effective use of interactive whiteboards during teaching and learning processes.
3. The curriculum planners should plan the nation's curriculum to accommodate the use of interactive whiteboards for teaching students and should allot more time to basic science teachers in the school timetable to allow for proper implementation of basic science concepts.

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Effectiveness of Chatbot-Based Hygiene Promotion and Classroom Health Talks on Handwashing Practices among Junior Secondary School Students in Akwa Ibom State

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Abstract

This study examined the effectiveness of chatbot-based hygiene promotion compared with classroom health talks on handwashing practices among junior secondary school students in Akwa Ibom State during the 2023/2024 academic session. Using a quasi-experimental pretest–posttest control group design, 320 JSS2 students were stratified by gender and location into experimental (chatbot) and control (classroom talks) groups. The intervention lasted six weeks. Data were collected with the 25-item Handwashing Practices Assessment Scale (HPAS; α = .89) and analysed via ANCOVA. Results showed that students receiving chatbot-based promotion scored significantly higher on posttest handwashing practices (M = 3.58, SD = 0.42) than those receiving classroom health talks (M = 3.21, SD = 0.51), F(1, 317) = 38.47, p = .000. The study concluded that chatbot-based hygiene promotion is more effective than traditional classroom talks and recommended integrating interactive chatbot programs into school health curricula.

1.0 Introduction

The integration of digital health communication technologies in hygiene education has emerged as a transformative approach in contemporary public health practice. Across African educational contexts, technology-mediated health promotion is increasingly recognised as a viable strategy for improving adolescent hygiene behaviours (Adewale and Ogundimu, 2019). In Nigeria, where infectious disease burden remains high and

school-based health education resources are often limited, innovative digital tools offer promising avenues for reaching large student populations with consistent, evidence-based health information.

'Chatbot-based hygiene promotion' refers to the systematic use of automated conversational agents that provide personalised, interactive, and accessible hygiene education through digital platforms. These agents enable students to receive consistent health information, ask questions, and obtain immediate feedback about proper handwashing techniques (Okoro and Nnamdi, 2020). Handwashing practices, as operationalised in this study, encompass students' consistent application of proper hygiene behaviours: frequency of handwashing, duration of washing, use of soap, appropriate timing (before meals, after toilet use, and after coughing or sneezing), and adherence to recommended handwashing steps as outlined by health authorities (Umoren and Akpan, 2018).

This study is grounded in two complementary theoretical frameworks. The Health Belief Model (Rosenstock, 1974) posits that health behaviour change is driven by perceived susceptibility to illness, perceived severity of outcomes, perceived benefits of protective action, and perceived barriers to action. Chatbot interventions can directly influence these perceptions by delivering tailored risk information and reinforcing the benefits of handwashing through repeated, personalised messaging. Social Cognitive Theory (Bandura, 1986) further emphasises the role of observational learning, self-efficacy, and behavioural reinforcement in shaping health habits. Chatbot platforms enhance self-efficacy by allowing students to practise health knowledge interactively, receive immediate corrective feedback, and track personal progress over time—mechanisms that traditional lecture-based instruction rarely provides at scale (Bassey and Udo, 2021).

Classroom health talks, by contrast, involve traditional face-to-face instructional approaches in which health educators deliver hygiene information through lectures, demonstrations, and group discussions. While these methods offer direct teacher–student interaction and immediate clarification opportunities, they are constrained by fixed schedules, large class sizes, and limited opportunities for individualised follow-up (Etuk and Okon, 2019). This study, therefore, examines how chatbot-based hygiene promotion compares with classroom health talks in influencing handwashing practices among junior secondary school students in Akwa Ibom State, with attention to gender and location variations.

1.2 Purpose of the Study

The primary aim of this study is to investigate the effectiveness of chatbot-based hygiene promotion compared with classroom health talks on handwashing practices among junior secondary school students in Akwa Ibom State. Specifically, the study seeks to:

i. Determine the effect of chatbot-based hygiene promotion compared with classroom health talks on handwashing practices of junior secondary school students.
ii. Examine the extent to which the effectiveness of chatbot-based hygiene promotion on handwashing practices differs between male and female junior secondary school students.
iii. Assess the extent to which the effectiveness of chatbot-based hygiene promotion on handwashing practices differs between urban and rural junior secondary school students.

1.3 Research Questions

i. What is the effect of chatbot-based hygiene promotion compared with classroom health talks on handwashing practices of junior secondary school students in Akwa Ibom State?
ii. To what extent does the effectiveness of chatbot-based hygiene promotion on handwashing practices differ between male and female junior secondary school students in Akwa Ibom State?
iii. To what extent does the effectiveness of chatbot-based hygiene promotion on handwashing practices differ between urban and rural junior secondary school students in Akwa Ibom State?

2.0 Literature Review

2.1 Theoretical Framework

The Health Belief Model (HBM) provides a foundational lens for understanding how students evaluate the personal relevance and benefits of handwashing. According to Rosenstock (1974), individuals are more likely to adopt preventive health behaviours when they perceive themselves as susceptible to disease, recognise the severity of potential outcomes, believe the recommended behaviour is effective, and face minimal barriers to action. In the Nigerian school context, where water and soap availability can be inconsistent, perceived barriers remain substantial (Umoren and Akpan, 2018). Chatbot interventions can reduce these barriers by providing just-in-time reminders, problem-

solving tips for low-resource settings, and normative feedback that frames handwashing as a socially desirable peer behaviour.

Social Cognitive Theory (SCT) complements the HBM by emphasising the dynamic relationship among personal factors, environmental influences, and behavioural outcomes (Bandura, 1986). Self-efficacy, on the other hand, is the belief in one's capacity to execute a behaviour successfully and is a central SCT construct. For adolescent learners, chatbot interactions can strengthen handwashing self-efficacy through mastery experiences (completing quizzes), vicarious experiences (viewing peer demonstration videos), and verbal persuasion (receiving encouraging feedback). Bassey and Udo (2021) argue that digital health platforms which incorporate these SCT mechanisms are more likely to produce sustained behaviour change than passive information delivery.

2.2 Empirical Evidence

A comprehensive study conducted in Lagos State, Nigeria, by Adebayo et al. (2022) examined the effectiveness of chatbot-based health education among 450 junior secondary school students. The study found significant improvements in hygiene practices following digital intervention implementation. Students exposed to chatbot-based hygiene education demonstrated significantly superior handwashing practice scores at six-week follow-up ($M = 3.52$, $SD = 0.48$) compared to a control group receiving traditional health talks ($M = 3.18$, $SD = 0.63$), $F(1, 448) = 23.87$, $p < .001$. The researchers attributed this difference to enhanced accessibility, personalised feedback, and consistent reinforcement that chatbot platforms provided.

Similarly, a study in Rivers State by Okonkwo et al. (2021) demonstrated significant gender differences in response to digital health education interventions among 380 JSS2 students. Female students exposed to chatbot-based hygiene promotion showed significantly higher improvement in handwashing practices ($M = 3.61$, $SD = 0.44$) compared to male students ($M = 3.38$, $SD = 0.52$), $F(1, 158) = 8.45$, $p = .004$. The study suggested that female students' greater engagement with health-focused digital content and preference for detailed information contributed to superior behaviour change outcomes through chatbot interventions.

A comparative study in Cross River State by Okoro et al. (2020) examined urban–rural differences in digital health education effectiveness among 520 junior secondary students. Urban students demonstrated significantly higher improvement in hygiene practices following chatbot intervention ($M = 3.64$, $SD = 0.41$) compared to rural students ($M = 3.42$, $SD = 0.49$), $F(1, 258) = 12.36$, $p = .001$. The researchers noted that technology

access, digital literacy, and infrastructure differences contributed to varied effectiveness patterns across urban and rural contexts.

International research by Thompson and Martinez (2019) in Kenya found similar patterns among 600 secondary school students, with chatbot-based health education demonstrating superior behavioural outcomes compared to traditional methods. The study reported that digital interventions produced significantly higher handwashing practice improvements at a three-month follow-up (Cohen's d = 0.78) and sustained behaviour maintenance rates (Cohen's d = 0.71) compared to conventional classroom-based health education.

However, not all evidence uniformly favours digital interventions. A meta-analysis by Davis and Johnson (2020) reported that the effectiveness of chatbot-based health education is moderated by contextual factors such as teacher support, baseline digital literacy, and the quality of content design. In some Nigerian school settings, well-delivered classroom health talks produced comparable short-term knowledge gains when facilitated by trained health educators who employed interactive demonstration techniques. These findings suggest that while chatbot-based promotion offers distinct advantages in personalisation and accessibility, traditional classroom methods retain value in resource-limited environments where technology infrastructure remains inadequate. Consequently, hybrid models that combine digital tools with face-to-face instruction may offer the most robust pathway for sustained hygiene behaviour change in diverse school contexts.

2.3 Nigerian Local Context in School Hygiene and Digital Education

Nigeria presents a unique landscape for school-based hygiene promotion. Despite national policies mandating health education in basic schools, implementation remains uneven. A study by Umoren and Akpan (2018) in Akwa Ibom State found that fewer than 40% of public secondary schools had functional handwashing stations, and structured hygiene curricula were largely absent. Students relied on occasional health talks delivered during assembly periods, which lacked reinforcement and individualised feedback. These conditions create an environment where digital interventions could fill critical gaps by providing structured, repeatable learning experiences outside the constraints of physical school infrastructure.

In the digital education sphere, Okoro and Nnamdi (2020) documented widespread mobile phone penetration among Nigerian adolescents, even in rural areas, suggesting that platform accessibility may be less prohibitive than commonly assumed. Nevertheless, Okon and Umoren (2021) identified persistent challenges, including inconsistent electricity

supply, high data costs, and low teacher digital literacy, as barriers to scalable implementation. Nwosu and Ekwueme (2022) further emphasised that adolescent engagement with digital health content in Nigerian schools is shaped by peer influence, parental attitudes toward screen time, and the perceived credibility of the information source. These localised factors underscore the importance of context-specific adaptation when deploying chatbot-based hygiene programmes in Akwa Ibom State.

Regarding adolescent health behaviour, Bassey and Okon (2018) examined gendered patterns of health information seeking among Akwa Ibom adolescents and found that female students were more likely to seek detailed preventive health guidance and to share health tips within peer networks. Male students, conversely, demonstrated higher initial scepticism toward digital health tools but showed strong response rates when content included gamified elements and competitive benchmarks. These findings align with the broader digital health literature and inform the present study's examination of gender as a potential moderator of chatbot effectiveness.

3.0 Methodology

3.1 Research Design

This study adopted a quasi-experimental research design with a pretest–posttest control group approach to examine the effectiveness of chatbot-based hygiene promotion compared with classroom health talks on handwashing practices among junior secondary school students in Akwa Ibom State. A quasi-experimental design was chosen for its effectiveness in examining causal relationships between interventions and outcomes while accommodating practical constraints in educational settings that prevent full randomisation (Creswell and Creswell, 2018). This design enables the researcher to compare intervention effects between experimental and control groups while controlling for pre-existing differences through statistical analysis.

3.2 Area of Study

This study was conducted in eight public secondary schools within Akwa Ibom State, Nigeria, representing diverse geographic and socioeconomic contexts. Four schools were selected from urban areas (Uyo and Ikot Ekpene) with relatively advanced technology infrastructure and reliable internet connectivity. Four schools were chosen from rural areas with varying levels of digital access and connectivity. School selection criteria included diverse student populations representing various socioeconomic backgrounds, basic

technology infrastructure capable of supporting digital interventions, administrative support for research implementation, and balanced gender enrolment patterns.

3.3 Population

The target population comprised 3,250 Junior Secondary 2 (JSS2) students from public secondary schools in Akwa Ibom State who had basic digital literacy skills and access to mobile devices or computers for chatbot interaction. These students were selected because they represent a critical developmental stage where hygiene habit formation occurs and cognitive capabilities support meaningful digital interaction (Morrison and Campbell, 2020). The JSS2 level also ensures that students have sufficient maturity and technological readiness to engage meaningfully with chatbot interfaces while being young enough to develop new hygiene behaviours through educational intervention (Parker and Henderson, 2022).

3.4 Sample and Sampling Technique

This study adopted a stratified random sampling technique to select 320 students from the target population, ensuring equal gender representation (160 males and 160 females) and balanced urban–rural distribution (160 urban and 160 rural students). Stratified random sampling divides the population into distinct subgroups based on relevant characteristics and then randomly selects participants from each stratum (Sharma et al., 2021). The primary strata were gender and location, with secondary stratification by school type and technology access level.

School-level assignment was employed to minimise contamination between experimental and control conditions. Within each urban and rural zone, two schools were randomly assigned to the experimental condition (chatbot-based hygiene promotion) and two schools to the control condition (classroom health talks). Within each selected school, intact JSS2 classes were randomly chosen, and students within those classes who met the inclusion criteria (basic digital literacy for experimental schools; regular attendance for all) were invited to participate. These two-stage randomisations were used, schools first and then intact classes, in order to preserve the practical integrity of school scheduling while reducing selection bias. Students were not individually reassigned to conditions; rather, all eligible students within designated experimental classes received the chatbot intervention, and all eligible students within designated control classes received classroom health talks. This approach is consistent with cluster-randomised quasi-experimental conventions in educational research (Peterson and Kumar, 2023).

3.5 Instrumentation

Data collection was conducted using the Handwashing Practices Assessment Scale (HPAS), which is a 25-item, four-point Likert scale questionnaire designed to assess student handwashing practices, hygiene knowledge, and behavioural patterns. The HPAS measured four key domains: Handwashing Frequency (e.g., "I wash my hands before eating meals"); Handwashing Technique (e.g., "I use soap and wash my hands for at least 20 seconds"); Handwashing Timing (e.g., "I wash my hands immediately after using the toilet"); Hygiene Knowledge Application (e.g., "I understand when handwashing is most important for preventing illness"). The HPAS demonstrated high internal reliability with a Cronbach's alpha (α) of 0.87. 89. The instrument used a four-point scale ranging from "Always" (4) to "Never" (1), eliminating neutral responses to ensure definitive participant positions on handwashing practice frequency and effectiveness.

3.5.1 Validity of the Instrument

The validity of the research instrument was established through content validity, construct validity, and criterion validity. Content validity was assessed by a panel of five experts in digital health communication, public health education, adolescent health psychology, educational technology, and measurement and evaluation, who reviewed the HPAS for relevance, clarity, comprehensiveness, and cultural appropriateness within the Nigerian educational context (Thompson and Williams, 2021). Construct validity was evaluated through confirmatory factor analysis, confirming that the instrument effectively measured the theoretical constructs of handwashing practices and hygiene behaviour. The factor analysis revealed four distinct factors explaining 78.4% of the total variance, aligning with the theoretical framework (Anderson and Garcia, 2023). Criterion validity was established by correlating HPAS scores with established measures of hygiene behaviour and health knowledge, yielding significant positive correlations ($r = .84$, $p < .001$).

3.6 Reliability of the Instrument

The reliability of the research instrument was determined using multiple reliability assessment methods. Internal consistency was evaluated using Cronbach's alpha, which yielded a high reliability coefficient ($\alpha = .89$) for the HPAS, indicating strong internal consistency among questionnaire items (Roberts and Davis, 2022). Test-retest reliability was assessed by administering the HPAS to 60 randomly selected students twice within a three-week interval, yielding a correlation coefficient of $r = .86$ ($p < .001$), confirming temporal stability. Split-half reliability analysis using the Spearman-Brown formula

produced a coefficient of .85, further validating the instrument's internal consistency (Foster and Kumar, 2024).

3.7 Intervention Protocol

The intervention lasted six weeks. The chatbot-based intervention was delivered via a custom-built conversational agent accessible through WhatsApp and a lightweight mobile web interface. The chatbot provided daily hygiene tips, interactive quizzes, video demonstrations of proper handwashing technique, and personalised reminders. Students in the experimental group could initiate conversations, ask questions, and receive immediate feedback. Engagement metrics, including session frequency and completion rates, were logged anonymously to monitor adherence.

The classroom health talk intervention followed a standardised curriculum delivered by trained health educators during scheduled school hours. Each session lasted 45 minutes and included lectures, live demonstrations, group discussions, and printed handouts. The control group received six weekly sessions covering identical content domains as the chatbot programme to ensure content equivalence between conditions. Attendance was recorded for all sessions to account for dosage differences in subsequent analyses.

3.8 Ethical Considerations

This study adhered to established ethical principles for research involving human participants. Formal approval was obtained from the Akwa Ibom State Ministry of Education Ethics Review Committee and the institutional research board of the researchers' university. Permission was also sought from principals of the selected secondary schools prior to data collection. Informed consent was sought from parents and guardians of all participating students through signed consent forms, while assent was obtained directly from the students. Participation was entirely voluntary, and students were informed that they could withdraw at any time without penalty. Confidentiality was maintained by assigning unique identification codes to all participants. Data were stored on password-protected devices and cloud servers with restricted access. The chatbot platform was configured to exclude data mining for commercial purposes, and all multimedia content was age-appropriate and culturally sensitive.

3.9 Data Analysis

Data analysis employed descriptive statistics, an independent samples t-test, and analysis of covariance (ANCOVA) to examine intervention effectiveness and group differences. Descriptive statistics including means, standard deviations, and frequency distributions provided comprehensive understanding of student handwashing practices and intervention outcomes. An independent samples t-test compared pretest–posttest changes between experimental and control groups.

ANCOVA was used to control for pretest differences while examining intervention effects, with pretest scores serving as covariates. Gender and location analyses employed 2 × 2 factorial ANCOVA to examine interaction effects between intervention type and demographic variables. Prior to conducting ANCOVA, assumptions of homogeneity of regression slopes, linearity, and homoscedasticity were verified. Statistical significance was set at $\alpha = .05$ with effect sizes calculated using Cohen's d and partial eta-squared (Field, 2018).

4.0 Results and Discussion

Research Question 1

What is the effect of chatbot-based hygiene promotion compared with classroom health talks on handwashing practices of junior secondary school students in Akwa Ibom State?

Table 4.1: Effect of Chatbot-Based Hygiene Promotion vs Classroom Health Talks on Handwashing Practices

Group	N	Pretest Mean (SD)	Posttest Mean (SD)	Mean Difference	F	df	p-value	Decision
Chatbot-Based	160	2.84 (0.61)	3.58 (0.42)	0.74	38.47	1,317	0.000	Reject H_{01}
Classroom Talks	160	2.87 (0.58)	3.21 (0.51)	0.34				

The Analysis of Covariance (ANCOVA) results reveal a significant difference between chatbot-based hygiene promotion and classroom health talks in their effect on handwashing practices among junior secondary school students. Students who received chatbot-based hygiene promotion demonstrated significantly higher posttest handwashing practice scores (M = 3.58, SD = 0.42) compared to students who received classroom health

talks (M = 3.21, SD = 0.51), with F(1, 317) = 38.47, p = .000, after controlling for pretest differences. The effect size (η^2 = .108) indicates a moderate to large practical significance, suggesting that chatbot-based intervention produced substantially greater improvement in handwashing practices. This difference may reflect the enhanced accessibility, personalised feedback, and consistent reinforcement that chatbot platforms provide. The p-value is less than .05, confirming statistical significance at the 95% confidence level. Therefore, H_{01} is rejected.

Research Question 2

To what extent does the effectiveness of chatbot-based hygiene promotion on handwashing practices differ between male and female junior secondary school students in Akwa Ibom State?

Table 4.2: Gender Differences in Chatbot-Based Hygiene Promotion Effectiveness

Gender	N	Pretest Mean (SD)	Posttest Mean (SD)	Mean Difference	F	df	p-value	Decision
Female	80	2.81 (0.59)	3.63 (0.39)	0.82	4.25	1,158	0.041	Reject H_{02}
Male	80	2.87 (0.63)	3.52 (0.45)	0.65				

The ANCOVA analysis shows a significant difference between male and female students in the effectiveness of chatbot-based hygiene promotion on handwashing practices. Female students demonstrated significantly higher posttest handwashing practice scores (M = 3.63, SD = 0.39) compared to male students (M = 3.52, SD = 0.45), with F(1, 158) = 4.25, p = .041, after controlling for pretest differences. The effect size (η^2 = .026) indicates a small to moderate practical significance. This difference may reflect female students' greater engagement with health-focused digital content, higher completion rates of chatbot interactions, and stronger motivation for hygiene behaviour improvement. The p-value is less than .05, confirming statistical significance. Therefore, H_{02} is rejected.

Research Question 3

To what extent does the effectiveness of chatbot-based hygiene promotion on handwashing practices differ between urban and rural junior secondary school students in Akwa Ibom State?

Table 4.3: Urban-Rural Differences in Chatbot-Based Hygiene Promotion Effectiveness

Location	N	Pretest Mean (SD)	Posttest Mean (SD)	Mean Difference	F	df	p-value	Decision
Urban	80	2.79 (0.62)	3.67 (0.38)	0.88	9.87	1,158	0.002	Reject H_{03}
Rural	80	2.89 (0.60)	3.49 (0.46)	0.60				

The ANCOVA analysis reveals a significant difference between urban and rural students in the effectiveness of chatbot-based hygiene promotion on handwashing practices. Urban students demonstrated significantly higher posttest handwashing practice scores (M = 3.67, SD = 0.38) compared to rural students (M = 3.49, SD = 0.46), with F(1, 158) = 9.87, p = .002, after controlling for pretest differences. The effect size (η^2 = .059) indicates a moderate practical significance. This difference may reflect urban students' greater digital literacy, more reliable internet connectivity, higher frequency of chatbot interactions, and stronger familiarity with digital learning platforms. The p-value is less than .05, confirming statistical significance. Therefore, H_{03} is rejected.

4.4 Discussion

The results demonstrate significant positive effects of chatbot-based hygiene promotion compared to classroom health talks on handwashing practices among junior secondary school students in Akwa Ibom State. The finding that chatbot-based intervention significantly enhanced handwashing practices aligns with previous research by Umoren and Akpan (2020), who suggested that digital health communications create more engaging and memorable learning experiences through personalised feedback, consistent reinforcement, and accessible support that traditional methods cannot provide. This difference may reflect the importance of continuous availability and individualised guidance in promoting sustained behaviour change among adolescent students.

The significantly superior improvement among female students compared to male students following chatbot intervention supports findings by Bassey and Okon (2018), who documented that female adolescents typically demonstrate greater engagement with health-focused digital content and show stronger motivation for behaviour change through technology-mediated interventions. This difference may also reflect female students'

preference for detailed health information and collaborative learning features that chatbot platforms can provide through comprehensive content and interactive support systems.

The significant advantage of urban students over rural students in chatbot intervention effectiveness is consistent with research by Etuk and Inyang (2023), who found that technology access, digital literacy, and infrastructure differences significantly influence the effectiveness of digital health education across geographic contexts. This pattern may reflect urban students' greater familiarity with digital platforms, more reliable connectivity, and supportive technology environments that enhance chatbot interaction quality and frequency. These disparities underscore the need for targeted infrastructure investments and digital literacy training in rural schools to ensure equitable benefits from technology-mediated health education.

5.1 Conclusion

This study reveals that chatbot-based hygiene promotion is significantly more effective than classroom health talks in improving handwashing practices among junior secondary school students in Akwa Ibom State. Students exposed to the chatbot intervention demonstrated greater posttest gains in handwashing frequency, technique, timing, and knowledge application compared to their peers who received conventional classroom instruction. The findings further indicate that the benefits of chatbot-based promotion are not uniform across all student populations: female participants showed greater improvement than male participants, and urban students outperformed their rural counterparts. These variations suggest that gender-related engagement patterns and geographic disparities in technology access and digital literacy moderate intervention outcomes. Overall, the results highlight the potential of digital health communication technologies to enhance hygiene education effectiveness through personalised, accessible, and engaging educational experiences that promote sustained behaviour change among adolescent students. Policymakers and educators should therefore consider integrating evidence-based chatbot programmes into school health curricula while addressing equity gaps to maximise population-level impact.

5.2 Recommendations

Based on the findings of this study, the following recommendations are offered for policy, practice, and research:

i. The Akwa Ibom State Ministry of Education, in collaboration with the State Ministry of Health, should develop comprehensive digital health education policies that

integrate chatbot-based hygiene promotion into junior secondary school curricula. These policies must ensure equitable access to technology-mediated health education across urban and rural contexts, with specific provisions for infrastructure development, subsidised internet connectivity, and deployment of low-bandwidth chatbot solutions in underserved areas. Furthermore, state-level guidelines should mandate age-appropriate digital health content, data privacy protections for minors, and routine monitoring of programme fidelity to safeguard intervention quality.

ii. School administrators and health educators should adopt blended instructional models that complement classroom health talks with chatbot-based reinforcement. Teachers should be trained in basic digital health pedagogy to support students who experience technical difficulties and to facilitate make-up sessions for learners with limited after-school device access. School counsellors and nurses can leverage chatbot engagement analytics to identify students with persistently low hygiene scores for targeted follow-up. Additionally, parent–teacher associations should be engaged to promote home-based handwashing reminders and to encourage shared family device use for health education in resource-constrained households.

iii. Future studies should employ longitudinal designs to examine the sustainability of chatbot-induced handwashing behaviour beyond the immediate post-test period. Researchers should also investigate the differential impact of chatbot content modalities, such as text, video, and gamified quizzes, on male and rural students to identify design features that close existing gender and geographic gaps. Mixed-methods inquiry incorporating qualitative student feedback and classroom observation would enrich understanding of implementation barriers.

iv. Finally, cost-effectiveness analyses comparing chatbot deployment against traditional health education are needed to inform scalable resource allocation decisions in low- and middle-income settings.

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Programme Implementation Strategies and their Impact on Sports Development: A Case Study of Uyo Township Stadium, Akwa Ibom State, Nigeria

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Abstract

This study examined programme implementation strategies and their impact on sports development at Uyo Township Stadium, Akwa Ibom State, Nigeria. The study specifically investigated the influence of scheduling and logistics, staff supervision, volunteer management, and quality assurance on sports development. A descriptive survey research design was adopted for the study. The population consisted of sports officials, coaches, athletes, and users of the stadium facility. A sample of 100 respondents was selected using a simple random sampling technique to ensure fairness and equal representation among respondents. Data were collected using a structured questionnaire titled Sports Programme Implementation Questionnaire (SPIQ). The instrument consisted of 20 items arranged on a 4-point Likert scale and grouped into sections based on the study variables. The instrument was validated by experts in sports administration and measurement and evaluation, while reliability was established through pilot testing using Cronbach's alpha, which yielded a reliability coefficient of .82. Data were analysed using mean and standard deviation, while hypotheses were tested using a one-sample t*-test at the .05 level of significance. Findings revealed that effective programme implementation strategies significantly enhance sports participation, facility utilisation, athlete performance, and programme effectiveness. The results further showed that all hypotheses tested were significant at the .05 level. However, inconsistencies in supervision and scheduling were identified as major challenges affecting sports programme delivery. The*

study concluded that structured programme implementation strategies are essential for effective sports development in public sports facilities.

Keywords: programme implementation, sports administration, stadium management, sports development, quality assurance, Nigeria

Introduction

Sports development remains a critical component of national growth, contributing to physical fitness, social integration, talent identification, and economic empowerment. In Nigeria, sports have historically served as a powerful force for national unity, with generations of athletes bringing pride to the continent through triumphs on global stages. However, despite flashes of individual brilliance and a passionate fan base, the nation's sporting fortunes have experienced a marked decline over the past two decades (Adebayo, 2020; Ogunleke & Adeleke, 2025).

The challenges confronting Nigerian sports are multifaceted and deeply structural. At the policy level, frequent leadership changes and institutional restructuring, such as the recent dissolution of the Ministry of Sports Development and reinstatement of the National Sports Commission (NSC), have disrupted long-term planning and weakened continuity (Oladipo, 2025; Premium Times, 2024). Budgetary allocations have fluctuated significantly, with sports funding increasing from approximately ₦10 billion to over ₦100 billion annually under the current administration, yet questions persist regarding transparency and actual disbursement for capital projects (National Sports Commission, 2025). Former Minister of Sports Solomon Dalung has noted that since 1999, budgetary commitment to sports has been "abysmally low", with yearly allocations equivalent to what some countries budget for a single tournament.

Infrastructure deficit represents perhaps the most visible manifestation of these challenges. Ajibade (2026) reported that a 2025 investigation by the New Telegraph confirmed that over 40 stadiums across Nigeria remain in poor condition, with many federal government stadiums in a "total or near total state of disrepair". The once-celebrated National Stadium in Lagos now hosts informal businesses, including pepper soup joints, on its premises, while the MKO Abiola National Stadium in Abuja (refurbished at over $1 million through Aliko Dangote's Adopt-A-Pitch initiative) has deteriorated into what journalists have described as a "potato farm pitch". Presently, only the Godswill Akpabio International Stadium in Uyo is certified by the Confederation of African Football to host major international matches. This facility, the focus of the present study, thus represents

both a rare exception and a critical case for understanding what enables effective sports programme implementation in the Nigerian context.

Program implementation, which is the process of translating planned objectives into practical actions through coordination, supervision, and evaluation (Bucher & Krotee, 2015), is widely recognised as a determinant of sports development outcomes. Yet recent research continues to highlight gaps in this area. A 2024 study on sports facilities and equipment management in Nigeria emphasised that effective management practices are imperative for young athletes' participation, particularly in creating safe and healthy environments that set the tone for future athletic performance. Similarly, research from the University of Ibadan has demonstrated that risk management practices, including surveillance plans, emergency care protocols, and maintenance practices, significantly predict sustainable participation in university sports (Ibikunle, 2018).

The absence of strategic policies and careful planning has been repeatedly identified as a barrier to developing championship-winning athletes in Nigeria. The National Sports Commission's newly unveiled RHINSE Agenda (Reengineering Nigerian Sports Ecosystem) promises reform, yet critics argue that beyond conferences and photo-ops, evidence of real implementation remains limited. Sports development scholar Peter Bramham, as cited in Nigerian policy discussions, emphasises that effective sports development requires a coherent policy framework, well-defined processes of planning and evaluation, and collaborative practices among government agencies, sports organisations, and community groups.

This study, therefore, examines the impact of programme implementation strategies on sports development at Uyo Township Stadium. By investigating scheduling and logistics, staff supervision, volunteer management, and quality assurance mechanisms, the research aims to identify practical strategies that can inform stadium management and sports administration across Nigeria's struggling sports infrastructure landscape.

Objectives of the Study

The study aimed to:

i. Examine the effect of scheduling and logistics on sports development.
ii. Determine the role of staff supervision in program effectiveness.
iii. Evaluate the influence of volunteer management on sports programmes.
iv. Assess the impact of quality assurance on sports delivery.

Research Questions

i. How does scheduling and logistics affect sports development?
ii. What role does staff supervision play in program effectiveness?
iii. How does volunteer management influence sports delivery?
iv. What is the impact of quality assurance on program success?

Research Hypotheses

H_{01}: Scheduling and logistics have no significant effect on sports development at Uyo Township Stadium.
H_{02}: Staff supervision has no significant influence on program effectiveness.
H_{03}: Volunteer management does not significantly affect sports programme delivery.
H_{04}: Quality assurance has no significant impact on sports development.

Literature Review

Programme implementation is a fundamental aspect of sports administration that determines whether planned activities achieve desired outcomes. According to Bucher and Krotee (2015), effective implementation requires proper coordination of human and material resources.

Scheduling and logistics are essential for efficient facility utilisation and programme organisation. Poor scheduling often leads to conflicts and reduced participation (Hoye et al., 2018). Staff supervision ensures that responsibilities are effectively carried out, thereby improving programme outcomes (Lussier & Kimball, 2019).

Volunteer management is another important factor, as volunteers contribute significantly to the execution of sports programmes (Cuskelly et al., 2006). Furthermore, quality assurance mechanisms help maintain standards and improve performance through continuous monitoring and evaluation (Olorunsola, 2014).

Akindutire (2012) investigated administrative practices in Nigerian sports institutions and found that poor implementation strategies, including irregular scheduling and lack of structured supervision, negatively affected athlete participation and performance. The study recommended institutionalising administrative standards, but it did not specifically examine stadium-based programmes.

Hoye et al. (2018) examined sport facility management across multiple countries and reported that effective scheduling and logistics improved facility utilisation rates by up to 40%, reduced user conflicts, and enhanced programme coordination. However, their

study focused on developed economies, leaving a gap regarding similar dynamics in developing countries like Nigeria.

Cuskelly et al. (2006) conducted a longitudinal study on volunteer management in community sports events and found that volunteer training, role clarity, and recognition significantly predicted event success and volunteer retention. Their findings support the importance of structured volunteer systems, yet their research did not extend to stadium-based daily operations.

Lussier and Kimball (2019) explored staff supervision in sports organisations and concluded that regular performance monitoring, feedback mechanisms, and leadership training improved accountability and operational efficiency by over 30%. Nevertheless, their study did not address the unique challenges of public stadium management in resource-constrained settings.

More recently, Ibikunle (2018) examined risk management practices in Nigerian university sports and found that consistent quality assurance mechanisms, including surveillance and emergency protocols, significantly predicted sustainable athlete participation. This aligns with Olorunsola (2014), who argued that quality assurance improves service delivery in educational and sports contexts.

While existing literature confirms the general importance of scheduling, supervision, volunteer management, and quality assurance, very few studies have specifically examined these four implementation strategies together within a single stadium in sub-Saharan Africa. Furthermore, no known study has focused on Uyo Township Stadium (Nigeria's only CAF-certified facility) as a case for understanding successful implementation strategies. The present study fills this gap by providing empirical evidence from this unique context.

Theoretical Framework

Systems Theory (Ludwig von Bertalanffy, 1968)

Systems theory views an organisation as an open system composed of interdependent parts (inputs, processes, outputs, and feedback) that work together to achieve common goals. In this study, the inputs include human resources (staff, volunteers, and coaches), physical resources (stadium facilities and equipment), and financial resources. The processes comprise programme implementation strategies such as scheduling, supervision, volunteer management, and quality assurance. The outputs are sports development outcomes such as increased participation, improved athlete performance, and

enhanced facility utilisation. Feedback from evaluation mechanisms informs future planning.

This framework explains why weaknesses in any single implementation strategy (e.g., poor scheduling) disrupt the entire system, leading to reduced sports development outcomes. It justifies the study's holistic examination of multiple strategies rather than isolated factors.

Management by Objectives (Peter Drucker, 1954)

MBO complements systems theory by emphasising that clear objectives, participatory goal-setting, and performance evaluation improve organisational effectiveness. In stadium management, this means that implementation strategies must be linked to measurable sports development targets. The theory supports the study's focus on quality assurance as a feedback mechanism.

Program Implementation Theory (Pressman & Wildavsky, 1973)

This theory posits that successful policy or programme outcomes depend on the quality of execution, not just planning. It identifies coordination, communication, resource allocation, and supervision as critical implementation variables. The theory directly aligns with the study's four strategies and helps explain why inconsistent supervision or poor logistics leads to implementation failure, even with adequate plans.

Methodology

To ensure fairness and eliminate selection bias, each of the 200 individuals in the sampling frame was assigned a unique number, and 100 numbers were randomly generated using Microsoft Excel's RAND function. This procedure guaranteed that every eligible respondent had an equal and independent chance of being selected. The study adopted a descriptive survey research design, targeting sports officials, coaches, and users of Uyo Township Stadium, from whom a sample of 100 respondents was selected through simple random sampling.

Data was collected using a structured questionnaire titled the Sports Programme Implementation Questionnaire (SPIQ), which included 20 items divided into four sections based on the study variables. The questionnaire used a 4-point Likert scale ranging from Strongly Agree (4) to Strongly Disagree (1). The instrument was validated by experts in sports administration and measurement, ensuring content validity. Its reliability was

confirmed through pilot testing with a similar group of 20 respondents, yielding a Cronbach's alpha coefficient of 0.82, indicating high internal consistency.

For data analysis, means and standard deviations were used to answer the research questions, while hypotheses were tested using a one-sample t-test at the 0.05 significance level. The one-sample t-test was appropriate because the study aimed to determine whether respondents' mean ratings significantly differed from the criterion mean of 2.50, which served as the decision-making threshold.

Data Analysis and Results

Table 1: Mean and Standard Deviation of Responses

S/N	Items	Mean (*M*)	SD	Decision
1	Scheduling and logistics improve participation and facility utilization	3.45	0.62	Agree
2	Staff supervision enhances programme effectiveness	3.60	0.55	Agree
3	Volunteer management supports programme delivery	3.30	0.70	Agree
4	Quality assurance improves performance	3.55	0.58	Agree

Decision Rule: Mean score of 2.50 and above indicates agreement.

Table 1 presents the mean and standard deviation scores of respondents on various programme implementation strategies and their influence on sports development at Uyo Township Stadium. The decision rule stated that any mean score of 2.50 and above indicates agreement among respondents. Since all the items recorded mean scores above the benchmark of 2.50, the respondents generally agreed that programme implementation strategies contribute significantly to sports development.

The item on scheduling and logistics recorded a mean score of 3.45 with a standard deviation of 0.62. This indicates that respondents agreed that effective scheduling and proper logistical arrangements improve participation and enhance facility utilization within the stadium. The relatively low standard deviation shows that respondents' opinions were closely related, indicating consistency in their responses.

Staff supervision had the highest mean score of 3.60 and a standard deviation of 0.55. This suggests that respondents strongly agreed that proper supervision of staff

enhances the effectiveness of sports programmes. The low standard deviation further indicates that there was little variation in respondents' opinions, reflecting a strong consensus on the importance of staff supervision in sports development.

Volunteer management recorded a mean score of 3.30 with a standard deviation of 0.70. Although it had the lowest mean among the items, the score is still above the criterion mean of 2.50, indicating agreement that volunteer management supports programme delivery. The slightly higher standard deviation compared to other items suggests that respondents' opinions varied more on this issue, though the general view remained positive.

Quality assurance had a mean score of 3.55 and a standard deviation of 0.58. This reveals that respondents agreed that maintaining quality standards improves programme performance and contributes to sports development. The low standard deviation implies that respondents shared similar opinions regarding the relevance of quality assurance practices. In all, the findings from Table 1 demonstrate that respondents perceived scheduling and logistics, staff supervision, volunteer management, and quality assurance as important programme implementation strategies capable of enhancing sports development at the stadium.

Hypothesis Testing

Table 2: One-Sample t-Test Analysis

Hypotheses	Mean	*t*-cal	*df*	p-value	Decision
Scheduling and logistics	3.45	8.62	99	0.00	Rejected
Staff supervision	3.60	9.11	99	0.00	Rejected
Volunteer management	3.30	7.54	99	0.00	Rejected
Quality assurance	3.55	8.89	99	0.00	Rejected

Table 2 presents the results of the one-sample t-test analysis carried out to determine whether programme implementation strategies significantly influence sports development at Uyo Township Stadium. The variables tested included scheduling and logistics, staff supervision, volunteer management, and quality assurance.

The result for scheduling and logistics showed a mean score of 3.45, a t-calculated value of 8.62, 99 degrees of freedom, and a p-value of 0.00. Since the p-value is less than the 0.05 level of significance, the null hypothesis was rejected. This implies that scheduling and logistics significantly influence sports development. Effective planning of activities,

transportation, timing, and facility coordination therefore contributes positively to sports programmes.

For staff supervision, the mean score was 3.60 with a t-calculated value of 9.11 and a p-value of 0.00. The null hypothesis was also rejected because the p-value was below 0.05. This indicates that staff supervision has a significant effect on sports development. Proper monitoring, coordination, and supervision of staff members help to improve programme effectiveness and organizational efficiency.

Volunteer management recorded a mean score of 3.30, a t-calculated value of 7.54, and a p-value of 0.00. Since the p-value is less than 0.05, the null hypothesis was rejected. This finding suggests that volunteer management significantly supports sports development. Proper recruitment, coordination, and motivation of volunteers enhance programme delivery and contribute to the success of sports activities.

Similarly, quality assurance had a mean score of 3.55, a t-calculated value of 8.89, and a p-value of 0.00. The null hypothesis was rejected because the p-value was below the 0.05 significance level. This indicates that quality assurance significantly improves sports development by ensuring that programmes are implemented according to established standards and objectives.

Generally, the findings in Table 2 reveal that all the programme implementation strategies examined significantly influence sports development at the stadium. The rejection of all the null hypotheses confirms that effective implementation strategies are essential for achieving improved sports performance and programme success.

Discussion of Findings

The findings of the study revealed that scheduling and logistics significantly influence sports participation and programme organisation at Uyo Township Stadium. Respondents agreed that effective scheduling and proper logistical arrangements improve participation and facility utilization. This suggests that when sports activities are well planned and resources are adequately coordinated, programmes are implemented more effectively. The finding agrees with Hoye et al., who emphasized that effective scheduling improves programme coordination and facility utilization. The implication is that efficient planning and organization remain essential for the successful management of sports programmes and sporting facilities.

The study also revealed that staff supervision significantly enhances programme effectiveness and accountability. The high mean score and significant t-test result indicate that respondents considered supervision an important factor in ensuring the smooth

implementation of sports programmes. Proper supervision helps staff members carry out their responsibilities effectively and ensures that programme objectives are achieved. This finding supports the position of Lussier and Kimball, who observed that proper supervision contributes to organizational efficiency and improved staff performance. Therefore, effective supervision can strengthen administrative control and improve overall programme outcomes in sports centres.

Furthermore, the findings showed that volunteer management significantly supports sports programme delivery. Respondents agreed that volunteers contribute meaningfully to the organisation and implementation of sports activities. This indicates that volunteers remain an important human resource in sports administration, especially in programme coordination and event support. The finding aligns with Cuskelly et al., who explained that volunteers play important roles in organizing and implementing sports activities. This suggests that proper recruitment, coordination, and management of volunteers can improve the effectiveness of sports programmes and increase operational support within sports facilities.

In addition, the findings revealed that quality assurance significantly improves programme performance and sports development. Respondents agreed that maintaining standards and monitoring programme activities contribute positively to programme outcomes. This indicates that quality assurance practices help to ensure consistency, accountability, and effective service delivery in sports management. The significant result obtained from the hypothesis testing further confirms the importance of quality assurance in achieving successful sports programmes and enhancing sports development at the stadium.

The practical implication of these findings is that sports administrators and policymakers in Nigeria must prioritise effective programme implementation strategies to improve sports participation, athlete performance, programme effectiveness, and facility management in public sports centres. Emphasis should be placed on proper scheduling, effective staff supervision, efficient volunteer management, and quality assurance practices in order to strengthen sports development initiatives and improve the overall management of sports facilities.

Conclusion

The study concluded that programme implementation strategies significantly influence sports development at Uyo Township Stadium. The findings demonstrated that effective scheduling and logistics, staff supervision, volunteer management, and quality assurance

contribute positively to programme effectiveness, facility utilisation, and athlete performance. The positive responses obtained from respondents, as well as the significant results from the hypothesis testing, indicate that these implementation strategies play important roles in the successful organisation and management of sports programmes within the stadium.

The study further established that effective implementation strategies are essential for achieving sustainable sports development in public sports facilities. Proper coordination of activities, efficient supervision of personnel, effective management of volunteers, and adherence to quality standards help to improve programme delivery and strengthen sports administration. Consequently, sports administrators and policymakers should give adequate attention to programme implementation strategies in order to promote increased participation, improve operational efficiency, and enhance sports development outcomes in public sports centres in Nigeria.

Recommendations

From the findings and conclusions drawn, the researchers recommend the following:

i. Stadium management should implement structured and digital scheduling systems.
ii. Regular staff supervision and periodic staff development workshops should be organized.
iii. Volunteer programmes should be properly organized and monitored.
iv. Quality assurance mechanisms should be consistently applied.
v. Periodic facility evaluation and maintenance should be conducted.
vi. Government and sports administrators should strengthen policy implementation frameworks for public sports facilities in Nigeria.

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Social Media Adoption and Students' Learning Outcome: A Case of Social Studies Students in Akwa Ibom State College of Education, Afaha Nsit, Nigeria

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Abstract

This study investigated the relationship between social media adoption and students' learning outcomes: A Case of Social Studies Students in Akwa Ibom State College of Education, Afaha Nsit. Nigeria. Specifically, the study examined the relationship between social media usage and students' learning outcomes in Akwa Ibom State College of Education, Afaha Nsit as well as the influence of social media adoption on students' learning outcomes in Social Studies in Akwa Ibom State College of Education, Afaha Nsit. A survey research design was adopted for the study. The population comprised all final-year (300 Level) undergraduate students of the 2025/2026 academic session in Akwa Ibom state College of Education Afaha Nsit. Census sampling technique was employed which resulted in a sample size of 329 students. Data were collected using a structured questionnaire, while descriptive statistics and linear regression analysis were used for data analysis. The findings revealed that social media usage had a significant positive relationship with students' learning outcomes. The study further established that social media adoption significantly and positively influenced students' learning outcomes in Social Studies in Akwa Ibom State College of Education, Afaha Nsit. The study concluded that the effective integration of social media into instructional practices can enhance students' learning outcomes and strengthen the teaching and learning process in Akwa Ibom State College of Education, Afaha Nsit. Based on the findings, the study recommended that lecturers should integrate relevant social media platforms into instructional delivery, students should be encouraged to utilize social

media responsibly for academic purposes, and educational institutions should provide adequate digital infrastructure and training to facilitate effective educational use of social media technologies.

Keywords: Academic Performance, Colleges of Education, Learning Outcomes, Social Studies, Social Media Adoption, Social Media Learning

1.0 Introduction

The subject of social studies is a very crucial subject to human development and cordial relationship in a society, Nigeria inclusive. However, despite Nigeria's government educational curriculum reforms and support systems, many students from our secondary educational institutions do not opt for social study at the tertiary educational institutions, Colleges of Education inclusive. The research of Ekpe *et al* (2024) found that teachers, learning environment, student's self-motivation and social influence had positive impacts on the students' academic performance in Malaysia. In recent time, it has been observed that students prefer to send snap-chats on social media instead of handwritten notes. Popular social media outlets patronized by Nigerian youths include Facebook, Instagram and YouTube. Similarly, the social media mostly used in teaching and learning in Nigeria include Google Classroom, Zoom, Facebook, Instagram, and YouTube. This could negatively affect their vocabularies. Some use social media to chat with friends and share photographs instead of using it for their studies such as homework, assignments and so on. This study examines whether or not social media can enhance the youths' academic performance. In addition, the study investigates the possible reasons for lack of interest in social studies among students at Nigeria's Colleges of Education?

Some previous researchers have investigated the impact of social media on students' academic performance (Akinsolu, 2020; Ekpe et al., 2024; Li, 2022) but few studies have examined the effect of social media on student's learning outcome regarding social study subject. This is a gap in literature that this study intends to fill.

2.0 Literature Review

2.1 Social media adoption and students' learning outcomes

Technology Acceptance Model (Davis et al., 1989) was used to explain the reasons people adopt or reject information systems regarding computer applications; the adoption that depends on the users' attitude and behavioral intentions towards it. The model explains that individuals adopt technological systems based primarily on perceived usefulness and

perceived ease of use. Perceived usefulness refers to the extent to which students believe that social media platforms can improve their academic learning and performance, while perceived ease of use refers to the degree to which students consider such technologies simple, accessible, and convenient for educational purposes. In relation to this study, students are more likely to adopt social media for learning Social Studies when they perceive that these platforms enhance access to instructional materials, support academic collaboration, facilitate communication with peers and lecturers, and improve understanding of course contents. Therefore, the acceptance and continuous use of social media for educational activities are expected to positively influence students' learning outcomes.

There are many advantages of using social media for teaching and learning, some of which include collaborative efforts, cost saving, and learning motivation and effectiveness (Brown, 2020). Online group learning can help introvert students in enhancing their communication skills. Complex academic tasks can be handled using social media technologies in tertiary educational institutions as well as a means of communication and group discussions among students regarding their studies (Hamid et al. 2025). Again, it provided active interaction and involvement as well as opportunities for effective learning. Teachers and students can also share and publish new ideas and information such as course materials as well as receiving feedback via the same route. Students can use social media to resolve academic issues among themselves (Andreas and Haenlein, 2020; Ekpe et al., 2024).

Several studies have found a significant positive impact of social media adoption on students' academic performance. For example, a significant positive effect of social media use on students' learning outcomes was found in USA (Dufur, 2023). Also a positive influence of social media engagement on academic performance was found in Malaysia (Al-Rahmi and Othman (2023). Galy et al. (2021) found that university students who received online lessons from their lecturers performed better than those in classroom. Other studies (Ahmahamid et al., 2020; Davoudi and Fartash, 2022) found that technology knowledge sharing had significant positive impact on employee's learning commitment as well as job satisfaction and organizational commitment. However, Englander (2020) found a negative impact social media on students' academic performance because of their use of it to solve personal rather than academic issues. In the light of this, we hypothesize that:
H1: Social media is positively related to student's learning outcomes

2.2 Social media adoption and Social Studies learning outcomes

Many scholars (e.g Ekpe et al., 2024; Englander, 2020) have research on social media generally and its negative effect on student's academic performance. However, there is very scanty literature on the effect of social media adoption on students' learning outcome of Social Studies as a subject. The closest previous study to this study is that of Rajest and Priya (2020) who researched on the impact of social media on mental health of students in India, and found that too much time spent on social media affects students' mental health such as depression and anxiety. Therefore, this study is novel in the area of relating social media adoption specifically to the subject of Social Studies particularly in Colleges of Education in Nigeria. As such, it is paramount to investigate whether or not social media adoption in the teaching and learning of Social Studies can lead to student's learning outcome. In the light of this, we hypothesize that:

H2: Social media adoption is positively related to student's Social Studies learning outcome

3.0 Methodology

3.1. Survey Procedures

The study examined the effect of social media adoption on students' learning outcomes in in Akwa Ibom State College of Education, Afaha Nsit. However, for convenience and proximity, the study focused specifically on the College of Education Afaha Nsit. The study adopted a survey research design. Questionnaires were distributed to final year (300 Level) undergraduate students during the 2025/2026 academic session. To determine the sample size for the study, census or complete enumeration was carried out on the entire population of final year students in the College. Descriptive statistics and linear regression analysis were used to analyze the data collected from respondents. Ethical considerations were strictly observed during the conduct of the study. Participation in the study was voluntary and respondents were adequately informed about the purpose of the research before completing the questionnaire. Confidentiality and anonymity of participants were also maintained as no personal identifying information was required from the respondents. The researchers ensured that the data obtained were used strictly for academic purposes. To determine the reliability of the instrument, a pilot test was conducted using 30 students outside the study area. Cronbach Alpha statistics were used to estimate the internal consistency of the instrument. The reliability coefficient obtained for the social media adoption scale was 0.84, while the students' learning outcome scale yielded a reliability

coefficient of 0.81. These coefficients were considered adequate and acceptable for the study.

3.2 Measures

The study measured two major variables namely social media adoption and students' learning outcome in Social Studies. Social media adoption was conceptualized as the extent to which students utilize social networking platforms such as Facebook, WhatsApp, Twitter/X, YouTube, Instagram, Google+, blogs, and online discussion forums for academic activities and learning interactions. The construct was adapted from the works of AbuBakar et al. (2010) and Al-Rahmi and Othman (2013). The variable was measured using 10 questionnaire items focusing on frequency of use, academic interaction, collaborative learning, information sharing, and communication through social media platforms. Students' learning outcome was defined as the academic benefits, knowledge acquisition, understanding, participation, and improved learning experiences gained through the use of social media for educational purposes. The measurement items for this variable were adapted from the studies of Al-Rahmi and Othman (2013) and Ayub et al. (2014). The construct was measured using 8 questionnaire items assessing students' perceived improvement in understanding of Social Studies concepts, assignment completion, academic participation, and overall learning effectiveness.

Results

Hypothesis One

H1: Social media is positively related to students' learning outcome.

Table 1: Linear Regression Analysis of the Relationship between Social Media and Students' Learning Outcome

Variables	N	R	R^2	Adjusted R^2	F-value	Beta (β)	t-value	Sig.
Social Media Students' Learning Outcome	329	.682	.465	.463	132.76	.682	16.842	.000

Source: Field Survey, 2026 df-(1,327)

The result presented in Table 1 revealed that social media had a positive relationship with students' learning outcome. The regression coefficient value (β = .682) indicates a strong positive relationship between social media usage and students' learning outcome. The coefficient of determination (R^2 = .465) showed that social media accounted for 46.5% of the variation in students' learning outcome, while the remaining 53.5% could be attributed to other factors not included in the study. The t-value of 16.842 with a significance value of .000, which is less than the 0.05 level of significance, indicates that the relationship was statistically significant. Therefore, the hypothesis which stated that social media is positively related to students' learning outcome was accepted. This implies that effective and educational use of social media platforms significantly enhances students' learning outcomes.

Hypothesis Two

H2: Social media adoption is positively related to students' Social Studies learning outcome.

Table 2: Linear Regression Analysis of the Relationship between Social Media Adoption and Students' Social Studies Learning Outcome

Variables	N	R	R^2	Adjusted R^2	F-value	Beta (β)	t-value	Sig.
Social Media Adoption								
Social Studies Learning Outcome	329	.714	.510	.508	131.93	.714	18.457	.000

Source: (Field Survey, 2026) df=(1,327)

The result in Table 2 revealed that social media adoption had a positive relationship with students' Social Studies learning outcome. The regression coefficient value (β = .714) indicates a strong positive relationship between social media adoption and Social Studies learning outcome. The coefficient of determination (R^2 = .510) revealed that social media adoption explained 51.0% of the variation in students' Social Studies learning outcome. The t-value of 18.457 and significance value of .000, which is less than the 0.05 level of significance, showed that the relationship was statistically significant. Therefore, the hypothesis which stated that social media adoption is positively related to students' Social

Studies learning outcome was accepted. This means that the adoption of social media in teaching and learning Social Studies significantly improves students' learning outcomes.

Discussion of Findings

The findings of the study revealed that social media was positively and significantly related to students' learning outcome. This implies that students who effectively utilized social media platforms for educational purposes demonstrated improved learning outcomes. The finding suggests that social media platforms provide opportunities for collaborative learning, sharing of academic materials, classroom interaction, and access to educational information which may enhance students' academic engagement and understanding. The finding agrees with the study of Rajest and Priya (2020), who observed that although excessive social media use may negatively affect students psychologically, moderate and purposeful educational usage can improve students' engagement and access to information. The finding also aligns with Ekpe et al. (2014), who noted that social media platforms can support communication and information exchange among students when used appropriately for academic purposes. Similarly, Englander (2010) observed that digital interaction platforms influence students' learning behaviours and educational experiences significantly. The finding further implies that social media has evolved beyond entertainment and social interaction to become an important instructional and learning support tool in modern education. Through social media, students can access online educational resources, participate in academic discussions, collaborate on assignments, and communicate easily with peers and lecturers.

The findings of the study revealed that social media adoption significantly and positively related to students' Social Studies learning outcome. This implies that students who adopted and utilized social media platforms in the learning of Social Studies achieved better learning outcomes than those who did not actively use such platforms for academic purposes. The finding supports the assertion that social media platforms facilitate interactive learning, promote access to current information, and improve communication between lecturers and students. Since Social Studies deals with human society, social interaction, culture, citizenship, and current affairs, social media platforms provide rich opportunities for discussion, information sharing, collaborative learning, and exposure to contemporary societal issues relevant to the subject. The finding also agrees with Rajest and Priya (2020), who emphasized that digital platforms significantly influence students' educational experiences and learning behaviours. Furthermore, the result suggests that when properly integrated into instructional activities, social media can enhance students'

participation, motivation, critical thinking, and understanding of Social Studies concepts. The finding therefore underscores the importance of integrating social media technologies into classroom instruction in Colleges of Education to improve students' learning outcomes in Social Studies.

Conclusion/ Recommendations

Based on the findings of the study, it was concluded that social media and social media adoption significantly and positively influence students' learning outcome and Social Studies learning outcome among final year students in Colleges of Education. It was evident that students who effectively utilized social media platforms for academic purposes demonstrated better understanding of concepts, improved classroom participation, enhanced communication, and higher learning outcomes. The adoption of social media in the teaching and learning of Social Studies significantly improved students' academic engagement and achievement in the subject. Therefore, the study concludes that proper integration and educational use of social media platforms can serve as effective tools for improving teaching and learning processes in Colleges of Education.

Based on the findings of the study, it is recommended that:

i) Lecturers in Colleges of Education should integrate social media platforms such as WhatsApp, Facebook, YouTube, Telegram, and X into instructional delivery to enhance students' learning outcome and academic engagement.

ii) Students should be encouraged to utilize social media platforms for academic discussions, collaborative learning, sharing of educational materials, and research activities rather than for purely social or entertainment purposes.

iii) The Akwa Ibom State College of Education should provide adequate digital infrastructure and internet facilities to support effective use of social media for learning purposes.

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