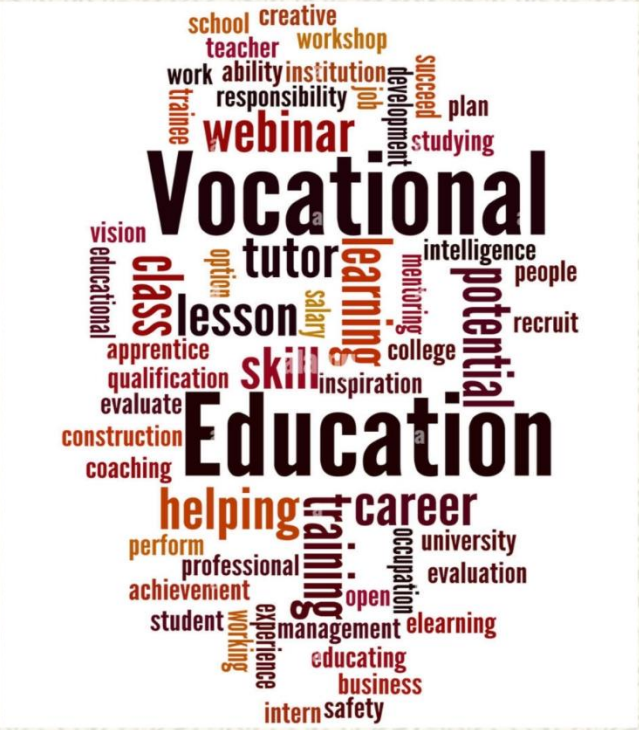
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WORK EFFICIENCY CUM LABOUR PRODUCTIVITY FOR ECONOMIC GROWTH IN THE DIGITAL AGE: THE NIGERIAN EXPERIENCE

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Abstract
In our present day economy, there is a growing concern as to the efficiency in the utilization of labour input in both private and public organizations, as profitability is dependent on the efficiency of labour resource transformation. This informed the choice of the topic "work efficiency cum labour productivity for economic growth in the digital age: the Nigerian experience" Specifically, the study is focused on the efficiency in which labour services/ inputs are transformed into output. Labour efficiency is viewed as a measured of marginal productivity of labour in the work places. It measures the efficiency of labour utilization. The study explained how the integration of digital tools and platforms into daily work activities has become essential element in driving growth, especially in nations seeking to compete for development in the global scene. It highlighted that Nigeria, with its youthful workforce and expanded technology/services sector can improve it labour productivity by leveraging on digital tools for efficiency. Based on the above, it was recommended that both government and the private sector should come together to provide the needed synergy for the development of digital tools and digital literacy for the enhancement of efficiency of labour to remain relevant in the digital age.
Keywords: Work Efficiency, Labour Productivity, Economic Growth and Digital Age

Introduction

Work efficiency and labor productivity are critical components of economic growth. They reflect the ability of individuals and organizations to achieve high output levels with minimal resources. Labour efficiency is the ratio of output to input of labour services. It is measured as a marginal productivity of labour. It measures the efficiency of labour utilization. In the digital era, technological advancements have introduced new opportunities for enhancing productivity across various sectors, re-shaping economies worldwide, including Nigeria's. The integration of digital tools and platforms into daily work activities has become essential element in driving growth, especially in nations seeking to compete for development in the global scene. Nigeria, with its youthful workforce and expanded technology/services sector, presents an interesting case for examining the role of labour efficiency and productivity in economic advancement. However, the potential of Nigerian economy is often constrained by infrastructural deficits, skill gaps, and fluctuating policy directions. Digital tools have the potential to improve work processes and output, yet their application remains uneven across industries (Afolabi and Oladimeji, 2020; Etim, Udo, and Akpan, 2021).

Economic growth is frequently measured by indices such as Gross Domestic Product (GDP), which captures the aggregate performance of productive activities of a nation. In this respect, productivity plays a critical role in determining economic outcomes. Evidence suggests that labor productivity in Nigeria has lagged behind global averages, a challenge partly attributed to inadequate adoption of digital technologies and limited workforce training as required in the digital age (Okoye, 2022). Bridging this gap is vital for enhancing the nation's competitive advantage.

This study examines how labour efficiency and productivity influence economic growth within the Nigerian economy in the digital age. It explores the extent to which digitalization has enhanced workplace performance and identifies barriers that hinder optimal productivity. The research aims to contribute to the discourse on the strategic utilization of digital tools for economic advancement in Nigeria. This work is presented in sections. Following the introduction is the second section which

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focuses on ICT and Labour Productivity in the Digital Age. Section three dwells on Sector-Specific Analysis while section four is on Strategies for Leveraging on Digital Innovations to Enhance Labor Productivity and Economic Growth Sustainability. Section five, presents the Challenges of Work Efficiency Cum Labour Productivity in the Digital Age and finally the section six which is the conclusion

ICT and Labour Productivity in the Digital Age

The role of Information and Communication Technology (ICT) in boosting productivity has been widely documented across various sectors. ICT refers to technologies that facilitate communication (processing and dissemination of information) including computers, smartphones, and internet-enabled platforms. These tools and systems have transformed traditional work practices by enabling faster communication, reducing transaction costs, and streamlining operations in both public and private enterprises.

In agriculture, ICT has improved efficiency by enabling access to real-time information on weather conditions, market prices, and farming techniques. Farmers who use digital tools for decision-making often experience increased crop yields and reduced post-harvest losses (Adekunle and Ogunbiyi, 2019). Additionally, platforms offering e-extension services allow farmers to consult with experts and to have access to agricultural inputs more effectively. The education sector has also benefited from ICT through tools that facilitate e-learning, virtual classrooms, and digital resource sharing. These innovations enable students and teachers to access learning materials anytime, thereby overcoming barriers posed by physical distance. According to Eze, Aniekan and Udom (2021), ICT integration in Nigerian education has resulted in better student performance and enhanced teacher productivity. The manufacturing sector has leveraged on automation and data analytics to optimize production processes. Digital tools allow companies to monitor supply chains, manage inventory, and predict market demand more accurately. Okafor (2022) reveals that factories utilizing digital tools experienced a 30% increase in output compared to those relying on manual processes.

The increasing adoption of automation technologies has become a defining feature of the modern labour market. Automation, which involves the use of machinery and artificial intelligence (AI) to perform tasks traditionally carried out by humans, has re-shaped employment patterns, influenced skills demand, and introduced both opportunities and challenges in the workforce. Automation has significantly influenced employment rates by altering the demand for specific job roles. Repetitive and manual tasks, particularly in industries like manufacturing, logistics, and agriculture, are increasingly being automated, leading to the displacement of workers in these roles; which advertently result to improvement in labour efficiency and productivity. For example, assembly-line tasks in factories are now often performed by robots, which can operate continuously without breaks or errors. A report by Adebayo and Okonkwo (2022) indicated that automation in manufacturing sector has reduced the need for unskilled labour by nearly 30% over the past decade.

However, automation does not only reduce job inefficiency, it also creates new opportunities. The introduction of advanced technologies has spurred demand for roles in robotics maintenance, software engineering, and data analysis. These positions require higher skill levels that typically offer better remuneration. According to Oladipo, Anena and John (2021), sectors integrating automation technologies in Nigeria have witnessed a shift in job roles, with high demand for professionals in ICT and engineering-related fields.

The net effect of automation on employment rates depends largely on the pace of technological adoption and the capacity of workers to adapt. While some industries may experience job losses, others may create new positions, leading to what is often referred to as job polarization, a phenomenon where low-skill and high-skill roles expand while middle-skill jobs decline. Automation has dramatically shifted the skills landscape, emphasizing the need for digital literacy and technical expertise. Workers are now required to acquire skills that enable them to collaborate effectively with automated systems rather than compete with them.

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The growing reliance on automation demands workers proficient in digital tools and platforms. Basic digital skills are no longer sufficient, as employers increasingly prioritize advanced technical skills like coding, machine learning, and data analytics. According to Bello and Umeh (2023), about 70% of employers in Nigeria now require proficiency in specific digital tools for mid-level and high-level job roles. Automation of routine tasks has placed a premium on human-centric skills such as creativity, critical thinking, and emotional intelligence. These skills are essential for roles that require problem-solving, leadership, and innovation, areas where machines cannot yet fully replicate human capabilities. Automation has created an urgent need for reskilling and up-skilling initiatives to prepare the workforce for new demands. Many workers displaced by automation lack the qualifications needed to transition into emerging, making government and private sector interventions crucial. For instance, vocational training programmes and partnerships between industries and educational institutions can help bridge this gap.

While automation presents numerous benefits, it also poses significant challenges. Workers in low-skill, repetitive jobs are the most vulnerable to displacement. Without adequate support, these workers may struggle to find new employment, leading to increased inequality and social unrest. A lag in adapting educational curricula and training programmes to meet the demands of automation creates a skills mismatch, where workers are either under-qualified or overqualified for available roles. Automation often benefits companies and workers with access to resources and technology, exacerbating disparities between developed and developing regions. On the other hand, automation can drive productivity, enhance innovation, and improve job quality in certain sectors. By automating repetitive tasks, workers can focus on more complex, rewarding activities, leading to higher job satisfaction and career growth.

In Nigeria, while industries such as banking and telecommunications have embraced automation, others, particularly agriculture and informal sectors, still rely heavily on manual labour. This uneven adoption highlights the need for targeted policies to manage automation's effects. Policies that encourage collaboration between the private sector and educational institutions can promote skills development aligned with industry needs. Additionally, government initiatives to improve digital infrastructure and expand access to technology can facilitate smoother transitions for workers displaced by automation.

Sector-Specific Analysis: Effects of Digital Transformation on Agriculture, Manufacturing, and Services Labour Efficiency in Nigeria

Digital transformation has become a significant driver of change across economic sectors, re-shaping traditional operations and unlocking new growth opportunities. In Nigeria, digital tools and platforms are influencing agriculture, manufacturing, and services, though the extent and impact vary across these sectors. Digital transformation in agriculture has introduced innovative practices that enhance productivity, reduce costs, and improve decision-making. However, its adoption in Nigeria is still limited due to infrastructural and socio-economic challenges.

Digital tools such as Geographic Information Systems (GIS), drones, and sensors are increasingly being used for precision farming. These technologies allow farmers to monitor crop health, soil conditions, and water usage in real-time, resulting in higher yields and efficient resource use. For instance, the adoption of drone technology in Kaduna State has improved maize production efficiency by 25% (Adebayo and Usman, 2022). Mobile applications and online platforms enable farmers to access weather forecasts, market prices information and agricultural best practices. Platforms like Farmcrowdy and ThriveAgric connect farmers with investors, facilitating funding and access to modern inputs. However, their reach is largely limited to urban and peri-urban areas due to inadequate internet coverage in rural communities (Ibrahim and Musa, 2023). Despite these challenges, digital transformation has the potential to revolutionize Nigeria's agricultural sector by addressing inefficiencies and improving food security.

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Technologies such as automation, artificial intelligence, and IoT (Internet of Things) are re-defining production processes and supply chain management. Automation and robotics enable manufacturers to produce goods more efficiently, reducing operational costs and minimizing errors. For instance, cement manufacturers in Nigeria, such as Dangote Cement, have integrated IoT systems to monitor production processes, achieving a 20% increase in operational efficiency (Oladimeji, Adekunle, Akinwale, 2021). Digital tools like block-chain and cloud computing are enhancing supply chain transparency and reducing delays. Manufacturers now use real-time tracking systems to monitor goods from production to delivery, ensuring accountability and reducing losses.

Strategies for Leveraging On Digital Innovations to Enhance Labor Productivity and Economic Growth Sustainability

Although digital innovations play a transformative role in boosting labor productivity and fostering sustainable economic growth, realizing these benefits requires deliberate strategies that address the unique challenges and opportunities in various sectors of the economy. Below are key strategies for leverage on digital innovations effectively.

Promoting Digital Infrastructure Development: Robust and reliable digital infrastructure is essential for the successful adoption of digital technologies. Investments in internet connectivity, broadband expansion, and power supply can significantly enhance access to digital tools.

Broadband Connectivity: Expanding affordable broadband to underserved regions ensures inclusivity in accessing digital resources. For instance, the National Broadband Plan 2020-2025 in Nigeria aims to achieve 90% internet penetration in urban areas and 70% in rural areas.

Reliable Power Supply: Ensuring stable electricity supports the functionality of digital tools, especially in industries and remote work setups. Renewable energy solutions can address electricity challenges sustainably.

Up-skilling and Reskilling the Workforce**:** Equipping the workforce with the necessary digital skills is critical to harnessing the potential of digital innovations.

Digital Literacy Training: Government and private sector collaboration can establish training centers focusing on basic and advanced digital skills. Initiatives such as Nigeria's Digital Skills for Jobs (DSJ) are examples of such efforts.

Sector-Specific Training**:** Tailored training programs ensure workers can use digital tools effectively in agriculture, manufacturing, and services. For instance, training farmers to use e-agriculture platforms enhances productivity.

Lifelong Learning: Promoting continuous education programs ensures workers stay relevant in an evolving technological landscape.

Strengthening Public-Private Partnerships: Collaboration between the public and private sectors accelerates the adoption of digital innovations by pooling resources and expertise.

Investment in Startups: Governments can provide funding and policy support to tech startups developing innovative solutions for productivity and growth.

Shared Infrastructure: Partnerships between telecom companies and local governments can enhance digital access in remote areas.

Policy Alignment: Coordinated efforts to align policies with technological advancements create a favorable environment for innovation.

Enhancing Data-Driven Decision-Making: Digital tools generate vast amount of data, which can be leveraged to optimize operations for proper policy direction.

Big Data Analytics**:** Industries can use analytics to identify inefficiencies and make data-informed decisions. For example, manufacturers can use predictive analytics to optimize supply chains.

Open Data Policies: Governments can adopt open data practices to encourage transparency and innovation in public services.

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Real-Time Monitoring: Digital tools like IoT enable real-time monitoring of processes, improving efficiency in sectors like agriculture and energy.
***Encouraging Digital Entrepreneurship*:** Digital innovations thrive when entrepreneurs are empowered to create and scale solutions.
Access to Funding: Providing grants, low-interest loans, and venture capital access to digital entrepreneurs fosters innovation.
E-Commerce Platforms: Supporting e-commerce platforms like Jumia and Konga helps small businesses access larger markets.
Mentorship Programs: Connecting entrepreneurs with mentors accelerates the adoption and scaling of innovative solutions.
Ensuring Inclusivity and Reducing Inequalities: Digital innovations must be inclusive to avoid widening socio-economic gaps.
Affordable Digital Tools: Subsidizing the cost of digital devices ensures that low-income populations can benefit from technological advancements.
Gender-Inclusive Policies: Encouraging women's participation in digital training and entrepreneurship helps bridge the gender gap in technology adoption.
Localization: Developing solutions tailored to local languages and cultural contexts increases accessibility for marginalized communities.
Supporting Green Digital Innovations: Sustainability must be prioritized to ensure that digital innovations contribute positively to the environment.
***Energy-Efficient Technologies*:** Promoting technologies that consume less energy reduces the carbon footprint of digital innovations.
***Smart Agriculture*:** Encouraging the use of precision farming tools reduces resource wastage and promotes sustainable farming practices.
Circular Economy Models: Supporting the development of platforms that enable recycling and resource optimization fosters economic growth while preserving the environment.
Enacting Supportive Policies and Regulations: Policy frameworks play a critical role in facilitating the integration of digital innovations into economic activities.
Digital Tax Incentives: Offering tax breaks to companies investing in digital tools encourages adoption.
Regulatory Sandboxes: Establishing environments for testing new technologies without the constraints of traditional regulations accelerates innovation.
Cybersecurity Policies: Strengthening cybersecurity ensures trust in digital systems, encouraging their use across sectors.
Leveraging Artificial Intelligence (AI) and Automation: AI and automation enhance productivity by streamlining repetitive tasks and enabling advanced problem-solving.
Task Automation: Adopting automation in manufacturing reduces costs and increases production efficiency.
AI in Services: Deploying AI-driven chatbots and virtual assistants improves service delivery in sectors like banking and healthcare.
Predictive Technologies: AI-powered predictive tools can anticipate market trends, guiding businesses and policymakers.
Encouraging Research and Development (RandD)*:* Investments in RandD drive innovation and ensure that digital solutions address local needs.
Public R and D Funding: Governments can fund research institutions focused on developing digital tools for productivity.
Industry-Academia Collaboration: Partnerships between universities and industries accelerate the creation of practical solutions.

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Innovation Hubs: Establishing tech hubs in regions like Yaba in Lagos fosters creativity and innovation.

1. **Challenges of Work Efficiency Cum Labour Productivity in the Digital Age**

The basic challenges of work efficiency cum labour productivity in the digital age lies on the provision and proficiency in the use of ICT technologies. Issues such as inadequate infrastructure, high costs of digital tools, and low digital literacy rates hinder widespread adoption. Nevertheless, continued investments in ICT infrastructure and training programmes could unlock further productivity gains across sectors. Adopting digital solutions has proven transformative in improving productivity and efficiency across various sectors. However, several challenges hinder their full implementation, particularly in developing countries like Nigeria. These challenges include limited digital infrastructure, skills gaps, and socio-economic disparities.

The availability of robust and reliable digital infrastructure is critical for the successful adoption of digital tools. Unfortunately, many regions in Nigeria face inadequate internet connectivity, unreliable power supply, and insufficient telecommunication networks. Abubakar and Eze (2021) noted that rural areas are disproportionately affected, with over 70% of households in these regions lacking access to high-speed internet. This digital divide limits the ability of individuals and organizations to use technologies effectively, creating a barrier to widespread digital adoption.

The successful deployment and utilization of digital solutions require a digitally literate workforce. However, many workers in Nigeria lack the technical skills necessary to use advanced tools and platforms effectively. This challenge is exacerbated by a lack of comprehensive digital literacy programmes in educational institutions and workplaces. As noted by Olanrewaju and Okoro (2022), only 35% of Nigeria's workforce has basic digital skills, making it difficult for organizations to maximize the benefits of digital tools. This skills gap also affects entrepreneurs and small business owners, who often lack the expertise needed to leverage digital platforms for growth.

Socio-economic inequalities further complicate the adoption of digital solutions. High levels of poverty and income disparity mean that a significant portion of the population cannot afford digital devices or internet services. According to Nwosu, Adeyemi and Obong (2023), over 40% of Nigerians live below the poverty line, and many prioritize basic needs over investments in technology. This inequality creates a scenario where access to digital tools becomes a privilege rather than a universal opportunity, perpetuating the digital divide and limiting productivity gains. Addressing these challenges requires targeted interventions, including investments in digital infrastructure, widespread digital literacy initiatives, and policies aimed at reducing socio-economic barriers. By tackling these issues, Nigeria can enhance its capacity to adopt digital solutions and improve productivity across all sectors.

Conclusion

Leveraging on digital innovations to enhance labor productivity and economic growth sustainably requires a multifaceted approach. Digital transformation has varying effects across agriculture, manufacturing, and services in Nigeria, reflecting differences in technological adoption and sector-specific challenges. While agriculture stands to benefit from improved productivity and food security, manufacturing is experiencing operational efficiencies, and services are leveraging digital tools to enhance customer experiences. Barriers such as infrastructure deficits, skills gaps, and socio-economic inequalities should be addressed to ensure that the benefits of digital transformation are widely shared. Investments in infrastructure, workforce development, and inclusive policies are critical to maximizing the benefits of digital tools. By prioritizing these strategies, Nigeria can unlock the full potential of digital transformation, ensuring long-term economic and environmental sustainability.

Suggestions

Based on the above, it is recommended that both government and the private sector should come together to provide the needed synergy for the development of digital tools and digital literacy for the enhancement of efficiency of labour to remain relevant in the digital age.

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IMPACT OF LEARNING ENVIRONMENT ON SKILL ACQUISITION AMONG STUDENTS IN TECHNICAL INSTITUTIONS IN NIGERIA

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Abstract

Skill acquisition is basic to all forms of education and training. It exposes the recipients to experiences that enable them acquire and develop manipulative, cognitive and attitudinal skills which prepare them for a brighter future. Skill acquisition in technical education provides its graduates with opportunities and skills to be dependent to face the challenges of world of work anytime and anywhere they find themselves. The extent of acquisition of these skills by students in technical institutions depends most importantly on the learning environment amongst others. The paper therefore focused on the impact of learning environment on skill acquisition among students in technical institutions in Nigeria by discussing, learning environment, components of learning environment, skill acquisition, skill acquisition in areas of technical education and present status of technical education learning environment in Nigeria. Based on these, the paper recommended amongst others that teachers should ensure that learning environment is safe and conducive for learning and as well students should report any case of damaged tools, equipment and machines to teachers and workshop attendants for repairs, maintenance or replacement.

Keywords: Learning environment, Skill acquisition, Technical Institutions.

Introduction

Technical institutions are saddled with the responsibility of imparting practical skills, attitudes, understanding and knowledge relating to occupations in various sectors of the economy. The practical skills, knowledge and attitudes are to make the recipients (individual) creative and productive in order to function well in the society. This implies that technical institutions are expected to train and produce graduates who are equipped with the relevant practical skills of their chosen trades. The trades offer in technical institutions includes Building construction technology, Woodwork technology, Automobile technology and Electrical and Electronics technology. Effective teaching and learning of the trades rest squarely on the teacher, students and most importantly the learning environment.

Learning environment plays a pivotal role in shaping the skill acquisition of students in technical institutions. lt provides an instructional process involving the teacher, the learner and the subject matter. Nwobia (2016) opined that learning environment supports a relationship between teaching and learning which helps to improve learner's mental health and academic performance. When learning environments are not conducive or secured or healthy, it tends to affect the teaching quality,

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workload and students interest. Pham in Okoro (2011) reported that the results of extensive research studies conducted in Australia, the United States of America and the Netherlands showed that classroom environment is an important mediator and determinant of learning outcome (skill acquisition inclusive). A supportive learning environment that incorporates hand- on activities, real- world applications and technology can foster deeper learning and improve skill acquisition.

Skill acquisition is always associated with many components of learning environment. These components include people, teaching materials, teaching tools and learning resources, curriculum, training and instructions as well as physical learning space (Balog, 2018). Effective instructional process cannot be accomplished in the absence of certain ingredients that create conducive environment for skills acquisition. Such ingredients include well equipped workshop with up-to-date facilities,right quality and quantity of teachers and adequate tools.To this, Abbo and Okunola (2021) stated that teaching facilities are central to developing students skills and competencies, motivation and knowledge. Moreso, learning environment can influence students' motivation, engagement and self-efficacy, ultimately affecting their skill acquisition. Therefore, the study seeks to examine the impact of learning environment on skill acquisition among students in Technical institutions.

Learning Environment

Environment plays a major role in the life of everyone whether student, teacher, employer or employee because it brings about better performance. Rolana in Nwobia (2016) opined that intelligence is not the only determinant of academic performance of a students. Academic performance of a student is always associated with many components of learning environment. Learning Environment is the entire surrounding where people interact to enrich learning experiences which lead to permanent change in behavior. It refers to the whole range of components and activities within which learning takes place. The Gloomy of Educational Reform in Nwobia (2016) define learning environment as the diverse physical locations, contexts and cultures in which students learn. Since students could learn in varieties of setting such as outside of school location, the term is often used as more accurate or preferred to classroom. Classroom environment comprising of activities and behaviours that influence students learning positively and negatively. The activities and behaviours include communication, clarity, coherence, consideration, cohesiveness, commitment, concern, and cooperation. (Mgboro & Eke, 2015). To Kitonyi (2013) learning environment is a social, physical, psychological and pedagogical context in which learning occurs and which affects learner's performance and attitude. Learning Environment as applied to this study is a place where the teacher interact with the learners in order to acquire knowledge and skills. The knowledge and skills acquisition resulting from such is manifested by the ability of the learner to create meanings from activities, draw conclusions specifically from previous experiences and apply them in real life situations.

Components of Learning Environment.

Learning does not take place in a vacuum. It occurs as a result of interaction among components of the learning environment. Moore in Onogiro (2013) stated that there are important interactions that occurs in the learning environment such as learner- content, learner- learner and teacher-learner interaction. During the learner- content interaction, information is transferred from short -term memory to long - term memory. As this happens, the students find the need for support which takes the form of

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learner to learner and learner to teacher. The teacher to learner interaction provides feedback and dialogue between the students and the teacher.

The learner to learner interaction facilitates the exchange of information, ideas and dialogue among peers. Implicit in the interactions stated above is the teacher who is an important player in the learning environment whose role is to improve on the quality of the interactions in the learning environment. Components of learning environment according to Arul in Usman and Madudili (2019) includes the teacher, students, contents, learning process as well as learning situation.

Teacher: Teachers are the link between the curriculum and the students. They create a favourable teaching and learning environment that will make the instructional process easy, adaptable and useful. Ogwo (2006) averred that teachers have more intimate relationship with the students than any other members of the school community. They are more likely to have greater influence on the character and habit of students. Bandiele and Faremi (2012) stated that the teacher exert a great deal of influence on character formation and the process of socialization of learners within environment. That is to say the way which teacher's personality interacts with learner's personalities helps to determine the kind of behaviour which emerges from the learning situation.

Learner: Learners are viewed as th**e** key element in teaching learning process. The teacher and the content exists because there is someone who learns - the learners. The learner is not just a passive recipient of information in the classroom but an active participant in teaching learning process otherwise little or no learning will take place. The more interested the learners is in the content being presented the more attentive such student will become in receiving the instruction or lesson. Ogwo (2006) stated that teacher's explanation should be carefully presented so as to sustain students' interest and trigger their actions in acquiring skills.

Content: This is the totality of what is to be taught in the school system. Contents are the important concepts, facts and principles to be taught. It could be inform of knowledge, skills and values that learners are exposed to. Learning environment are designed to provide opportunities for learner in variety of ways thereby developing their knowledge, skills and attitudes. Amasuoma and Jupo (2014) stated that content must be inconformity with the learning **objectives** to be achieved by the end of each respective lesson.

*Learning Process: L*earning is the foundation of an individual's development. It takes place individually in a cultural and social context in which students combines their new knowledge with their previous cognitive structures. Learning process is a step by step activities taken by a student when acquiring knowledge. It is the activities carried out by students to achieve educational objectives. Learning cannot take place without teaching. Teaching without learning on the other hand is ineffective. To this Gracia-Bulle (2022) conceived teaching and learning as the interaction between the teacher and the students where the teachers try to transmit knowledge and contents to students according to their age, capacities, skills and living conditions. The teacher determines how the teaching materials could be delivered by various pedagogies and whether the students achieved learning by assessing the course outcomes. In the same vain, the teacher have a full control over the choice of content to be delivered, how learners will be supported but may have little or no control over learners characteristics.

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Learning environment plays a fundamental role in the learning process. Creating a an interactive learning environment makes learning process exciting and stimulating thereby providing opportunities for all students to learn and succeed. Gracia- Bulle (2022) sees learning environment as one in which students feel a sense of belonging, trust others and feel encouraged to tackle challenges, take risks and ask questions.

Learning Situations: These are the physical conditions for learning. Waldman (2016) stated that for students to succeed academically they must have the feeling of safety both physically, mentally and emotionally in their environment. Learning in an environment where tools, equipment and materials are inadequate, obsolete and in bad conditions affects student's skill and knowledge acquisition. Moreso, situations where teachers fails to recognise the learning differences in students in their instructional delivery skill acquisition may become an uphill task. Students must feel welcomed, supported and recognised in their learning varieties. This will help students develop skills, think critically, work collaboratively and commun**ic**ate effectively**.**

Concept of Skill Acquisition

Skill is the ability which is developed by a person with time and becomes automatic in terms performing the required skills. It can also be defined as the ability to do something expertly and well in accordance to set standard and manufacturer's instructions. Skill acquisition according to Olaitan in Nwankwo (2010) is a process of equipping youth or adult with saleable skills necessary for employment and or for updating their job skills. It is a process of demonstrating the habit of active thinking or behaviour in a specific message activity. In the same vein, Donli in Idoko, (2014) stated that skill acquisition is the manifestation of knowledge or ideas through training that is generated towards instilling an individual the spirit of entrepreneurship needed for meaningful development. The author further stated that when learners are given the opportunity to acquire the desired skills required for self-sustenance in the economy it will enhance their charisma in the work environment. In other words, for skill to be acquired appropriate knowledge, attitude, habit of thought and qualities of character are learnt to enable the recipient develop intellectual, emotional and moral character which prepares the recipient for a brighter future. Therefore one can adduce that skill acquisition is a form of training given to individuals or groups of individuals that could lead to acquisition of knowledge for self-sustenance. Oke in Barimia and Olarewaju (2022) opined that certain skills can be considered acquired when a person can perform it without thinking about the action or dividing a process into convenient parts. Skill acquisition is the responsibility of the teacher to the learner.Akudolu in Ogwa (2015) pointed out that the teacher's preoccupation should not only be to teach skills but to also help them acquire skills involving three factors- immitation, repetition, and occupational participation. One may wish to say that to possess/ acquire a skill means the ability to demonstrate the habit of activity, thinking and behaving in a specific activity in such a way that the process becomes natural to the individual through repetition in practice.

Skill Acquisition in areas of Technical Education.

Skill acquisition is basic to all forms of education and training. It can occur in different ways by personal experiment in a certain field, by repeating some actions automatically without applying any thinking process. Acquisition of skill is necessary for success in any occupation, trade, or job. Ezeji and okorie in Oriola (2009) opined that most jobs require some special manipulative activities, the

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extent which varies from one occupation to another most especially in the areas of technical education. Technical education is designed to equip individuals to enter into selected jobs, positions and occupations as well as to provide upgrading skills for those who are already employed in the selected occupations. Therefore skill acquisition in technical institutions can enable one to be self-employed thus finding himself a means of livelihood in the following areas;

Woodwork technology: Woodwork technology is one of the technical education courses taught in technical institutions in Nigeria. It is designed to provide theoretical and practical skills by exposing students to drill practice for mastery in the use of tools and equipment for cutting, planning, construction of joints, assembling of woodwork articles, applying different types of finishes on furniture articles as well as maintenance of tools and equipment in the workshops.Woodwork technology education is perceived as a programme which necessitates the acquisition of cognitive and psychomotor skill in furniture making, cabinet making, upholstery construction, carpentry,wood machining and general wood working. (Muhammad,Yusri,Yahya,Halliru and Abdulli, 2020). According to National Board for Technical Education (NBTE) in Olabiyi, (2014) woodwork craftsmen is expected to design, construct, service and repair any fault in the building structure to design and construction specification.. The skills involved in woodwork technology develop the ability of the craftsmen to be able to use machine correctly in achieving desired shapes from a given piece of wood.

Building Construction Technology: Building construction technology is one on the courses offered in technical institutions in Nigeria designed to equip the students with the technical methods, skills, processes, techniques needed for the design, construction and maintenance of buildings. It produces graduates who will man the building industries.Ogubiyi in Obayu,Fagbenle,Asusan,and Musa, (2022) stated that building technology graduates are required to operate in a variety of positions in the construction industry such as contract manager, project manager, facilities manager, maintenance manager, project management consultant, health and safety officer as well as building officer. Among the major goals of building construction technology is to produce competent building technicians with sound technical knowledge who be able to perform types of construction, renovation, demolition, relocation maintenance and repair of building structures as well as chimney, waste disposal, fencing, landscaping, structural works using building equipment and tools. (National Board for Technical Education, (NBTE) in Asogwa,Okanya, Ahuoiza, Edozie, and Ezugwu, 2022).

Automobile Technology: Automobile technology involves the application of scientific knowledge in the design, selection of materials, construction, operation and maintenance of motor vehicle. This according to NBTE in Olabiyi, (2014) automobile technology is classified to include Auto-electric work, vehicle body building and motor vehicle maintenance. The inclusion of Automobile trade in technical institutions is geared towards imparting basic knowledge as well as training skills leading to production of skilled technicians who will be enterprising, self- reliant and sufficiently competent to meet the demands in the world of work. Through the skill acquisition, the recipients should be able to acquire the essential knowledge and experiences needed to meet challenges in the automobile workplace. Research findings revealed that varieties of occupational trade areas are available in the field of automobile technology due to continuous innovations in the automobile industries.To this Nyapson in Idris, Audu, Abdulkadir, Abutu and Mustapha (2020) stated that each of the major systems and sub- systems, units and accessories in a motor vehicle provides an occupational areas where

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individuals can earn a living and be self-reliance economically. National Automobile design and development Council (NDDC),(2017) stated that skill areas in automobile trade includes sensor maintenance and installation, fault diagnosis, vehicle costing and valuing, installation of vehicle anti-theft security gadgets and electronic control unit (ECU) servicing and repairs. In this regard Olaitan and Ikeh (2015) stated that occupational areas of automobile technology include repair and maintenance, engine servicing, auto electricity/electronics, auto body building, steering and suspension, vulcanizing, braking system and auto air conditioning.

Electrical Electronics Technology: This area of specialization in technical education provides both theoretical and hands-on knowledge of electrical and electronics deviced and circuits (Oluka and Onyebuenyi,2017). The authors further stated that electrical and electronics technology education offers trades in; appliances maintenance and repair, electrical installation and maintenance works, Instrument mechanics, Radio, television and electronics works. During the course of the study, students learn practical skills required to install, operate, maintain and repair electrical/electronics equipment. National Board for Technical Education (NBTE) in Akamobi (2022) pointed out that electrical craftsmen are required to test, diagnose, repair, service, install any electrical equipment using the manual. Corroborating with this view, Ogwa (2015) stated that skills in electrical and electronics technology as required for acquisition by learners for effective employment opportunities include the following; conducting of surface and conduit electrical installation, measurement of electrical parameters such as voltage, current and resistance, conducting continuity tests in electrical and electronics circuits, wire stripping, construction of various lighting circuits, fault tracing in electrical and electronics equipment, soldering and disordering in electronics circuits.

Present Status of learning environment in Technical institutions in Nigeria.

Learning environment remains an important area that should be studied and well managed to enhance student's academic performance. This is because where knowledge is acquired is as important as the knowledge itself. Research by Eden in Ahiauzu (2015) revealed that a pleasant and attractive environment forms parts of the resource power which manifest on student's performance. Learning environment for technical education programs which include the classroom, workshop, libraries and industries affect student's skill acquisition. The degree to which learning could be enhanced in students largely depends on availability of instructional facilities and the structure of the classrooms, (Usman & Madudili, 2019) Corroborating with the view Ngu in Ahiauzu (2015) emphasized that the physical facility in which the students learn must be both comfortable and secure. The machines, tools and equipment must be available, enough and safe for use. To this Oluwatelure (2010) stated that learning environment must accommodate the equipment, tools and materials that are used in education and training. Unfortunately, learning environment for technical education programmes in Nigeria seems to be characterized by deteriorating classroom building, poor lighting and seating conditions, insufficient supply of instructional materials/ resources, obsolete machines and tools e.t.c thereby leading to lack of motivation on the part of both the teachers and the students which in turn has resulted and is still resulting to unskilled graduates from technical education institutions. Ojimba in Gaya (2022) observed that Nigerian institutions lack the tools to give students the skills employers needed. In most institutions in Nigeria workshop tools and equipment are often left unattended for a long period of time due to lack of maintenance culture. This reduces the chances of students to acquire saleable skill for sustainability.

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A good technical education program makes provision for the learning of the skill employed in the use of tools and equipment and materials of the occupation and guides the users on safety procedures for handling them.

It is important that the workshop, classrooms and the total environment where technical education is given must be adequately equipped as the actual working environment to ensure the impartation of effective skill. This statement is in agreement with one of the theories of vocational education which states that vocational education will be effective if a replica of the real work environment is replicated in the training environment. To Toby in Onele (2014), students cannot learn skills of their chosen occupation at maximum efficiency with poor and obsolete equipment, neither will the students develop positive attitude towards the use of tools and equipment of their trade if the workshop are not safe and secured. UNESCO-UNEVOC (2006) stated that the long- standing problem with technical education facilities and equipment has been the inability to keep the equipment current with that in those enterprise where their graduates will be employed. UNESCO- UNEVOC went further to state that technical and vocational education graduates are often trained with obsolete machines and tools rarely found in those enterprise where they are being trained to work. This constitutes a major gap in the quality of input and output in technical education, thus non- attainment of the set standard and goals in technical education institutions. Skill acquisition requires adequate workshop facilities and equipment, training materials and consumables without which skills cannot be acquired (Olateju, 2012). This could be one of the reasons for high rate of unemployed graduates (technical education graduates inclusive) roaming the street because most technical institutions lack the necessary workshop facilities, tools and equipment needed to provide them with requisite skills for employment.

Conclusion

Learning environment provides an instructional process involving the teacher, the learner and the subject matter. Although teachers are essential instruments to this endeavour but no effective teaching and learning in technical institutions can take place without materials, equipment and tools related to the skills to be learnt. The availability of facilities at the teacher's disposal will not only make teaching easier for the teachers but will as well make learning faster and interesting to students. Workshops should be well equipped with current facilities to guide the teachers in teaching practicals so as to make students to be involved sufficiently in the practicals for the purpose of understanding the applications to daily life. Without providing good learning environment for teaching and learning of technical education courses the products of technical education institutions will remain ill-equipped.

Recommendations

1. The private sectors, training institutions and employers of labour should be involved in provision of skill training centers.
2. Students should report any case of damaged tools, equipment and machines to teachers and workshop attendants for repair, maintenance or replacement.
3. Government at all levels should ensure that technical institutions have adequate facilities for practicals.

4. Teachers should ensure that learning environment is safe and conducive for students learning.
5. Priority should be given to maintenance of tools, machines and equipment by technologist/technicians attached to the workshops on a regular basis to ensure that the facilities are serviceable.
6. There should be periodic monitoring and supervision of workshops, classrooms, tools, equipment and materials by ministry of education to ensure their functionality.
7. School management should make an arrangement with the employers of labour for use of their workplace and its environment to create links between learning in school and skill required in the workplace.
8. Fund should be made available by federal, state, local government as well as non- governmental agencies for maintenance, repair and procurement of facilities for skill acquisition when the need arises.

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INTERNAL CONTROL PRACTICES AND FINANCIAL MANAGEMENT OF HOTEL BUSINESSES IN AKWA IBOM STATE, NIGERIA

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Abstract

The study examined the influence of internal control practices on financial management of hotel businesses in Akwa Ibom State, Nigeria. The study adopted descriptive research design. The population of the study comprised 214 accountants of registered hotels in Akwa Ibom State. A sample of 139 was drawn from the population using cluster, proportionate and simple random sampling techniques. The researcher-made questionnaire entitled "Internal Control Practices and Financial Management of Hotel Businesses Questionnaire (ICPFMHBQ) was used to collect data for this study. The instrument was validated by three validates while Cronbach's Alpha using Statistical Package for Social Sciences (SPSS) version 22.0 was adopted in the determination of the internal consistency of the instrument and reliability coefficient of 0.91 was obtained. Regression analysis was used to answer research questions test the null hypotheses at 0.05 level of significance. The findings of the study reveals that internal control has a significant influence on financial management in hotel businesses in Akwa Ibom State. The study therefore, concluded that effective internal control measures such as restricting access to finance and risk assessment are essential in preventing fraud, errors, and mismanagement of resources, ensuring accurate financial reporting, and promoting transparency and accountability. It was therefore recommended among others that hotels should conduct regular risk assessments to identify potential internal control risks and implement mitigating controls.

Keywords: Internal control, Restricting access to finance and Risk assessment

Introduction

In the hospitality industry, the market is constantly changing, and this requires changing the system to an internal control system to allow the financial aspect and management process to be guided by laid down policies and processes. Internal control is an instrument and means of risk control, which helps an organisation to achieve its goals and to perform all its tasks. Internal control is a critical component of organizational management process, ensuring accuracy, reliability and authenticity of financial information. Effective internal control practices help to prevent errors, misstatements and fraudulent activities, thereby contributing to an organisation's success and sustainability.

Hotel businesses need internal control practices because, it enables organisations to achieve its desireable goals more efficiently, it also helps to analyze and improve risk management, it controls and govern procedures through the use or implementation of a strategy that is methodological and scientific. Internal control as a process is essential for companies because it enables them to accomplish their goals more effectively (Yego, 2019). A hotel is a temporary home away from home provided by a business that specializes in offering private room accommodations (Farland, 2023).

According to Taouab and Issor (2019) organization's financial success is a reliable measure for assessing its performance. Furthermore, financial performance is commonly used to assess the management team's ability to transform firm resources into profits. Businesses must continue to operate normally and ensure that shareholders receive acceptable returns on their investments.

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Risk assessment is a general term used across many servicing industries to determine the likelihood of loss on an asset, loan or investment. Financial risk assessment is an examination of where businesses are likely to lose value. It is the process of identifying how and where a business is exposed to some form of risks (Garafalo 2024). Risk assessment is the determination of the quantitative and qualitative estimate of risk. In this study risk assessment is considered as the process of identifying the risk that might befall the finances of an organization and how to overcome such in order for the business to maximize profit and achieve its goals and objectives.

Statement of the Problem

Hotel is one of the booming businesses in Nigeria. A hotel offers services such as lodging/accommodation, entertainment, laundry and restaurant to their customers. The influx of visitors and tourists into many cities has increased the customer based of the industry in recent times. As such many hoteliers are making huge revenue from this business in many cities of which Akwa Ibom State is a beneficiary of this business.

However, the researcher has observed that many hotels in Akwa Ibom State are crumbling after few years of operation. It appears that many of these businesses are not generating adequate revenue and profits to meet important obligations. This situation may not be unconnected to financial mismanagement alone. The researcher has observed that employees often let out rooms to customers without remitting money paid to the business coffers. Some employees sell drinks to customers without remitting the correct amount to the business. while some take food home without the knowledge of their employers. It has also been observed that some workers divert business money for personal use. As such, hotel owners can hardly make enough revenue to meet important expenses such as maintenance of rooms, electricity, rent, salary, among others. If this situation is not urgently nipped in the bud, many hotel owners, investors and employees will be adversely affected. Owners and investors could lose their investments, while employees will lose their jobs thereby increasing the rate of unemployment in the state. It is against this that the researcher embarked on this study to determine the influence of internal control practices on financial management of hotel businesses in Akwa Ibom State, Nigeria.

1.3 Purpose of the Study

The main purpose of this study was to determine the influence of internal control practices on financial management of hotel businesses in Akwa Ibom State. Specifically, the study sought to determine the:

1. Influence of restricting access to finance on financial management of hotel businesses in Akwa Ibom State.
2. Influence of risk assessment on financial management of hotel businesses in Akwa Ibom State.

Research Questions

1. How does restricting access to finance influence financial management in hotel businesses in Akwa Ibom State?
2. How does risk assessment influence financial management in hotel businesses in Akwa Ibom State?

Research Hypotheses

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$Ho_{1:}$ There is no significant influence of restricting access to finance on financial management in hotel businesses in Akwa Ibom State.

$Ho_{2:}$ There is no significant influence of risk assessment on financial management in hotel businesses in Akwa Ibom State.

Literature Review

Internal Control

Kenton (2023) defined internal controls as accounting and auditing processes used in a company's finance department to ensure the integrity of financial reporting and regulatory compliance. According to Committee of Sponsoring Organizations of the Treadway Commission (2013), internal control is "a process, effected by an entity's board of directors, management, and other personnel, it is designed to provide reasonable assurance regarding the achievement of objectives relating to operations, reporting, and compliance." Committee of Sponsoring Organizations (COSO) formed by accounting and financing professionals developed a framework for consistent internal controls evaluation, instead of regulations, the framework acts as a guideline for effective internal control system. In addition, COSO was designed to be suitable for enterprises of all sizes and types in terms of expertise.

Zakaria *et al.* (2016) argued that internal control weaknesses can be a major contributing factor for committing fraud. Thus, Nawawi and Salin (2018) suggested that to minimize the risk of occupational fraud committed in the organization, a strong internal control implementation is a necessity. Likewise, Rendon and Rendon (2016) claimed that to mitigate fraud, the organization needs to improve effective internal control implementation within the organization.

According to Adekunle *et al. (*2021) internal control system of an organization encompasses all the financial and non-financial safeguards that have been put in place by top management to assure adherence to company regulations, protect company's assets and maximize the accuracy and completeness of records keeping. A well-designed and efficient internal control system help to avoid and deter errors and abnormalities. Davis *et al.* (2017) stated that internal control system of an enterprises makes up a basis for an efficient accounting system. Thus, there is an increased interest in the internal control technique. Ademola *et al.* (2015) observed that internal control consists of five integrated components: control environment, risk assessment, control activities, information and communication, and monitoring activities.

The cornerstone of internal controls within an organisation is environmental control, which establishes standards, processes, and structures that serve as the foundation. The management of the organisation is in charge of conveying the relevance of the control environment and establishing its expectations and standards. COSO (2023) noted that the integrity and ethical values of the organisation; the limits allowing the board of directors to carry out its authority oversight duties; the organisational structure and assignment of authority and responsibility; the process for attracting, developing, and retaining competent employees; the accuracy around performance measures, encouragements, and rewards to drive accountability for performance are all part of the control environment. The control environment has a long-term impact on the internal control system of an organisation. Lenand *et al.* (2018) internal control can be proactive or reactive, it may comprise a variety of manual and automated tasks such as authorisations, approvals, and verifications.

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Restricting Access to Finance and Financial Management of Hotel Businesses

Business owners should retain administrator's rights (if possible) to the company's accounting system and consider restricting user access to only areas necessary for their functions. This will help reduce the chances of an individual creating false entries and covering up the tracks. According to Tipalti (2024) restricting access to finance determines which area the individual should have access to the processes and procedures within the organisation. Restricting access to finance can restrict employees who can access private data center and employees who can sign off on computer processes like accessing logs for example.

Access to sensitive computer records is often restricted, so that information is only made available to those who need it to conduct specific tasks. Doing so reduces the risk of information theft and the risk of assets theft by modifying ownership records. Restricting access to finance is a trade-off between accessibility and security, giving temporary access to those who need it. If approval rights are granted to an employee or bookkeeper in online payment service, a review of credit memos should be performed to ensure the validity of issued credits and deter the creation of false credit memos to cover any intercepted cash. According to Vinciworks Group (2022) information security should be a top priority for all organisations. It involves protecting organisation's finances and optimizing information systems. The purpose of information security is to prevent confidentiality breaches, data losses, inappropriate data deletion and inaccurate data production.

According to Signature Analytics (2022), unmonitored permission opens up the potential for employees to hide fraud and theft. Restricting access to finance reduces the risk of employees changing and deleting entries. ZenGRC (2024) opined that it is vital to restrict access to accounting systems and finances to reduce the risk of employees or managers manipulating information and perpetuating fraud. Authorized persons should regularly review any transaction changes in the system, to uncover any irregular activity that may either point to an inadvertent error or outright fraud committed by others. Indeed Career Guide (2022) also noted that cash on hand leads to opportunities for mismanagement and theft. When it is necessary to have cash in the organization the following are important: restrict access to cash for safety, regularly reconcile petty cash book, keep incoming and outgoing cash separate, regularly deposit cash assets issue receipts for incoming cash, obtain receipt for outgoing cash and keep receipt books securely locked up.

Farnham (2023) opined that restricting access to finance is important because it protects an organisation's best interests. It helps employees to understand how to handle finance and empowers organizations to limit fraud and improve compliance with cash handling regulations. The author further stated that restricting access to finance contributes to a stronger compliance to policies, it fosters a more robust audit function and encourages employees to see even the smallest transactions as either helpful or harmful to the organization. According to Syracuse University (2024) to effectively restrict access to finance organisations should 1) restrictively endorse checks immediately upon receipt stating "for receipt only". 2) keep cash/ cheques in a lock and secure areas until they can be deposited. Access to the area should be restricted to only designated individuals. If a person with custody responsibility leaves their position, keys should be collected or changed. 3) make timely deposits of cash and cheques within 24 hours to reduce the exposure to theft or loss of funds. 4) all cash receipts should be recorded immediately by use of cash register, data entry into a computer system, pre-numbered receipt book or handwritten log.5) a copy of the pre-numbered should be provided to the payer while the other copy is kept on file. 6) deposits should be verified by making cash operations deposit slip to agree with the general ledger on a monthly basis. 7) cash registers and credit card machines should be balanced daily. Over or short amounts should be monitored. 8) a dated and signed record of the reconciliation should be maintained.

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Risk Assessment and Financial Management of Hotel Businesses

Risk is defined as an unexpected event or condition that might have either positive or negative effects on project or organization's objectives (Eldash in Obi, *et al* 2023). Risks include circumstances or situations, the existence or occurrences beyond all reasonable foresight, results in an adverse impact on any aspect of the implementation of the project (Srinivas in Obi, *et al* 2023). According to Kenton (2024) risk assessment is a general term used across many industries to determine the likelihood of loss on an asset, loan or investment. The author further opined that assessing risk is essential for determining how worthwhile a specific investment is and the best process(es) to mitigate risk. Risk assessment according to Kenton (2024) enables corporations, governments and investors to assess the probability that an adverse event might negatively impact a business, economy, project or investment. The author further pointed that there are two approaches potential investors can use to assess the risk of a potential investment opportunity namely quantitative analysis and qualitative analysis

i. Quantitative Analysis: a quantitative analysis of risk focuses on the building risk models and simulations that enables the user to assign numerical values to risk.
ii. Qualitative Analysis: a qualitative analysis of risk is an analytical method that does not rely on numerical or mathematical analysis instead it uses a person's subjective judgement and experience to build a theoretical model of risk for a given scenario. A qualitative analysis of a company might include an assessment of the company's management, the relationship it has with its vendours and the public's perception of the company.

According to Johansson (2024) current financial risk assessment in hotels includes:

i. Revenue Management Challenges: optimizing rooms rates, managing distribution channels and forecasting demand are complex tasks that directly impact a hotel's bottom line. Inadequate revenue management can lead to lost profit opportunities.
ii. Cost control: managing operating costs from labour to utilities and supplies is essential for maintaining profitability. Ineffective cost control can erode margins and put hotels at a financial disadvantage.
iii. Investment decision and capital expenditures: hotels must make strategic decisions about renovations, technology upgrades and expansion projects. Careful assessment of the potential return on investment (ROI) and long-term financial implications is crucial.
iv. Debt and liquidity issues: managing debt levels and ensuring sufficient cash flow to meet financial obligations is critical. Hotels with high debt or liquidity problems may face difficulty securing funding or meeting operational needs.
v. Rising Expense Ratios: increases in costs for labour, supplies or utilities relative to revenue might necessitate cost control measures or pricing adjustments.
vi. RevPAR (Revenue per Available Room): A decline in the revenue available per room highlights the need for a deeper analysis of revenue management strategies or operational efficiency.

According to the author, methods for assessing risk likelihood are

i. Qualitative assessment: using experience and judgment to assign a general probability level to each risk:

- Highly likely: risk is almost certain to occur.
- Likely: high probability of occurrence.
- Possible: risk could occur under certain circumstances.
- Unlikely: low probability but still a possibility.

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- Highly Unlikely: probability is extremely low.

ii. Quantitative Assessment:

- assigning numerical values or percentages to represent the probability of occurrence.
- This method requires more data and might be used for risks with significant potential impact.

iii. Risk Matrix: the risk potential impact is map (high due to reliance on a few suppliers) and likelihood on the matrix, indicating the need for urgent mitigation strategies.

Garafalo (2024) opined that the main aim of financial risk assessment is to take action which reduces the likelihood of the risk occurring at all. If that is not possible an alternative plan is to have a response prepared in case the risk occurs. According to the author types of financial risk assessment includes:

Market Risk: this is the risk that microeconomic changes could damage a business ability to remain competitive. These are circumstances outside the business control like inflation, downturns or pandemic

Customer Risk**:** customer risk is the risk of relying on a small customer base or customer concentration risk.

Cash Flow Risk**:** cash flow risk is the possibility that a business will not have sufficient cash flow to cover its obligations. There are two types of cash flow risk: collections risk and liquidity risk.

Collections Risk**:** this is the possibility accounts receivable go uncollected, either permanently or long enough to have an effect on working capital.

Liquidity Risk**:** this is concerned with assets and liabilities.

Operational Risk: this refers to the risk that comes with day-to-day operations. It covers factors like human error, fraud and compliance as well as operational disruptions.

Currency Risk**:** this is the risk of unfavourable changes to the exchanges rate between the operating currency and the transactional currency. Businesses diversified into foreign markets or relying heavily on the import and export of goods are most at risk. According to Allianz Trade (2024) financial risk can impact a company's profitability, cash flow and overall financial health. Financial risks are those risks that affect the cash flow and how money is handled in an organization. When an organisation's financial risk assessment is performed, it evaluates the financial risk level from multiple angles (which can include market fluctuation, changes in interest rates, credit defaults, operational failures or external economic conditions).

The Organisation for Economic Cooperation and Development (OECD) (2018) stated that risk assessments can be quantitative or qualitative. In a quantitative risk assessment, the risk officer or risk manager assigns numerical values to the probability of an event that may occur and the impact it would have on the business. The author observed that the numerical values are used to calculate an event's risk factor, which, in turn, can be mapped to a financial value. On the other-hand qualitative risk assessments are used more often and does not involve numerical probabilities or predictions of loss. Thorvaldsdóttir and Sigbjörnsson (2018) stated that it can be a costly venture for a business if it failed to have necessary controls in the workplace. The organisation could face not only financial loss (through fines, civil actions, etc) but also loss in respect of production time, damage to equipment, time to train replacement employees and negative publicity amongst others.

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Methodology

Descriptive survey research design was adopted for the study. The area of the study was Akwa Ibom State. The population of the study was 214 accountants from registered hotels in Akwa Ibom State. The sample size was 139 accountants of registered hotels in Akwa Ibom state. The sample size was determined statistically using Taro Yamane formula. The sample was selected through the cluster, proportionate and simple random sampling methods. The instrument used in gathering data for this study was a structured questionnaire designed by the researcher, titled, "Internal Control Practices on Financial Management of Hotel Businesses Questionnaire (ICPFMHBQ)". The researcher submitted the instrument together with the research topic, purpose of the study, research questions and hypotheses to three experts from the Department of Business Education, Faculty of Vocational Education, Library and Information Science, University of Uyo, for face validity. The internal consistency of the instrument was determined using trial test. 20 copies of the instrument were administered on accountants who were not part of the actual study. The application of Cronbach's Alpha using Statistical Package for Social Sciences (SPSS) version 22.0 was adopted in the determination of the internal consistency of the instrument and reliability coefficient of 0.91 was obtained. The research instrument (ICPFMHBQ) was administered on 139 accountants from registered hotels in Akwa Ibom State. Out of the 139 questionnaires administered, 135 were properly filled and retrieved, giving 97% return rate. Regression analysis was used to answer research questions and test all the null hypotheses at .05 level of significance.

Results

Research Question One

How does restricting access influence financial management in hotel businesses in Akwa Ibom State?

Table 1 Summary of the simple regression analysis for how restricting access influences financial management in hotel businesses in Akwa Ibom

(n =135)

Model		Unstandardized Coefficients		Standardized Coefficients	R^2
		B	Std. Error	Beta	
1	(Constant)	6.091	1.012		
	Restriction of Access	.793	.035	.893	.797

Source: Field Data, 2024

Entries in Table 1 gives the summary of the simple regression analysis for how restricting access influences financial management in hotel businesses in Akwa Ibom. The result shows the B value of the unstandardized coefficient as .232, indicating a positive influence of restricting access on financial management of hotel businesses in Akwa Ibom State. The coefficient of determination (R^2) is .797, indicating that 80% of changes in financial management of hotel businesses in Akwa Ibom State is as a result of restricting access. This means that restricting access has a very strong Influence on financial management of hotel businesses in Akwa Ibom State.

Research Question Two

How does risk assessment influence financial management in hotel businesses in Akwa Ibom State?

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Table 2 Summary of simple regression analysis for how risk assessment influences financial management in hotel businesses in Akwa Ibom State (n =135)

Model		Unstandardized Coefficients		Standardized Coefficients	R^2
		B	Std. Error	Beta	
1	(Constant)	13.700	1.323		
	Risk Management	.533	.045	.713	.508

Source: Field Data, 2024

Entries in Table 2 gives the summary of the simple regression analysis for how risk assessment influences financial management in hotel businesses in Akwa Ibom State. The result shows that the B value of the unstandardized coefficient is .533, indicating that there is a positive influence of risk assessment on financial management of hotel businesses in Akwa Ibom State. The coefficient of determination (R^2) is .508, indicating that 51% of changes in financial management of hotel businesses in Akwa Ibom State is explained by risk assessment. This means that risk assessment has a moderate influence on financial management of hotel businesses in Akwa Ibom State.

Research Hypothesis One

There is no significant influence of restricting access on financial management in hotel businesses in Akwa Ibom State.

Table 3: Result of simple regression analysis for how restricting access influences financial management in hotel businesses in Akwa Ibom State

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	125.101	1	125.101	521.72	.000
	Residual	31.892	133	.240		
	Total	156.993	134			

Source: Field Data (2024), Significant at .05

The result in Table 3 shows the summary of the regression analysis with an F-value of 521.72 with the probability value (p-value) of .000. Since the p-value is less than the alpha level of .05 ($P<.05_{.000}$), the result is statistically significant. Hence, the null hypothesis that there is no significant influence of restricting access on financial management in hotel businesses in Akwa Ibom State is rejected. Therefore, there is significant influence of restricting access on financial management in hotel businesses in Akwa Ibom State.

Research Hypothesis Two

There is no significant influence of risk assessment on financial management in hotel businesses in Akwa Ibom State.

Table 4: Result of simple regression analysis for how risk assessment influences financial management in hotel businesses in Akwa Ibom State

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	79.803	1	79.803	137.50	.000
	Residual	77.190	133	.580		

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Total	156.993	134

Source: Field Data (2024), Significant at .05

Entries in Table 4 shows the result of the regression analysis for how risk assessment influences financial management in hotel businesses in Akwa Ibom State. It reveals an F-value of 137.50 with the probability value (p-value) of .000. Since the p-value is less than the alpha level of .05 ($P<.05_{.000}$), the result is statistically significant. Hence, the null hypothesis that there is no significant influence of risk assessment on financial management in hotel businesses in Akwa Ibom State is rejected. Therefore, the financial management in hotel businesses in Akwa Ibom State is significantly influenced by risk assessment.

Conclusion

This study examined the influence of internal control on financial management of hotels in Akwa Ibom State. The findings revealed that internal control has a significant influence on financial management, emphasizing its crucial role in ensuring the effectiveness and efficiency of hotel operations. Effective internal control measures such as restricting access to finance and risk assessment are essential in preventing fraud, errors, and mismanagement of resources, ensuring accurate financial reporting, and promoting transparency and accountability. The study's results underscore the importance of implementing effective internal control systems, including restricting access to finance and risk assessment.

Recommendations

1. Hotels should implement effective access controls, including passwords, encryption, and secure authorisations protocols in order to protect financial information and systems.

2. Hotels should conduct regular risk assessments to identify potential internal control risks and implement mitigating controls.

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ASSESSMENT OF THE ACTIVITIES OF CENTRE FOR ADULT LITERACY AND ISLAMIC EDUCATION (CALIEK) IN PROMOTING LITERACY DEVELOPMENT IN KANO NORTH SENATORIAL DISTRICT, KANO NIGERIA

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Abstract
This study assessed the activities of the Centre for Adult Literacy and Islamic Education (CALIEK) in promoting literacy development in Kano North Senatorial District, Nigeria. The research was guided by two objectives: to examine the impact of literacy activities carried out by CALIEK and to identify the challenges confronting its programmes. A survey research design was employed, with a sample of 348 respondents drawn from staff and beneficiaries out of a total population of 3,660. Data were collected using a structured questionnaire validated by experts and tested for reliability through the test–retest method. Descriptive statistics were used for analysis with the aid of SPSS. Findings revealed that CALIEK has significantly improved beneficiaries' literacy skills, particularly in writing, reading, business application, family support, and confidence building, all of which had high mean ratings above 3.0. However, the programme showed limited impact on social participation, decision-making, and sustained motivation, which recorded lower mean scores. Major challenges identified included age disparity among learners, distance to literacy centres, socio-cultural constraints such as husbands' permission for housewives, and inadequate funding. Less critical issues were the gender of facilitators and staff adequacy. The study concludes that CALIEK has been effective in enhancing personal and household literacy competencies but faces structural and socio-cultural barriers that limit its broader social impact. It recommends strengthening community mobilization, expanding access through additional centres or mobile classes, enhancing women's participation, increasing funding, integrating vocational and financial literacy, and promoting continuous motivation and civic engagement. Implementing these measures will enable CALIEK to deepen its contribution to literacy development and inclusive growth in Kano North Senatorial District.

Keywords: **Adult literacy,** literacy skills, rural skills development**, Islamic education, Literacy development**

Introduction

Education has long been recognized as a fundamental driver of human progress. From ancient civilizations to modern societies, it has facilitated social transformation, political stability, cultural expression, and economic development. Within this broader landscape, literacy is widely acknowledged as the *foundation of lifelong learning* and a prerequisite for human empowerment and sustainable development (UNESCO, 2015; Wagner, 2018). Beyond the basic ability to read and write, literacy equips individuals with the capacity to interpret, apply, and communicate knowledge in ways that enhance social participation, productivity, and personal agency (Aderinoye, 2007; Bhola, 1994). In recognition of its central role, international frameworks such as the Universal Declaration of Human

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Rights (1948) and the Education for All (EFA) goals have declared literacy and education as fundamental human rights to which Nigeria is a committed signatory.

In Nigeria, education is not only a constitutional right but also a strategic tool for nation-building. The National Policy on Education (FRN, 2004) describes education as an *"instrument per excellence for effecting national development"* (p. 2). It emphasizes equal access for all citizens within both formal and non-formal learning systems, while also highlighting the role of education in building a democratic, egalitarian society based on justice and equity. These policy provisions underscore the significance of adult literacy and non-formal education in reducing inequality, promoting social justice, and fostering inclusive development (Oyebamiji & Adekola, 2008). Despite such recognition, Nigeria has historically struggled with low levels of adult illiteracy. As early as the 1980s, over 70% of the national population was estimated to be illiterate (Omolewa & Akinde, 1982), prompting the launch of the National Mass Literacy Campaign in 1982 under President Shehu Shagari. This initiative later evolved into the National Commission for Mass Literacy, Adult and Non-Formal Education (NMEC) in 1990, with state-level agencies established to support grassroots literacy services (Aderinoye, 2004). Kano State stands out as a pioneer in this regard. The creation of the State Agency for Mass Education (SAME) in the early 1980s marked a turning point in expanding adult literacy services across its 44 local government areas. Importantly, Kano's historical tradition of Islamic education, which predates colonial rule, has shaped its literacy provision (Fafunwa, 1974; Abdullahi, 2010). By integrating Islamic education into literacy programs, initiatives have gained greater cultural acceptance and community participation, especially among women and rural populations who may resist purely secular education models (Sulaiman, 2017). Over the years, government institutions, NGOs, and faith-based organizations have established adult literacy centers across Nigeria to empower marginalized groups with literacy, vocational, and life skills. Evidence shows that such programs contribute to poverty reduction, women's empowerment, and community participation (Yusuf & Onifade, 2012; Olaniran & Oladipo, 2020). Nonetheless, Northern Nigeria continues to record lower literacy rates compared to the national average, with women disproportionately affected (National Bureau of Statistics, 2018).

In response to these challenges, the Centre for Adult Literacy and Islamic Education, Kano (CALIEK) was established by the Kano State Government. CALIEK provides a holistic model that combines functional literacy, Islamic education, community development, and financial literacy training. Its programmes target vulnerable groups such as women, unemployed youth, and low-income adults, thereby promoting both individual empowerment and community development.Given the urgency of addressing illiteracy and the unique role CALIEK plays in Kano North Senatorial District, there is a pressing need to systematically assess its activities. This study therefore seeks to examine the literacy activities undertaken by CALIEK, and evaluate their impact on the literacy development of beneficiaries.

Statement of problem

Nigeria, with a population exceeding 200 million, is the most populous nation in Africa and among the largest globally (World Bank, 2022). Despite its vast human and natural resources, the country continues to face persistent poverty, unemployment, and widespread illiteracy (Adebayo, 2020; UNDP, 2022). This paradox of wealth amidst deprivation has been linked to inadequate investment in adult literacy, lifelong learning, and entrepreneurial education programmes essential for human capital development (Nnazor, 2005; Olaniran & Oladipo, 2020).

Illiteracy remains a significant impediment to national development. UNESCO (2021) estimates that over 35% of Nigerian adults lack basic literacy skills, with the majority concentrated in the northern region. Research further indicates that literacy levels in Northern Nigeria particularly among women and youth fall well below the national average (NBS, 2018; Akinwale, 2019). This educational gap perpetuates cycles of poverty, unemployment, and limited socio-political participation.

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Earlier, Adepoju (2005) observed that more than half of Nigeria's population lived below the poverty line, a situation still evident in the increasing number of able-bodied youths engaging in street begging and informal survival strategies.

To address these challenges, government agencies and development partners have launched numerous literacy initiatives aligned with the National Policy on Education and Sustainable Development Goal 4, which emphasizes inclusive and equitable quality education. In Kano State, the establishment of the State Agency for Mass Education (SAME) in the 1980s facilitated the expansion of adult literacy centers across its 44 local government areas, supported by voluntary and faith-based organizations (Aderinoye, 2007). Within Kano North Senatorial District, the Centre for Adult Literacy and Islamic Education (CALIEK), formally registered in 1982, has been notable in providing functional literacy, Islamic education, financial literacy, and community development programmes for disadvantaged groups. Nevertheless, illiteracy rates in Kano North remain high, raising questions about the scope and impact of CALIEK's interventions. Limited empirical evidence exists on whether its activities translate into measurable literacy gains and socio-economic empowerment. This study, therefore, seeks to assess the activities of CALIEK, focusing on its literacy programmes and their impact on beneficiaries in Kano North Senatorial District.

Research Objectives

This research will be guided by the following objectives:

1. To identify the impact of literacy activities taking place at the Centre for Adult Literacy and Islamic Education in Kano North Senatorial District.
2. To determine the challenges of the Centre's programmes on the beneficiaries and their contribution to literacy development in Kano North Senatorial District.

Research questions

Based on your **objectives**, here are the corresponding **research questions** written in clear academic form:

1. What is the impact of the literacy activities carried out at the Centre for Adult Literacy and Islamic Education (CALIEK) in Kano North Senatorial District?
2. What are the challenges of the Centre's programmes on beneficiaries in terms of literacy development within Kano North Senatorial District?

Literature Review

Concept of Adult Education and Literacy

Adult Education is any organized and sustained learning program designed for and appropriate to the needs of adults. Usually, adults need to fit in study alongside other domestic and work responsibilities; they bring a diversity of experience to their studies; and they study voluntarily. Adult education is an inclusive term covering all types of education and training activities for adults formal and informal, whether offered by schools, colleges, universities, voluntary organizations, industry, or public service bodies. Adult education takes different forms in different places at different times, reflecting the different social functions given to adult learning, and the different groups with access to opportunities. Both public and private bodies are engaged in the organization of adult education programs in Nigeria (Anyanwu, 1987). This entails that through the provision of knowledge in a given situation to various individual learners, there are of course ideas of great significance which encourages learners to acquire attitudes and change in behaviors which are contrary to normal community values.

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The concept of 'literacy' would seem to be a term that everyone understands. But at the same time, literacy as a concept has proved to be both complex and dynamic, continuing to **be** interpreted and defined in a multiplicity of ways. People's notions of what it means to **be** literate or illiterate are influenced by academic research, institutional agendas, national context, cultural values and personal experiences. In the academic community, theories of literacy have evolved from those focused solely on changes in individuals to more complex views encompassing the broader social contexts (the 'literate environment' and the 'literate society') that encourage and enable literacy activities and practices to occur. As a result of these and other developments, understandings in the international policy community have expanded too: from viewing literacy as a simple process of acquiring basic cognitive skills, to using these skills in ways that contribute to socio-economic development, to developing the capacity for social awareness and critical reflection as a basis for personal and social change.

Whenever an individual possesses the require skills and adequately puts them to use at **a** time required is referred to as Literate person, often simply put as a literate. A person who is at the early stage of becoming literate is referred to as Neo-literate. More so, anybody who is incapable of demonstrating any literacy skill is referred to as illiterate while a person who **is** at the early stage of relapsing back to illiteracy Neo-illiterate. Meanwhile, while the act of not being literate is referred to as illiteracy, the act of being literate is literacy. Kinds of literacy identified by Obi (2006) include; visual literacy, print literacy, social literacy, scientific literacy, political literacy, workplace literacy, computer literacy, school literacy, home literacy, market literacy, library literacy and so on.

Review of Related Literature

Globally, literacy is widely recognized as a cornerstone of lifelong learning and a key determinant of human empowerment and sustainable development (UNESCO, 2015; Wagner, 2018). It enables individuals not only to read and write but also to access, interpret, and apply knowledge for improved participation in society and economic productivity (Aderinoye, 2007; Bhola, 1994). Within Nigeria, the National Policy on Education (FRN, 2004) identifies education as an “instrument per excellence for effecting national development,” underscoring the importance of adult and non-formal education in promoting inclusive growth and social justice (Oyebamiji & Adekola, 2008). Empirical studies consistently demonstrate that adult literacy programs enhance participants’ basic competencies. Klauth and Garza Mitchell (2023) found that beneficiaries reported substantial improvements in reading, writing, and application of literacy in daily life, accompanied by increased self-confidence. Similar findings have been documented in Nigeria, where literacy interventions were shown to improve income generation, business management, and household support roles (Yusuf et al., 2020; Oduwaiye et al., 2017). In Ethiopia, Abebe (2017) reported that rural women who participated in adult literacy programs gained not only literacy skills but also greater capacity for economic activities and family health decisions. Beyond economic benefits, literacy education fosters psychological and social empowerment, with learners frequently reporting enhanced self-concept, self-efficacy, and motivation (Akinyemi, 2020). However, broader outcomes such as civic engagement, decision-making power, and community leadership often emerge more slowly and require supportive institutional frameworks (Pretorius & Spaull, 2021).

Despite these benefits, adult literacy initiatives face numerous challenges that undermine their effectiveness. In Nigeria, high illiteracy rates especially in the North where over 35% of adults lack basic literacy skills (UNESCO, 2021) are perpetuated by structural, socio-cultural, and economic barriers. Age disparity among learners has been identified as a major challenge, as differences in pace, motivation, and learning needs can hinder classroom cohesion and discourage participation (Okedara & Adeyemi, 2020). Similarly, the distance and location of literacy centers present obstacles for rural dwellers balancing household and economic responsibilities (Yusuf et al., 2020). Gender norms remain

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another barrier, with women's participation often contingent on husbands' permission, particularly in northern Nigeria (Abebe, 2017; Oduwaiye et al., 2017). Funding inadequacies further limit program sustainability, affecting the provision of learning materials, recruitment of facilitators, and outreach (Akinyemi, 2020). Inadequate community support and low participation also weaken outcomes, as literacy programs depend on local ownership and multi-stakeholder engagement (Pretorius & Spaull, 2021). Taken together, these findings reveal that adult literacy programs, including CALIEK, are constrained more by issues of accessibility, resources, and cultural dynamics than by technical or staffing deficiencies. Research suggests that while interventions like CALIEK yield measurable benefits in reading, writing, confidence, and economic participation (Klauth & Garza Mitchell, 2023; Yusuf et al., 2020), broader social outcomes such as civic participation and sustained motivation are less immediate and often constrained by program design, societal structures, and community engagement (Akinyemi, 2020; Pretorius & Spaull, 2021).

Methodology

This study was conducted using a survey research design. A survey research design is a type of research approach that seeks to identify the existence of a variable or determine the extent to which a variable is present in a phenomenon. The population of the study comprises staff and beneficiaries, totalling 3,660 individuals. A sample size of 348 was recommended by raosoft online calculator and respondents were selected using a random sampling technique. Data were collected using a 4-point Likert scale questionnaire. Face and content validity were established by professionals and experts in measurement and literacy studies. The reliability of the data collection instrument was determined through the test-retest method. Data were analyzed using descriptive statistics with the aid of the Statistical Package for the Social Sciences (SPSS).

Data presentation and Discussion

Demographic

Table 1: Distribution of respondents by gender

Theme	Frequency	Percentage
Male	168	53%
Female	149	46.8%
Total	318	100%

The data presented in Table 1 indicates that the study sample comprised 318 respondents, of which 168 (53%) were male and 149 (46.8%) were female. This near-even distribution suggests that both genders were fairly well represented, with only a slight predominance of male respondents. From an analytical standpoint, the relatively balanced gender composition enhances the credibility of subsequent findings, as it reduces the risk of gender-based bias in responses. The marginal difference between male and female participation also implies that the perspectives captured are likely to reflect the experiences, attitudes, or behaviors of both groups in a reasonably equitable manner.

Table 2: Distribution of respondents by age

Theme	Frequency	Percentage

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15-25	43	62.1
26-35	102	29.2
36-45	131	37.6
46- and above	73	20.9
Total	318	100%

The age distribution of respondents reveals a diverse representation across different age brackets. Out of the 318 participants, the largest proportion falls within the 36–45 age group (131 respondents, 37.6%), followed by the 26–35 age group (102 respondents, 29.2%). Respondents aged 46 years and above accounted for 73 individuals (20.9%), while the 15–25 age group was the least represented, comprising only 43 respondents (13.5%). This distribution indicates that the study sample is weighted toward middle-aged adults, particularly those between 26 and 45 years, who collectively constitute nearly two-thirds (66.8%) of the total sample. Younger participants (15–25 years) are underrepresented, suggesting that their perspectives may be less influential in shaping the study's overall outcomes.

Table 3: Distribution of respondents by marital status

Theme	Frequency	Percentage
Married	162	46.4
Single	35	10
Divorce	69	19.8
Widow	83	23.8
Total	318	100%

The marital status distribution shows that out of the 318 respondents, the largest proportion were married (162, 46.4%), followed by widowed individuals (83, 23.8%), and divorced respondents (69, 19.8%). The single category had the smallest representation, with only 35 respondents (10%). This indicates that the majority of participants were either currently married or had previously been in a marital relationship (widowed/divorced). In total, these groups account for more than 90% of the sample, highlighting a strong orientation toward respondents with marital experience. The comparatively low proportion of single respondents suggests that perspectives from individuals who have never been married are underrepresented in the study.

Table 4: Distribution of respondents by educational qualification

Theme	Frequency	Percentage
Quranic education	173	49.6
Non-formal education	53	15.2
Diploma in Arabic	17	4.9
Others	106	30.4
Total	318	100%

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The educational profile of respondents demonstrates notable variation across different categories. Of the 318 participants, nearly half (173, 49.6%) reported having attained Qur'anic education, making this the dominant educational background in the sample. A further 106 respondents (30.4%) fell under the category of "Others", which may encompass diverse forms of formal or informal learning not explicitly categorized. Non-formal education accounted for 53 respondents (15.2%), while only a small proportion (17, 4.9%) reported holding a Diploma in Arabic. The data highlights a strong prevalence of religious-based learning, particularly Qur'anic education, suggesting that religious institutions and traditional forms of instruction play a central role in shaping the educational experiences of the study population. Meanwhile, the comparatively small proportion of respondents with higher or specialized qualifications (e.g., Diploma in Arabic) suggests limited exposure to advanced or structured academic training.

Table 5: Distribution of respondents by occupation

Theme	Frequency	Percentage
Farming	165	49.3
Petty trading	73	20.9
Vocational occupation	55	15.8
Animal rearing	22	6.3
Others	34	9.7
Total	318	100%

The occupational distribution of the respondents reveals that the majority were engaged in **farming (165 respondents, 49.3%)**, followed by **petty trading (73 respondents, 20.9%)** and **vocational occupations (55 respondents, 15.8%)**. A smaller proportion were involved in **animal rearing (22 respondents, 6.3%)**, while **34 respondents (9.7%)** reported being engaged in other unspecified occupations. This distribution underscores the dominance of agriculture-based livelihoods, with nearly half of the respondents directly involved in farming. Petty trading and vocational occupations also account for a significant share, suggesting that while the economy of the study population is primarily agrarian, there is also noticeable engagement in small-scale commerce and skilled trades. The relatively low proportion of respondents in animal rearing indicates that it is a secondary economic activity compared to crop-based farming.

Table 6: Perceived impact of literacy programs on the beneficiaries (Rating scale: 5 [Very high] – 1 [Very low])

S/N	Statement	VH	H	AV	L	VL	M	SD	Remark
1	To what extent has the program improved your ability to read in english/arabic	90	120	60	30	18	3.65	1.05	H
2	To what extent has the program improved your ability to write in english/arabic	100	130	50	25	13	3.80	1.00	H

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3	To what extent has your confidence in increased through the program	75	95	80	40	28	3.45	1.12	H
4	To what extent can you now help your children/family with skill learnt	80	110	70	35	23	3.60	1.08	H
5	To what extent has the literacy helped you improve your business or income generating activities	60	100	90	40	28	3.50	1.15	H
6	To what extent has your participation in community groups increased because of the literacy skill	30	50	80	90	68	2.15	1.10	L
7	To what extent has your decision-making ability at home or in society improved	25	40	70	90	93	2.05	1.08	L
8	To what extent has the program motivated you to continue practicing literacy	25	40	70	90	93	2.10	1.05	L
Cluster Mean 3.03 Average									

Table 6 presents respondents' perceptions of the literacy program's impact. The first five items, which focus on **personal literacy skills and practical application,** received mean scores above 3.0 and were classified as **high (H)**. The highest impact was reported for **writing skills (M = 3.80)**, followed by **reading skills (M = 3.65),** the ability to **help family members (M = 3.60)**, improvement in **business or income-generating activities (M = 3.50)**, and increased **confidence (M = 3.45).** These results indicate that the program is effective in enhancing literacy competencies with direct personal and household benefits. Items related to **social participation, decision-making, and sustained motivation** (items 6–8) received lower mean scores (2.05–2.15) and were classified as **low (L).** Participation in community groups, improved decision-making, and motivation to continue practicing literacy were perceived as less influenced by the program, suggesting limited impact on broader social or civic engagement. The **overall cluster mean (3.03)** reflects an **average impact**, indicating that while literacy skills were effectively enhanced, the program's effect on social empowerment and sustained engagement remains moderate.

The findings of this study align with prior research on adult literacy programs in Nigeria and similar contexts. Adult literacy interventions have consistently been shown to improve participants' **reading and writing skills** as well as their ability to apply literacy in daily life, thereby enhancing **self-confidence and economic opportunities** (Klauth & Garza Mitchell, 2023; Yusuf et al., 2020). Studies in Ethiopia and Nigeria also revealed that participation in literacy programs contributed to **income-generating activities** and improved the capacity to support family members, particularly in household education and health decisions (Abebe, 2017; Oduwaiye et al., 2017). However, similar to the present study's lower mean scores on social participation, decision-making, and motivation, prior research cautions that broader **social and civic empowerment outcomes** are often less immediate and depend on factors such as program design, societal structures, and pre-existing community networks (Akinyemi, 2020; Pretorius & Spaull, 2021). This suggests that while literacy programs are effective in **enhancing individual competencies and household benefits,** their impact on **sustained motivation and civic engagement** requires intentional reinforcement through community-oriented programming.

Table 7: Perceived challenges of literacy programs (Rating scale: 5 [Strongly Agree] – 1 [Strongly disagree])

S/N	Statement	SA	A	N	SD	D	M	SD	Remark

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1	Age disparity among learner poses challenge	140	110	40	20	8	4.11	1.02	A
2	Distance and location of the centre is a challenge	120	100	50	30	18	3.86	1.18	A
3	Gender of the facilitators is a challenge	10	20	40	100	148	1.88	1.05	SD
4	Permission from husband is a challenge for housewives	100	90	60	40	28	3.61	1.28	A
5	Funding is a major challenge facing delivery of literacy	90	80	70	40	38	3.45	1.34	A
6	There is poor participation of beneficiaries in the program	80	70	60	60	48	3.23	1.4	N
7	There is inadequacy of qualified staff at program	20	40	70	90	98	2.35	1.21	SD
8	There is non-involvement of local artisans in the activities.	50	60	80	80	48	2.95	1.29	N
9	Community support for beneficiaries poses a challenge.	40	60	80	80	58	2.82	1.28	N
Cluster Mean 3.14 average									

The findings reveal that beneficiaries of literacy programs identify multiple constraints that hinder program effectiveness. The most salient challenges are age disparity among learners (M = 4.11), distance and location of centres (M = 3.86), and permission from husbands for housewives (M = 3.61). These three items received high mean scores, indicating broad agreement that they substantially affect participation and learning outcomes. Similarly, funding challenges (M = 3.45) are seen as a critical structural limitation. Moderately rated were poor participation of beneficiaries (M = 3.23), non-involvement of local artisans (M = 2.95), and insufficient community support (M = 2.82). These items suggest challenges that are acknowledged but not as strongly emphasized. By contrast, gender of facilitators (M = 1.88) and inadequacy of qualified staff (M = 2.35) were perceived as weak or non-critical challenges. This suggests that learners are more concerned with access, socio-cultural dynamics, and resources than with the profile or number of facilitators. The cluster mean of 3.14 indicates that, on average, respondents tend toward agreement that significant challenges exist, but with variation in the type and severity of barriers identified.

The constraints identified in this study are consistent with findings from related research on adult literacy programs in Nigeria and other African contexts. Age disparity among learners has been shown to create differences in pace, learning needs, and classroom dynamics, often discouraging sustained participation by both younger and older adults (Okedara & Adeyemi, 2020). Similarly, the distance and location of learning centres remain a critical barrier, particularly for rural dwellers who must balance long travel times with economic and household responsibilities (Yusuf et al., 2020). The challenge of husbands' permission for housewives reflects persistent socio-cultural and gender norms that constrain women's access to education, a factor documented in several literacy and empowerment studies (Abebe, 2017; Oduwaiye et al., 2017). In addition, funding limitations are widely recognized as a structural impediment to sustaining literacy centres, ensuring material provision, and recruiting facilitators (Akinyemi, 2020). Moderately rated issues, such as low participation, lack of artisan involvement, and weak community support, echo earlier research stressing that adult literacy initiatives require active local ownership and stakeholder engagement to succeed (Pretorius & Spaull, 2021). By contrast, the relatively low emphasis on facilitator gender and staff adequacy suggests that beneficiaries

prioritize accessibility and socio-cultural acceptance over facilitator profiles, confirming that program effectiveness is shaped more by structural and cultural dynamics than by staffing variables.

Conclusion

This study assessed the activities of the Centre for Adult Literacy and Islamic Education (CALIEK) in promoting literacy development in Kano North Senatorial District. The findings revealed that CALIEK has made significant contributions to improving beneficiaries' reading and writing skills in English and Arabic, boosting their confidence, and enabling them to support their families and enhance income-generating activities. These outcomes affirm the Centre's role in advancing individual empowerment and socio-economic well-being. However, the study also highlighted persistent challenges that undermine the Centre's broader impact. The most salient barriers include age disparity among learners, long distances to literacy centres, and socio-cultural constraints such as the need for spousal permission for women's participation. Funding limitations, weak community support, and limited involvement of local stakeholders further reduce programme sustainability. While issues such as facilitator gender and staffing adequacy were not viewed as critical, the overall cluster mean indicates that structural, cultural, and accessibility factors remain pressing challenges. In conclusion, CALIEK has succeeded in fostering individual literacy gains but faces difficulties in sustaining broader community participation, civic engagement, and long-term empowerment. Addressing these barriers is crucial if literacy programmes are to translate into inclusive development and break the persistent cycles of illiteracy in Northern Nigeria.

Recommendations

Based on the findings, several recommendations are proposed to strengthen CALIEK's effectiveness. Community mobilization should be intensified through awareness campaigns and engagement with religious leaders, artisans, and associations to boost participation and local ownership. Accessibility challenges can be reduced by establishing more centres in underserved areas or introducing mobile classes. Women's participation should be enhanced by addressing socio-cultural barriers, advocating with community leaders, and adopting flexible or home-based learning options. Adequate funding must be secured through government, NGOs, and public–private partnerships to provide teaching materials, trained facilitators, and infrastructure. Programmes should also integrate vocational and financial literacy to link learning with income generation and empowerment. Finally, sustained motivation and civic engagement can be promoted through peer groups, alumni networks, and community service initiatives. These measures will enable CALIEK to expand its impact and advance literacy development in Kano North Senatorial District.

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ASSESSMENT OF RELATIONSHIP BETWEEN SCHOOL HEALTH PROGRAMMES AND HEALTH PRACTICES AMONG SENIOR SECONDARY SCHOOL STUDENTS IN BICHI EDUCATION ZONE, KANO STATE

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Abstract
The study assessed the relationship between school health programmes and health practices among senior secondary school students in Bichi Education Zone of Kano State. Three research questions were answered in line with the objectives of the study and correlational survey research design was adopted. The study population comprised 10,413 students in all the public senior secondary schools in Bichi Education Zone of Kano State. A sample size of three hundred and eighty four (384) respondents was selected through simple random sampling techniques. Data was collected using researchers developed questionnaire named 'School Health Programme and Health Practices (SHP-HP-Q)'. The questionnaire was validated by five (5) professionals and standardized with a reliability index of 0.81. Descriptive statistics of mean and standard deviation were used to answer research question one and two while inferential statistics of Pearson Product Moment Correlation (PPMC) was computed to test research question three at 0.05 level of significance. Out of the 384 questionnaire distributed and administered, only 381 (99.2%) were dully filled and returned for analysis. The findings of the study revealed that overall status of SHP as perceived by the students is moderate and demonstrated good personal hygiene practices, but nutrition and physical activity habits were moderate, resulting in an overall moderate health-practice score. Also, there was a significant positive relationship (r = 0.49) between the status of SHP and student health practices. Based on the findings of this study, it was therefore recommended that schools should be well equipped with functional sick bays, staffed by qualified health personnel (such as school nurses), and stocked with essential first aid materials.

Keywords: Assessment, Relationship, School Health Programmes, Health Practices, Students

Introduction

School Health Programmes (SHPs) constitute an essential framework for promoting and protecting the health of school-age populations, particularly adolescents (students) who spend a significant portion of their day within school environments. Globally, SHPs are designed to integrate health instruction, health services and healthful school environments to improve students' health behaviours, prevent diseases, and enhance academic performance (Osian, et al., 2021). According to Smith et al (2020), in Nigeria and other developing countries, the school setting provides a strategic platform for implementing essential health interventions due to the central role schools play in adolescent development and socialization. The effectiveness of SHPs, however, depends largely on how well they are implemented, resourced, and aligned with the health needs of students.

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Oladeji (2023), in Nigeria, the National School Health Policy (NSHP) emphasises the provision of comprehensive school health services, including health education, skill-based health instruction, first aid, screening for common health conditions, environmental sanitation, nutrition services, and safety practices. Evidence suggests that schools with well-structured health programmes tend to produce students with better hygiene behaviours, improved nutritional practices, and enhanced awareness of disease prevention (Sanni et al., 2022). However, despite the existence of national policies, implementation gaps remain significant across states and educational zones. Studies have consistently reported inadequate facilities, insufficient trained personnel, poor supervision, and low levels of student utilization of available school health services (Lale & Ernest, 2022).

The adolescent period which is corresponding to the senior secondary school level is a critical stage characterized by rapid physical, cognitive, and psychosocial changes that influence health behaviour (Jaiyesimi et al., 2024). Poor health practices during this period such as inadequate handwashing, poor oral hygiene, risky sexual behaviour, substance use, and unhealthy dietary patterns have been associated with adverse health outcomes and reduced academic performance (Gadanya, 2021). School-based health interventions are therefore essential to guide students towards healthier lifestyles and prevent long-term health risks.

Research across different parts of Nigeria has highlighted varying levels of implementation of SHPs. In Gwagwalada, Abuja, for example, Sanni et al (2022) found that although some schools offered basic health services, essential components such as periodic health screening, counselling services, and environmental safety inspections were either absent or inconsistently implemented. Similar implementation gaps were reported in Oyo State, where Oladeji (2023) noted low utilization of SHS among secondary school students due to inadequate awareness and limited accessibility of services. A study conducted by Nyingifa et al (2024) in Bayelsa State, reported poor quality and coverage of SHP components, attributing these challenges to insufficient funding, lack of trained school health personnel, and weak monitoring systems.

Emerging research has also emphasized the importance of school health education as a tool to influence health practices. For instance, Udobang (2023) found that targeted hygiene education among boarding secondary students in Kogi State significantly improved personal hygiene practices. Also, Chukwurah et al (2023) in their study established that effective handwashing practices among school children were strongly associated with exposure to structured health instruction. Oral health research also demonstrates that school-based education significantly shapes health behaviour; studies in Enugu, Lagos, and Abuja reported marked improvements in oral hygiene practices following structured health education interventions (Igbinedion, 2023; Ekowmenhenhen et al., 2025). The school environment also plays a central role in shaping students' health practices. Access to clean water, functional sanitation facilities, handwashing stations, safe classrooms, and adequate waste disposal has been shown to improve students' hygiene behaviour and reduce disease transmission (Maani-Abuzahra et al., 2025). According to United Nations International Children's Emergency Fund (UNICEF) (2022), WASH (Water, Sanitation and Hygiene) infrastructure within schools significantly correlates with positive health behaviour among adolescents, suggesting that infrastructural factors should not be overlooked in school health assessments.

In Northern Nigeria particularly Kano State, adolescent health challenges remain prominent due to socio-economic, cultural, and infrastructural factors (Smith et al., 2020). Research within Kano State indicates persistent gaps in health behaviour among secondary school students, including poor hygiene practices, inadequate nutritional habits, and limited health awareness (Gadanya, 2021). Evidence from Bichi Education Zone, though limited, suggests the need for strengthened SHPs. All these studies revealed the inevitable role of SHPs in strengthening health practices among senior secondary school students. However, while existing literature demonstrates a general relationship between SHP implementation and improved health practices, there is a notable insufficient empirical research specifically examining this relationship within Bichi Education Zone. Hence, this study was

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conducted to assess the relationship between school health programmes and students' health practices in Bichi Education Zone of Kano State, Nigeria.

Statement of the Problem

School Health Programmes (SHPs) are structured to ensure the social, physical and mental well-being of students, yet many secondary schools in Nigeria continue to struggle with poor implementation and inadequate health practices among learners. Despite the existence of the National School Health Policy and several state-level directives, available evidence suggests that main components of the SHP such as health education, screening services, environmental sanitation, nutrition support, and first aid are either poorly executed or entirely absent in many schools. Reports from different regions of Nigeria have consistently highlighted gaps such as lack of trained health personnel, poor WASH (Water, Sanitation and Hygiene) facilities, overcrowded classrooms, inadequate health instruction, and weak supervision systems. These deficiencies often translate into unhealthy behaviours among students, including poor hand hygiene, risky dietary habits, low health-seeking behaviour, weak oral hygiene routines, and limited awareness of disease prevention.

In Kano State, where adolescents seems to be facing diverse health challenges related to socio-cultural practices, environmental conditions, and limited access to youth-friendly health services, the need for effective school-based health interventions is critical. In addition, very few empirical studies have examined how well school health programmes are implemented across educational zones within the state. Bichi Education Zone, in particular, has witnessed growing concerns about students' health behaviour, recurring hygiene-related illnesses, and inconsistent delivery of school health instruction. Preliminary observations and anecdotal evidence suggest that many schools lack functional sickbays, regular health inspections, or structured health education sessions. However, without empirical data, it is difficult to ascertain the extent to which these programme deficiencies contribute to students' health practices. Hence, there is need to understanding this relationship because poor health practices among students can lead to increased absenteeism, reduced concentration, higher susceptibility to communicable diseases, and ultimately lower academic performance. It is against this background that this study was conducted.

Research Objectives

The following are the specific objectives of the study:

1. To assess the perceived status of the school health programme among senior secondary school students in Bichi Education Zone of Kano State
2. To determine the level of health practices among senior secondary school students in Bichi Education Zone of Kano State
3. To examine the relationship between the status of the school health programme and the health practices of senior secondary school students in Bichi Education Zone of Kano State

Research Questions

The study was designed to answer the following research questions:

1. What is the perceived status of the school health programme among senior secondary school students in Bichi Education Zone of Kano State?
2. What is the level of health practices among senior secondary school students in Bichi Education Zone of Kano State?
3. Is there a significant relationship between the status of the school health programme and the health practices of senior secondary school students in Bichi Education Zone of Kano State?

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Methodology

The study adopted a correlational survey research design. This design was appropriate as it allowed for the systematic collection of data on two distinct variables. The status of the school health programme and students' health practices in order to determine the nature and strength of the relationship between them. The population of this study comprised of 10,413 students in all the public senior secondary schools in Bichi Education Zone of Kano State (Kano State Senior Secondary Schools Management Board, Department of Planning, Research and Statistics, 2024). The total sample used in this study comprised of 384 students. This is as suggested by The Research Advisors (2006) that for a population of 10,000 people and above, 384 respondents will be adequate as sample of the study. To select the required sample, simple random sampling technique was used to select 12 schools in the Zone. Also, simple random sampling technique was used to select 32 students each from the selected schools. This gave a total of 384 respondents.

In collecting data for this study, researchers' developed questionnaire titled: School Health Programme and Health Practices (SHP-HP-Q) was used. The instrument was divided into three sections: A, B and C. Section A sought information on demographic data of the respondents. Section B elicited information on assessment of the School Health Programme. Section C requested for information on assessment of Students' Health Practices. The instrument was validated by five (5) experts. Four (4) of them are specialists in Health Education from Colleges of Education and one (1) Professor from Bayero University, Kano. A pilot study was also conducted to determine the reliability of the instrument using test-retest method. The instrument was administered to sixty (60) students from Fagge Education Zone of Kano State. Results obtained were analyzed using Spearman Brown Prophesy formula to estimate the reliability coefficient of the instrument and yielded 0.81, indicating a strong internal consistency.

After obtaining official permission to conduct the study and the purpose of the research was clarified and participants were assured that the information provided would retain privacy and confidentiality. The questionnaire was distributed and administered by the researcher and twelve (12) research assistants (each representing a school). The data were coded and analyzed using the Statistical Package for the Social Sciences (SPSS) version 29. The researcher used descriptive statistics of simple frequency and percentage to summarize the demographic information of the respondents, mean and standard deviation to answer research question one and two while inferential statistics of Pearson Product Moment Correlation (PPMC) Coefficient (r) was computed to test the relationship between the mean score of SHP and the mean score of students' health practices at 0.05 level of significance (Research question three). Out of the 384 questionnaire distributed and administered, only 381 (99.2%) were dully filled and returned for analysis.

Presentation of findings

Research Question One: What is the perceived status of the school health programme among senior secondary school students in Bichi Education Zone of Kano State?

Table 1: Mean Scores for School Health Programme (SHP) Components

SHP Component	Mean Score (1-5 scale)	SD
Health Education and Instruction	3.5	1.12
School Health Services (e.g., nurse, first aid)	2.8	1.25
Healthful School Environment (e.g., sanitation)	3.3	1.05
Overall Mean SHP Score	**3.2**	**1.08**

Table 1; indicates that the overall status of the school health programme in the Bichi Education Zone as perceived by the respondents is moderate, with a mean score of 3.2. Students rated health education and instruction; and healthful school environment more favorably than the availability of direct health services (school health services).

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Research Question Two: What is the level of health practices among senior secondary school students in Bichi Education Zone of Kano State?

Table 2: Mean Scores for Student Health Practices

Health Practice Component	Mean Score (1-5 scale)	SD
Personal Hygiene (e.g., hand washing)	4.1	0.95
Nutrition and Eating Habits (e.g., balanced diet)	3.2	1.15
Physical Activity and Exercise	3.2	1.08
Overall Mean Health Practices Score	**3.5**	**0.98**

Table 2; shows that students' personal hygiene practices were rated highly, while their nutrition and physical activity habits were rated as moderate. The overall mean score for health practices was 3.5.

Research Question Three: Is there a significant relationship between the status of the school health programme and the health practices of senior secondary school students in Bichi Education Zone of Kano State?

Table 3: Correlation Between School Health Programme and Student Health Practices

Variable	N	r	df	Prob.	Interpretation
SHP Score Health Practices Score	381	0.49	379	0.001	Significant

r = 0.49, df = 379, (p < .05)

Table 3, presents the core finding of the study and shows that there is a significant positive correlation between the status of the school health programme and the health practices of the students (r = 0.49, p = .001 < 0.001). This indicates that as the quality and implementation of the SHP improve, so do the health practices of the students.

Discussion of Findings

The outcomes of research question one shows that the overall perceived status of the School Health Programme (SHP) in Bichi Education Zone is moderate. Among the SHP components, Health Education and Instruction received the highest rating, followed by Healthful School Environment**,** while School Health Services, including availability of trained personnel and first aid facilities, received the lowest rating. This suggests that schools are relatively effective in providing health knowledge and maintaining a supportive environment but lack adequate direct health services. These findings gain the support of previous studies revealing that while health education and environmental interventions are commonly implemented in Nigerian schools, on-site health services remain limited (Owoeye & Yara, 2020; Faleke, 2022). The lower score for School Health Services reflects challenges such as insufficient

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trained personnel and inadequate emergency facilities (Adebayo, 2019; Yaro et al., 2022), which may hinder students' access to immediate care and overall health outcomes. The higher ratings for education and environment suggest that schools prioritize low-cost, manageable interventions, consistent with WHO (2021), although comprehensive services remain essential for optimal adolescent health.

The findings of research question two in Table 2 show that the overall health practices of senior secondary school students in Bichi Education Zone are moderate**,** with a mean score of **3.5** on a 5-point scale. These results are in agreement with Ibrahim and Umar (2021) who found that while adolescents often exhibit satisfactory personal hygiene behaviours, they demonstrate sub-optimal dietary practices and low levels of physical activity due to limited resources, lack of awareness and lifestyle factors. The finding is also consistent with Adebayo (2019) who reported that Nigerian secondary school students generally maintain good hygiene but have moderate to poor nutritional habits. He further highlighted the need for more targeted interventions in exercise and diet. The pattern observed may also reflect the influence of school-level health promotion activities. Personal hygiene is often reinforced through classroom instruction and routine practices in schools, while nutrition and physical activity require more sustained support from both the school environment and families (WHO, 2021). This finding stresses the importance of integrating comprehensive school health programmes that address multiple domains of health behaviour, not only hygiene but also physical activity, diet and general wellness.

Besides, the outcome of research question three, presents the correlation between the overall School Health Programme (SHP) score and student health practices score. A moderate, positive, and statistically significant relationship was found, $r = 0.49$, $df = 379$, $p = 0.001$. This indicates that students who perceive their school health programme as better implemented are more likely to engage in positive health practices. This finding aligns with Owoeye and Yara (2020) that well-structured school health programmes significantly improve students' health behaviours, particularly in hygiene and routine preventive practices. The study also gained the support of Onyemaechi and Adiele (2020) who found a positive correlation between the quality of school health services and student adoption of healthy habits, including sanitation, nutrition and physical activity. The moderate correlation suggests that while SHP plays an important role in influencing health behaviours, other factors such as socioeconomic status, peer influence, parental guidance and availability of resources also contribute to students' health practices (Faleke, 2022; Yaro et al., 2022).

Conclusions

On the basis of the findings of this study, the following conclusions were drawn that:

1. Overall status of SHP is moderate, with students perceiving health education and environmental components more positively than direct health services.
2. Students demonstrated good personal hygiene practices, but nutrition and physical activity habits were moderate, resulting in an overall moderate health-practice score. 3.
3. There was a significant positive relationship between the status of SHP and student health practices, suggesting that better-implemented SHPs are associated with healthier behaviours.

Recommendations

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

1. Schools should be well equipped with functional sick bays, staffed by qualified health personnel (such as school nurses), and stocked with essential first aid materials.

2. The Ministry of Education, in collaboration with the Ministry of Health, should prioritize the full and effective implementation of the National School Health Policy. This includes allocating dedicated budgets for SHP activities.

3. The health education curriculum should be revised to be more practical and engaging, focusing on skill-based learning in areas such as nutrition and physical fitness to translate knowledge into practice.

4. Teachers and other school staff should receive regular training on health promotion and the effective delivery of health education.

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AWARENESS OF THE CAUSES AND IMPACTS OF CLIMATE CHANGE AMONG SECONDARY SCHOOL STUDENTS IN BICHI LOCAL GOVERNMENT AREA OF KANO STATE

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Abstract

The study was carried on awareness of the causes and impacts of climate change among secondary school students of Bichi Local Government Area, Kano State. To achieve the objectives of the study, four research questions and four hypotheses were formulated. The study employed a descriptive design of survey type. The population of the study comprised of all the public senior secondary school students totaling 8,754; out of which a sample size of 370 was selected using simple random techniques. The instrument used for data collection was researchers' developed questionnaire. It was validated and subjected to pilot study that yielded a reliability index of 0.78. Bio-data of the respondents were described using frequency and percentages; and the formulated hypotheses were analyzed using chi-square and t-test at 0.05 alpha level of significant. The data from 366 students that duly filled and returned the questionnaire were analyzed and reported. The result of the study indicated that students of Bichi LGA are significantly aware of the causes ($p = 0.001 < 0.05$) of climate change and do not significantly differ ($p = 0.43 > 0.05$) in their awareness of causes of climate change based on gender. The study also found that the respondents are significantly aware of the impacts ($p = 0.001 < 0.05$) of climate change and do not significantly differ ($p = 0.051 > 0.05$) in their awareness of impacts of climate change based on gender. Based on the findings and conclusions of this study, it was recommended among others that, there is need for reactivation of forest reserves programme by the government and the inclusion of tree planting exercise should be encouraged in school campuses for the protection of the environment.

Keywords: *Awareness, causes and effects, climate change, students*

Introduction

Climate Change is defined as a change in the state of the climate that can be identified by changes in the mean and/or the variability of its properties (e.g., temperature, precipitation, humidity, incident radiation, isothermality, wind patterns), and that persists for an extended period, typically decades or longer (Field & Barros, 2014). Natalial et al (2023) climate change is considered a threat and has become a global issue for humanity. Advanced countries, developing and underdeveloped regions face problems that arise from climatic shifting (Liu et al., 2018). To exist, all living being requires resources from the environment. It would be difficult for life to survive in a distressed environment if not protected (Jharotia, 2018). Problems like floods, storms, and droughts in addition, since the industrial revolution, greenhouse gases: Carbon (iv) oxide (CO_2), Methane (CH_4), oxide (N_2O), Hydrofluorocarbons (HFC), Perfluorocarbons (PFCs), and Sulphur hexafluoride (SF6) confronted as a result of human interference. It has been studied that climate change is associated with Greenhouse Gas emissions (Hanson et al., 2011). The most probable reason behind its occurrence is an imbalance in the activities of humans. Climate change is mainly contributing to socio-economic issues

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around the globe. Also, developing countries including Nigeria are considered more vulnerable to climate change than developed countries (Zhu et al., 2022).

Awareness is generally a basic prerequisite for people to be able to understand a particular issue and its implications. Any lack of awareness/knowledge is associated with indifference and inability to recognize the need to act both individually and collectively. Mohammed (2022), the importance of global environmental awareness for addressing environmental issues like global warming has been highlighted by several researchers. In the early 1990 people's understanding of the issue of global warming was nascent. People linked the hole in the ozone layer with global warming, although both are distinct phenomena, which have separate causes, effects, and solutions (Ungar, 2000). Deforestation, burning fossil fuels, rubbish decaying is all enhancing the greenhouse gases. In the result of this, we have witnessed changes in global precipitation, temperature, and the change in sea level with weather extremes. However, Jeronen (2002) study the relationships between children's environmental concern. The researcher agreed that children have particular knowledge on global warming, but need to build more knowledge on mitigation measures.

Although climate change may be caused by natural events such as the Earth's orbit, volcanic eruptions, meteoroids and asteroids reaching the Earth's surface (VijayaVenkataRaman, et al., 2012). Accumulating evidence suggests that 21st century climate change is caused by increased greenhouse gas concentrations in the Earth's atmosphere due to human activities (Meinshausen, et al., 2020). The main greenhouse gases (GHGs) are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulfur hexafluoride (SF_6) (Meinshausen, et al., 2020). The socio-economic drivers that increase the concentrations of GHGs in the atmosphere include household energy use, manufacturing, transportation, unsustainable consumption patterns and population growth (VijayaVenkataRaman, et al., 2012). Nabeel and Bassam (2021) climate change (CC) is traced back to varying natural and anthropogenic causes. Falaye and Okwilagwe (2016) underscored that CC is caused by two factors: (i) bio-geographic factors, which encompass natural forces, and (ii) anthropogenic factors, which are factors that are linked with human activities. The latter factors encircle (i) the emission of large quantities of greenhouse gases (GHGs) into the atmosphere through, for example, fossil fuel burning, gas flaring, industrialization, biomass burning, animal farming, and solid waste incineration; and (ii) the human activities which reduce the amount of carbon that is absorbed from the atmosphere like deforestation (Akrofi, et al., 2019; Yang et al., 2018). The emitted GHGs are the major culprit for global warming (Hulme et al., 2009).

Climate change has already impacted and will continue to have negative consequences on all aspect of human life and wellbeing, including food and water supplies, energy production and use, human health, socio-economics, lifestyles, governance, political stability, international trade and migration (Nelson et al., 2014). Climate change has also had noticeable effects on many natural systems, including marine and terrestrial ecosystems, such as alterations in species the distribution, timing of seasonal biological events (phenology), community composition and biotic interactions as well as increases in invasion of alien species, pests and diseases (Hill, et., 2016). The adverse impact of climate change on human health and wellbeing, biodiversity and ecosystems threatens the attainment of the UN Sustainable Development Goals (Anderson, 2012).

The Intergovernmental Panel on Climate Change (IPCC) (2022) asserted that climate change will be irreversible, pervasive, and severe on people and the ecosystems if greenhouse gas emissions continue to go unchecked. The predicted impacts include:

i. Increased incidence of extreme weather events (flooding, storm surges, and droughts)
ii. Breakdown of critical services and infrastructure, particularly in cities and coastal regions
iii. Breakdown of food systems contributing to a heightened risk of food insecurity
iv. Increased mortality and ill-health from extreme heat events
v. Increased risk of water and food-borne diseases
vi. Greater risk of people being displaced and associated conflict

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vii. Increased loss of terrestrial and marine ecosystems and species (IPCC, 2022).

Statement of the Problem

Climate change is one of the biggest challenges facing the world today, with its effects seen in rising temperatures, irregular rainfall, and desertification, especially in northern Nigeria. In places like Bichi Local Government Area of Kano State, where most people rely on farming, these changes threaten livelihoods and the environment. Yet, many secondary school students have limited understanding of what causes climate change or how it affects their communities (Adebayo & Sunday, 2022). This lack of awareness makes it difficult for them to adopt positive environmental practices or contribute meaningfully to climate action. The problem is made worse by the limited inclusion of climate change education in the school curriculum and poor community sensitization. When students lack knowledge, they may unknowingly engage in activities that worsen environmental degradation, such as deforestation and poor waste disposal. There is therefore a need to assess the level of awareness of the causes and impacts of climate change among secondary school students in Bichi. It is against this background that this research was carried out.

Research Questions

The study was guided by the following research questions:

1. What is the level of awareness on the causes of climate change among senior secondary school students in Bichi Local Government Area of Kano State?
2. Are there differences in the level of awareness on the causes of climate change among students in Bichi Local Government Area of Kano State based on gender?
3. What is the level of awareness of climate change impacts among senior secondary school students in Bichi Local Government Area of Kano State?
4. Are there differences in the level of awareness on the impacts of climate change among students in Bichi Local Government Area of Kano State based on gender?

Hypotheses

The following null hypotheses were formulated and tested at 0.05 alpha level:

$H0_1$: Senior secondary school students in Bichi Local Government Area of Kano State are not significantly aware of causes of climate change

$H0_2$. Senior secondary school students in Bichi Local Government Area of Kano State are not significantly different in their awareness of causes of climate change based on gender

$H0_3$: Senior secondary school students in Bichi Local Government Area of Kano State are not significantly aware of the impacts of climate change

$H0_4$: Senior secondary school students in Bichi Local Government Area of Kano State are not significantly different in their awareness of impacts of climate change based on gender

Methodology

The research design employed for this study was descriptive of survey type. This design is appropriate for this study because it makes it possible to collect data quickly and affordably from a large population. The population of this study consists of all the students in all the public senior secondary schools in Bichi Local Government Area of Kano State. According to Kano State Senior Secondary Schools Management Board (KSSSSMB), Department of Planning, Research and Statistics, there are 18 senior secondary schools and students' enrolment as at 2023/2024 academic session was 8,754**.** The total sample used in this study consists of 370 students from the selected public senior secondary schools in Bichi Local Government Area of Kano State. This is in line with The Research Advisors (2006) that suggests that for a population of 10,000 people and above, 370 respondents will be adequate as sample of the study. To select the required sample, simple random sampling technique was used to select ten (10) public senior secondary schools from which 37 respondents (boys and girls)

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were randomly selected from each school for the study. The instrument for data collection was researchers' developed questionnaire. The questionnaire was validated by five experts and standardized with a reliability index of 0.78 using Cronbach Alpha statistic. The instrument was administered by the researchers with the help of ten (10) trained research assistants. Inferential statistics of chi-square and independent samples t-test were used to analyze the hypotheses at 0.05 level of significance. Data from 366 students that duly filled and returned the questionnaire were analyzed and reported. Statistical Package for Social Science (SPSS) version 27 was used in data analysis

Hypotheses Testing:

Hypothesis 1: Senior secondary school students in Bichi Local Government Area of Kano State are not significantly aware of causes of climate change

Table 1: Chi-square analysis of awareness on causes of climate change

Variable	Observed	Expected	df	χ^2	p	Decision
Agree	232	183	1	26.24	0.001	Rejected
Disagree	134	183				
Total	366	366				

$\chi^2_{table} = 3.84$, df = 1, ($p = 0.001 < 0.05$)

Table 1, reveals statistical analysis that p = 0.001 is less than 0.05, indicating that senior secondary school students in Bichi Local Government Area of Kano State are significantly aware of causes of climate change. Hence, the null hypothesis is rejected.

Hypothesis 2: Senior secondary school students in Bichi Local Government Area of Kano State are not significantly different in their awareness of causes of climate change based on gender

Table 2: t-test analysis of awareness on causes of climate change based on gender

Variables	N	Mean	SD	df	t	p	Decision
Male	204	23.54	1.95	364	0.86	0.43	Accepted
Female	162	23.27	3.62				
Total	366						

t = 0.86, df = 364, ($p > 0.050$)

Table 2 shows that, t = 0.86, df = 364, ($p = 0.43 > 0.05$), this indicated that senior secondary school students in Bichi Local Government Area of Kano State do not significantly differ in their awareness of causes of climate change based on gender. Therefore, the null hypothesis was accepted. This implies that there is no difference in the awareness of causes of climate change between male and female respondents.

Hypothesis 3: Senior secondary school students in Bichi Local Government Area of Kano State are not significantly aware of the impacts of climate change

Table 3: Chi-square analysis of awareness on impacts of climate change

Variable	Observed	Expected	df	χ^2	p	Decision
Agree	217	183	1	12.64	0.001	Rejected
Disagree	149	183				
Total	366	366				

$\chi^2_{table} = 3.84$, df = 1, ($p = 0.001 < 0.05$)

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Table 3, reveals statistical analysis that p = 0.001 is less than 0.05, indicating that senior secondary school students in Bichi Local Government Area of Kano State are significantly aware of impacts of climate change. Hence, the null hypothesis is rejected.

Hypothesis 4: Senior secondary school students in Bichi Local Government Area of Kano State are not significantly different in their awareness of impacts of climate change based on gender

Table 4: t-test analysis of awareness on impacts of climate change based on gender

Variables	N	Mean	SD	df	t	p	Decision
Male	204	23.29	2.33	364	-0.37	0.051	Accepted
Female	162	23.40	3.15				
Total	364						

t = -0.37, df = 364, (p > 0.050)

Table 4 shows that, t = -0.37, df = 364, (p = 0.051 > 0.05), this indicated that senior secondary school students in Bichi Local Government Area of Kano State do not significantly differ in their awareness of impact of climate change based on gender. Therefore, the null hypothesis was accepted. This implies that there is no difference in the awareness of impacts of climate change between male and female students sampled.

Discussion of findings

The findings of hypothesis one of this study reveals that Senior Secondary School Students in Bichi LGA of Kano State are significantly aware of the causes of climate change. This could be as a result of their exposure to various sources of information regarding climate change such as print media, internets and classroom teaching. This study is in agreement with the findings of Agboola and Emmanuel (2016), where a total of 90% of the respondents agreed that bush burning and burning of fossil fuels are part of the human activities that cause climate change. The study also agrees with that of Yang et al. (2018) who investigated association between knowledge of the causes of climate change (CC) and its perceived impacts. They performed countrywide cross-sectional survey and collected data from 1387 nursing, public health, and medical students enrolled in five regional universities in China. They found that nearly 83.0% of their sample students believed that CC is generally bad, which is a percentage that shows that the students are aware of the causes of climate change. Also, about 58% of the respondents in their study could successfully identify the causes of CC.

Besides, findings of hypothesis two indicated students in Bichi Local Government Area of Kano State are not significantly different in their awareness of causes of climate change based on gender. This could be because they have been exposed to the same teaching and almost in the same environment. This study disagrees with the findings of Ekpoh & Ekpoh (2011) that male and female teachers showed significant variation in their climate change awareness, thereby highlighting that gender was an important factor affecting climate change awareness among teachers. Male teachers exhibited more climate change awareness than their female counterparts. A possible reason for the differences between male and female teachers may hinge on the fact that both groups are essentially exposed to sources of information on climate change differently. Male teachers listen more to news, and buy newspapers more frequently which probably gives them wider access, knowledge and information on various climate change issues in different parts of the world. Besides they readily have access to internet facilities which further boost their knowledge on climate change issues, whereas their female counterparts are not exposed to such information.

The findings of hypothesis three reveals that the respondents are significantly aware of the impacts of climate change. This study agrees with the findings of Ogunsola, et al (2018) that 80% of their respondents agreed that our food and water are at risk due to climate change and about 84.3% of the respondents also agreed that climate change affects many aspects of life such as how and where people, animals and plants live. The result of this findings also supports the work of Barreda (2018)

who affirmed that the more people are educated the more their knowledge about weather conditions. In addition to the aforementioned, about 72.7% of their respondents agreed that climate change endangers lives with the natural security being jeopardized by poor human activities (Barreda, 2018).

Lastly, the findings of hypothesis four showed that there was no significant difference between the male and female respondents with regards to their awareness of impacts of climate change. This insignificant difference in the awareness of the male and female students in this study may be due to the fact that the respondents are almost in the same environment and are exposed to relatively the same level of awareness. This study disagrees with the findings of Rahman et al (2014) who found that female respondents paid more attention to the psychological effects of climate change while male respondents paid more attention to the physical effects of climate change, such as heat-related stress. The reason for this could be that both genders could be socially and emotionally sensitive to issues of climate change due to new access to information.

Conclusion

Based on the outcomes of this study, the following conclusions were drawn that:

1. Senior secondary school students in Bichi Local Government Area of Kano State are significantly aware of causes of climate change
2. Male and female students in Bichi Local Government Area of Kano State are not significantly different in their awareness of causes of climate change
3. Senior secondary school students in Bichi Local Government Area of Kano State are significantly aware of the impacts of climate change
4. Senior secondary school students in Bichi Local Government Area of Kano State are not significantly different in their awareness of impacts of climate change based on gender

Recommendations

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

1. The is need for reactivation of forest reserves programme by the government and the inclusion of tree planting exercise should be encouraged in school campuses for the protection of the environment.
2. There is need for stakeholders in education planning to integrate climate change into primary and secondary schools' curriculum in the country in order to increase its awareness.
3. There is urgent need to encourage development of environmental friendly technology known as green technology in Kano State and Nigeria in general in order to be able to mitigate the adverse effects of climate change.
4. Periodic talks and counseling on causes and impact of climate change on health and environment should be organized in schools for all the male and female students to encourage and retain those that already had the knowledge and others to key-in to it.

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RELATIONSHIP AMONG DOMESTIC VIOLENCE, PSYCHOLOGICAL WELLBEING AND ACADEMIC PERFORMANCE OF SECONDARY SCHOOL STUDENTS IN BICHI LOCAL GOVERNMENT AREA OF KANO STATE

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Abstract

The study investigated relationship among domestic violence, psychological wellbeing and academic performance of secondary school students in Bichi Local Government Area of Kano State. In line with the study objectives, three research questions were raised and three hypotheses were formulated. A correlational design was adopted for the study. The population of the study comprised of 8,754 public senior secondary school students in Bichi Local Government Area of Kano State while the sample size of 400 respondents were randomly selected. Data were collected using a researchers developed questionnaire which was validated by professionals and subjected to a test-retest method that yielded a reliability index of 0.88. The statistical techniques used in analyzing the data collected for this study were frequency counts and percentages; and Pearson Product Moment Correlation Coefficient (PPMCC) to test the hypotheses at 0.05 alpha level. Only the questionnaire from 391 respondents that were dully completed and returned were used for analysis. The major findings of this study showed that there is a significant negative relationship between domestic violence and psychological wellbeing ($r = –0.56$, $p < 0.05$); a significant positive relationship between psychological wellbeing and academic performance among the respondents ($r = 0.49$, $p < 0.05$). Also, there is a significant negative relationship between domestic violence and academic performance ($r = –0.43$, $p < 0.05$) among the sampled respondents. Based on the major findings of this study, it was recommended among others that there is urgent need to implement school-based counseling services to support students exposed to domestic violence.

***Keywords**: Relationship, Domestic Violence, Psychological Wellbeing, Academic Performance, Students*

Introduction

Domestic or intimate partner violence is widely recognized not only as a serious interpersonal and public health issue, but also as a phenomenon with far-reaching developmental consequences on children and adolescents who are exposed to it. Empirical research has established that exposure to domestic violence during childhood and adolescence can impair psychological wellbeing, disrupt family stability, and compromise educational outcomes (Tajima, et al., 2011). Such exposure represents a chronic stressor that may undermine a young person's ability to thrive cognitively, emotionally, and socially. Domestic violence is the violence between adult and intimate partners, husband and wife. It could be assaultive and coercive behaviours that include: physical, sexual, psychological attacks and

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economic coercion (World Health Organization (WHO), (2013). These are presumably used by adolescents and adults against their intimate partners. A cordial and healthy relationship is expected to exist between a man and a woman, sharing common interest, goals in life, good and bad times and in most cases the general philosophies of life. Such unity or coexistence has been responsible for the wellbeing and social upliftment of mankind.

According to Njambi (2022) children and teen are often hidden victims of domestic violence/abuse. When exposed to a parent who is abusive, children and teens often witness domestic violence/abuse, get hurt accidentally or become direct victims of abuse. The effects of exposure to domestic violence/ abuse can be as damaging to children and teens as the damage that an abusive person inflicts on his/her partner. The good news is that children and teens are resilient. They are strong and able to heal if they are listened to, nurtured and allowed to feel safe. Three to 10 million children witness domestic violence/abuse (Ozioko & Chimma, 2024). The extent of the risk and trauma of witnessing domestic violence/abuse depends on the age of the child and the severity length and frequency of the abuse. Children as young as 1 and 2 years and teens exposed to an abusive parent often feel afraid, helpless, guilty, angry, frustrated, isolated and confused.

As the incidents of interpersonal violence grows in our society so does the need for investigation of the cognitive, emotional and behavioral consequences produced from exposure to domestic violence especially in children and teens. Traumatic stress is produced by exposure to events that are so extreme or severe and threatening that they demand extra ordinary coping efforts. Such events are often unpredictable and uncontrollable. They overwhelm a person's sense of safety and security. A traumatic event can seriously interrupt the school routine and the processes of teaching and learning. Unless attempts are taken to reach out to students and staff with extra information and resources, there are typically significant levels of emotional turmoil, the potential for disruptive conduct, or loss of student attendance. It has been shown that students who have experienced trauma due to exposure to violence perform worse academically than their peers and report missing more days of school. They might struggle more to focus and learn in class, as well as exhibit especially risky or aggressive behavior (Njambi, 2022).

In addition, the children from a violent household are greatly affected in the mental torture (Ekpu, 2020). Research shows that it has an inter-generational effect on the children who witness their father abuse their mothers (Goldsmith, 2017; National Network to End Domestic Violence, 2019). They are themselves battered and also suffer the most profound behavioural and emotional distress and may exhibit a host of adverse behaviours and emotions which include becoming violent themselves in response to threats (in school or at home), attempt suicide, use drugs and abuse alcohol, develop eating disorders, abuse themselves (cutting), anxiety, and depression, poor social skills, may enter into abusive relationships (Goldsmith, 2017). The United State Department of Justice (2002) reported that children who grow in homes where violence is present are six times more likely to be sexually assaulted, sixty-seven times more likely to engage in delinquent behaviours as adolescent, hundred times likely to engage in delinquent, behaviours as adolescent, hundred times more likely to be abusers themselves, one thousand five hundred times more likely to be abused or neglected (Ekpu, 2020). All these have effects on students' academic performance and psychological wellbeing in school.

Statement of the Problem

Domestic violence is one of the prevailing social problems in many homes that affect school children academic achievements and psychological wellbeing in schools (Ozioko & Chimma, 2024). It is considered a special problem that threatens the health and emotional wellbeing of the entire family fold but with grievous effects on child upbringing and academic achievements in school. Despite this, it has not been given much attention in the field of research (Ojedokun & Bello, 2020). Perhaps, this accounts for the affirmative statement of John and Wanda (2019) that only recently have researchers focused on children affected by domestic violence. It was further affirmed that though concern over

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battered women has been discussed and researched on, researches on effects of domestic violence on children had not appeared much in research literature.

In addition, the available information or knowledge of domestic violence as it affects children require more research input. It was noted that children exposed to domestic violence are at enormous risk for maladjustment than those who do not live with such violence (Ozioko & Chimma, 2024). Without more accurate and reliable information about the prevalence of domestic violence and how it affects children, its prevention and intervention by the social workers and school counsellors cannot be designed. It is against this background that this study was conducted on: "Relationship among domestic violence, psychological wellbeing and academic performance of secondary school students in Bichi Local Government Area of Kano State".

Objectives of the Study

The primary objective of the study was to find out the relationship among domestic violence, psychological wellbeing and academic performance of secondary school students in Bichi Local Government Area of Kano State with the view to improve on their psychological wellbeing and academic performance. Specifically, this study sought to:

1. Find out the relationship between domestic violence and psychological wellbeing of secondary school students in Bichi Local Government Area of Kano State.
2. Determine the relationship between psychological wellbeing and academic performance of secondary school students in Bichi Local Government Area of Kano State.
3. Explore the relationship between domestic violence and academic performance of secondary school students in Bichi Local Government Area of Kano State.

Research Questions

The following questions were raised to serve as guide for the study:

1. What is the relationship between domestic violence and psychological wellbeing of secondary school students in Bichi Local Government Area of Kano State?
2. What is the relationship between psychological wellbeing and academic performance of secondary school students in Bichi Local Government Area of Kano State?
3. What is the relationship between domestic violence and academic performance of secondary school students in Bichi Local Government Area of Kano State?

Hypotheses

In order to achieve the objectives of this study, three (3) hypotheses were formulated and tested at 0.05 level of significance:

$H0_1$: There is no significant relationship between domestic violence and psychological wellbeing of secondary school students in Bichi Local Government Area of Kano State.

$H0_2$: There is no significant relationship between psychological wellbeing and academic performance of secondary school students in Bichi Local Government Area of Kano State.

$H0_3$: There is no significant relationship between domestic violence and academic performance of secondary school students in Bichi Local Government Area of Kano State.

Methodology

A correlational design was adopted in this study to collect the relevant data. The design was considered appropriate for the study as it seeks to establish the relationship between the variables of the study. Study was conducted in Bichi local government area of kano State.The population of this study consist of all the students in all the public secondary schools in Bichi Local Government Area of Kano State. It is estimated to be Eight Thousand Seven Hundred and Fifty–four (8,754) students (Kano State Senior Secondary Schools Management Board, Department of Planning, Research and Statistics

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(2023). The focus of the study was llimited to only senior secondary school students in Bichi Local Government Area of Kano State. The total sample used in this study consist of 400 students from the selected public senior secondary schools in Bichi LGA of Kano State. This is in line with The Research Advisors (2006) that suggests that for a population of 10,000 people and above, 370 respondents will be adequate as sample of the study. However, in this study, 400 respondents were selected to take care of mortality in filling and returning the questionnaire. To select the required sample, simple random sampling technique was used to select ten (10) public secondary schools from which 40 pupils (boys and girls) were also be randomly selected. This gives a total of 400 respondents for the study.

In collecting data for this study, researchers' developed questionnaire on the Relationship among Domestic Violence, Psychological Wellbeing and Academic Performance of Secondary School Students in Bichi Local Government Area of Kano State was used. The questionnaire was divided into four (4) sections: A, B, C and D. Section A sought information on demographic data of the respondents. Section B elicited information on the relationship between domestic violence and psychological wellbeing. Section C requested for information on relationship between psychological wellbeing and academic performance and Section D was on relationship between domestic violence and academic performance. The instrument was validated by five (5) experts. The experts are specialists in counselling and psychology. Three (3) of them were from Colleges of Education and two (2) Professors from Bayero University, Kano. A pilot study was also conducted to determine the reliability of the instrument using test-retest method. The instrument was administered to forty (40) Senior Secondary school students from Government Secondary School, Tarauni in Tarauni Local Government Area of Kano State using Cronbach alpha and 0.88 was obtained.

Data Collection Procedure

The researchers wrote letters of introduction and took to the management of the selected schools in order to seek permission from the institutions' authorities to conduct the study. All the students who are in senior secondary schools during the study period and who were ready to participate voluntarily in the study population were included. The participants were met in their classrooms and the questionnaire was distributed and administered through the trained research assistants. For better understanding, the questionnaire items were read and interpreted in Hausa Language in a manner that did not influence their response.

Data Analysis

The demographic information of the respondents were summarized by the researcher using frequency counts and percentages while Pearson Product Moment Correlation Coefficient (PPMCC) was used to test the three hypotheses at 0.05 alpha level. The data were analyzed using the Statistical Package for Social Science (SPSS) version 27. Out of the 400 questionnaire distributed, only 391 were duly filled and returned. Hence, 391 responses were used for data analysis.

Result

Table 1: Bio data of the respondents

Variable	Category	Frequency (n=391)	Percentage (%)
Gender	Male	197	50.4
	Female	194	49.6
Age (years)	12–14	85	21.7
	15–17	220	56.3
	18–20	86	22.0
Class	SSS I	130	33.2
	SSS II	131	33.5
	SSS III	130	33.2
Family Type	Polygamous	245	62.7
	Monogamous	146	37.3

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Table 1 shows that 391 respondents participated in the study. The sample was almost equally split by gender, with the majority aged 15–17 years. The distribution across SSS1–SSS3 classes was balanced. Most respondents come from poly**gamous households (62.7%)**, reflecting the local population structure.

Hypotheses Testing

Hypothesis 1: There is no significant relationship between domestic violence and psychological wellbeing of secondary school students in Bichi LGA of Kano State

Table 2: PPMCC result on domestic violence and psychological wellbeing

Variable	N	df	r	p-value
Domestic Violence Psychological wellbeing	391	389	-0.56	0.001

r = -0.56, df = 389, (p < 0.05)

The Pearson Product correlation coefficient (PPMCC) was conducted to determine the *relationship between domestic violence and psychological wellbeing of secondary school students in Bichi LGA of Kano State. Statistical analysis in Table 2 reveals* a **significant negative relationship** (r = -0.56, p = 0.001< 0.05) between domestic violence and psychological wellbeing. This indicates that higher exposure to domestic violence is associated with **lower psychological wellbeing** among the respondents.

Hypothesis 2: There is no significant relationship between psychological wellbeing and academic performance among secondary school students in Bichi LGA of Kano State

Table 3: PPMCC result on psychological wellbeing and academic performance

Variable	N	df	r	p-value
Psychological wellbeing Academic Performance	391	389	0.49	0.001

r = 0.49, df = 389, (p < 0.05)

Pearson Product correlation coefficient (PPMCC) was conducted to determine the *relationship between* **psychological wellbeing and academic performance** *of secondary school students in Bichi LGA of Kano State. From Table 3, statistical analysis reveals* a moderate positive correlation (r = 0.49, p < 0.001) exists between psychological wellbeing and academic performance. Hence, students with higher levels of psychological wellbeing tend to achieve better academic outcomes.

Hypothesis 3: There is no significant relationship between domestic violence and academic performance among secondary school students in Bichi LGA of Kano State

Table 4: PPMCC result on domestic violence and academic performance

Variable	N	df	r	p-value
Domestic Violence Academic Performance	391	389	-0.43	0.001

r = 0.43, df = 389, (p < 0.05)

Table 4, shows that PPMCC was conducted to determine the *relationship between domestic violence* and academic performance *of secondary school students in Bichi LGA of Kano State. Statistical analysis shows that domestic violence is negatively correlated with academic performance (r = -0.43, p < 0.001), suggesting that students exposed to higher levels of violence at home tend to perform worse academically.*

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Discussion of Findings

Hypothesis one of the study found a significant negative relationship between domestic violence and psychological wellbeing among the respondents. This implies that students who experience higher levels of domestic violence are more likely to suffer emotional exhaustion, depression, anxiety, and reduced psychological stability. This finding aligns with prior empirical studies showing that domestic violence undermines adolescents' emotional regulation and mental health. Kidman et al (2025) in their study found that domestic violence exposure across six Sub-Saharan African countries was strongly associated with lower adolescent mental wellbeing. Nigerian studies echo this pattern, with Adeyẹmọ et al (2023) demonstrating that adolescents exposed to violent home environments reported high levels of depression and emotional instability. Thus, the present study reinforces global evidence showing that domestic violence is a major threat to adolescent psychological wellbeing.

Result of hypothesis two also revealed a significant positive relationship between psychological wellbeing and academic performance among the respondents. This shows that students with better emotional health, stable moods, and positive psychological functioning are more likely to perform well academically. This finding is supported by Lee et al (2024) who found that psychological wellbeing contributed significantly to students' school engagement and learning outcomes. Nigerian evidence from Ozioko and Chimma (2024) also reported that students with positive emotional health consistently achieved higher grades and demonstrated better concentration during learning activities. The results of this study therefore confirm existing literature which demonstrates that students' academic success is closely linked to their psychological state, and that emotional wellbeing plays a protective and enabling role in learning.

The study further showed a significant negative relationship between domestic violence and academic performance. This indicates that exposure to domestic violence disrupts students' concentration, increases absenteeism, weakens motivation, and ultimately leads to lower academic performance. This finding is consistent with Williams et al (2024), who found that domestic violence predicted poor school attendance and reduced academic outcomes among Nigerian adolescents. Similarly, Sardinha et al (2024) demonstrated across 21 countries that household violence was strongly associated with reduced school completion and poor academic functioning. However, these studies align with the findings of the present research, confirming that domestic violence has both direct and indirect negative impacts on adolescents' learning and academic achievement.

Conclusions

On the basis of the findings of this study, it was concluded that:

1. Domestic violence has a substantial negative impact on adolescents' psychological wellbeing**.** That is, students exposed to frequent violence are more likely to experience anxiety, depression, low self-esteem, and emotional distress.
2. Psychological wellbeing is a significant predictor of academic performance. Hence, students with stronger mental and emotional health achieve higher academic outcomes.
3. Domestic violence adversely affects academic performance**,** both directly and indirectly. Thus, exposure to violence undermines concentration, school engagement, and motivation.

Recommendations

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

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1. There is need to implement school-based counseling services to support students exposed to domestic violence.
2. Conducting awareness campaigns about the impact of domestic violence on mental health and education. This will promote psychological wellbeing among students and improve academic performance.
3. Parents/Families should seek psychosocial support when conflict arises to minimize children's exposure to violence.
4. Implementing community-based interventions targeting domestic violence prevention and adolescent wellbeing is neccessary.

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EFFECTS OF GOOGLE CLASSROOM ON THE ACADEMIC PERFORMANCE OF BUSINESS EDUCATION STUDENTS IN AUDITING IN FEDERAL COLLEGES OF EDUCATION IN NORTH-WEST NIGERIA

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Abstract
The study was carried out to investigate the Effects of Google Classroom on the academic performance of business education students in Auditing in Federal Colleges of Education in North-West Nigeria. Quasi-experimental design was adopted for the study. In order to achieve this, three specific objectives and three research questions were raised. Three null hypotheses were tested for the study. The population of the study was 130 students, and the sample was 100. Auditing Performance Test (APT) was used as the instrument for data collection. The instrument consisted of two sections. Section A was the pre-test, and Section B post-test. The data collection procedure lasted for four weeks. The research question on to three were answered using mean and standard deviation. Null hypotheses one and two were tested using the T-test analysis and Null hypothesis three was tested using the Two-way Analysis of Variance (ANOVA). All the hypotheses were tested at the 0.05 level of significance. Null hypothesis one was rejected, while hypotheses two and three were retained. The study revealed that Google Classroom had positive effects on the academic performance of Business Education students in Auditing. However, there was no significant gender effect on the academic performance of male and female students who were taught Auditing using Google Classroom. There was a significant difference in the academic performance of business education students taught Auditing using Google Classroom and Traditional method. Based on the findings, it was concluded that Google Classroom had a positive effect on the academic performance of Business Education students in Auditing. It was recommended, among others, that Google Classroom should be used to teach Auditing to Business Education students in Colleges of Education. Also, training and re-training of business education lecturers on the innovative methods of teaching is very crucial.
Keywords: *Google Classroom, Academic performance, Business Education and Auditing.*

Introduction

Education has resulted in a dynamic change in the current society. It increases development, encourages self-reliance, community relationships and national integration. With the increasing adoption of digital learning platforms globally, Google Classroom has emerged as a popular tool due to its accessibility, collaborative features and integration with other Google tools. In Nigeria, especially in higher education institutions like federal colleges of education, the shift to online platforms has been accelerated by challenges such as the Covid-19 pandemic and infrastructural limitations. Business education and specifically Auditing, which requires both theoretical understanding and practical application, can benefit from digital tools to enhance comprehension and engagement (Huang, Hou & Wang, 2019).

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Business education refers to education for business and education about business. This is in line with the view of Salome (2022) who defined business education as that aspect of education that inculcates in its recipients' attitudes, knowledge, skills and values that are required in the world of work and business.

Google Classroom offers ways for Students to collaborate. Teachers can facilitate online discussion within the classroom. In addition, Students can collaborate on Google documents which have been shared by the teachers. Through Google Classroom, teachers are easily able to differentiate instruction for learners. Assigning lessons to the whole class, individual Students, or a group of Students takes a few simple steps when creating an assignment on the classroom page (Ifakhar, 2016).

Performance of Students in auditing is important because it is one of the courses offered in business education (accounting option) for N.C.E graduation. Records has shown that the performance of business education NCE students in auditing has not been encouraging. This shows that methodology is very key in any teaching and learning process as adopted by the teacher may promote or hinder learning. The deplorable performance of business education students in auditing may be as a result of over-reliance on lecture method by lecturers in Federal Colleges of Education.

As a result of these, there is a need to re-evaluate the teaching method used in teaching auditing. This is why the present Study intends to evaluate the effect of Google Classroom on the academic performance of business education students in auditing in Federal Colleges of Education in North West Nigeria.

Statement of the Problem

In recent years, technological innovations have significantly transformed the landscape of education, with e-learning platforms such as Google Classroom offering a flexible, interactive, and accessible means of interaction, communication, and assessment. Despite its potential, there is limited empirical evidence on its specific impact on students' academic performance, particularly in specialized courses such as Auditing within Business Education programs. In the context of Federal Colleges of Education in North-West Nigeria, where infrastructural and pedagogical challenges often hinder effective teaching and learning, the integration of Google Classroom presents both opportunities and concerns. While some business education lecturers have adopted the platform, others remain sceptical about its effectiveness in improving learning outcomes, especially in technical courses like Auditing that demand critical thinking and application of concepts. This study is, therefore, necessary to bridge the gap in existing literature by examining the effect of Google Classroom on the academic performance of Business Education students in Auditing. The research will provide insights into whether the use of this digital platform enhances or impedes students' understanding and mastery of auditing concepts.

Objectives of the Study

The main objective of this study is to investigate the effects of Google Classroom on the academic performance of business education students in Auditing in Federal Colleges of Education in North-west. The specific objectives are to:

1. Determine the effects of Google Classroom on the academic performance of business education students in auditing.
2. Establish the effects of gender on the academic performance of business education students who were taught auditing using Google Classroom.

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3. Ascertain the interaction effect of treatment and gender on the academic performance of business education students who were taught auditing.

Research Questions

The study answered the following research questions:

1. What is the effect of Google Classroom on the academic performance of business education students in auditing?
2. What is the effect of gender on the academic performance of business education students who were taught Auditing using Google Classroom?
3. What is the interaction effects of treatment and gender on the academic performance of business education students taught auditing?

Research Hypotheses

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

HO_1. Google Classroom has no significant effect on the academic performance of business education students in auditing.

HO_2. There is no significant difference in the academic performance of male and female business education students who were taught Auditing using Google Classroom.

HO_3. There is no significant interaction effects of treatment and gender on the academic performance of business education students taught auditing.

Litearture Review

Theoretical Framework

The key theory that formed the foundation of this study is the Constructivist theory, combined with the Technology Acceptance Model (TAM)

Constructivist Theory

This was developed by Jean Piaget (1980)

Core idea: This theory posits that learners actively construct their own understanding and knowledge of the world through experiences and reflecting on those experiences.

Relevance to Google Classroom:
Google Classroom promotes active learning, collaboration, and student-centred instruction. It aligns with the idea that students learn best when they are engaged and interact with content, peers, and instructors' features enabled by digital platforms.

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Technology Acceptance Model (TAM)

This was developed by Fred Davis (1989)

Core idea: TAM explains how users come to accept and use technology based on perceived usefulness

Relevance to Google Classroom:

It provides insight into how students and instructors adopt Google Classroom. Useful in measuring how user-friendly and beneficial students perceive the platform to be, which directly relates to their engagement and academic outcomes.

Conceptual Framework

The conceptual framework is discussed under the following subheadings:

1. Independent Variable - Google Classroom Usage:
    - Components
    - Accessibility and availability
    - User engagement and participation
    - Instructor-student interaction
    - Multimedia and content delivery
    - Assessment and feedback mechanism.

2. Dependent Variable - Academic performance in Auditing Indicators:
    - Test and exam scores
    - Assignment and project grades
    - Overall course performance
    - Cognitive skill development (e.g., analysis, evaluation).
3. Intervening/Moderating Variables:
    - Student's digital literacy
    - Internet connectivity
    - Instructor's proficiency in using Google Classroom
    - Institutional Support and training

Model Representation

The model presentation was discussed under the following:

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Google Classroom Usage

↓

(Influences)

↓

Academic performance in Auditing is moderated by:

- Digital literacy
- Internet Access
- Instructor Proficiency
- Institutional Support

This framework proposes that the use of Google Classroom positively influences the academic performance of Business Education students in Auditing. However, the strength and direction of this effect may be moderated by factors such as technological access and user competence.

Methodology

The study adopted the quasi-experimental design, specifically, pre-test and post-test non-equivalent Control group design was used. The design was considered appropriate because it was not possible for the researcher to assign subjects randomly to the groups. The population of the study was 130 students. It comprised NCE III Business Education (Accounting option) students who offered auditing in Federal Colleges of Education in North-West, Nigeria. 100 respondents were drawn as sample size for the study. The two colleges were sampled; they are Federal College of Education (Technical), Bichi, Kano State and Federal College of Education, Katsina State. Using purposive sampling, the instrument for data collection was the Auditing Performance Test (APT), containing Section A for pre-test and Section B for post-test. After using this technique, Federal College of Education (Technical), Bichi, Kano State, was assigned experimental group and Federal College of Education, Katsina, was assigned to the control group. The demographic variable was analysed using percentages, while the data for the research questions 1-3 were analysed using mean and standard deviation. Null hypotheses one and two were tested using the t-test analysis, and hypothesis three was tested using Two-way Analysis of Variance (ANOVA). All the hypotheses were tested at 0.05 level of significance.

Results

RQ1: What is the effect of Google Classroom on the academic performance of business education students in auditing?

Table 1: Mean and Standard Deviation of Post-Test Scores of effect of google classroom

Group	N	Mean	SD	Mean dif.	Sd dif.
Google Classroom (EG)	60	44.57	18.64	11.29	4.12
Traditional Method (CG)	40	33.28	14.52		

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Source: field experiment, 2025

As presented in Table 1, the experimental group (Google Classroom) demonstrated a higher mean post-test score of 44.57 and SD of 18.64, compared to the Traditional method (control group). Also. the analysis indicates a mean difference of 11.29 points between the groups, with a standard deviation of the difference of 4.12. This positive difference was statistically significant. Therefore, the results suggested that the use of Google Classroom had a significant and positive effect on the academic performance of business education students in auditing.

RQ2: What is the effect of gender on the academic performance of business education students taught Auditing using Google Classroom?

Table 2: Mean and Standard Deviation of Post-Test Scores of Business Education Students by Gender and Group

Group	Gender	N	Mean	SD	Mean diff	SD did.
Google Classroom (EG)	Male	40	47.0	16.73	2 2	4.91
	Female	20	44.8	21.64		

Source: field experiment, 2025

Table 2 presents the mean and standard deviation of post-test scores of male and female Business Education students who were taught Auditing using Google Classroom. The results show that male students had a mean score of 47.0 (SD = 16.73), while female students had a mean score of 44.8 (SD = 21.64). Although the mean score of the male students is slightly higher than that of their female counterparts, the difference of about 2.2 points is relatively small when compared with the spread of scores (as indicated by the standard deviations). This suggests that gender did not have a substantial influence on the academic performance of students exposed to Auditing instruction via Google Classroom.

In other words, both male and female students performed comparably well indicating that the use of Google Classroom as an instructional tool was effective across genders . The observed differences in performance are more likely due to individual differences rather than gender-related factors.

RQ3: What is the interaction effects of treatment and gender on the academic performance of business education students taught auditing?

Table 3: Mean and Standard Deviation Showing the Interaction Effects of Treatment and Gender on the Academic Performance of Business Education Students.

Group	Gender	N	Mean	SD	Mean Dif. For male	mean dif. Female
Google Classroom (EG)	Male	40	47.0	16.73	12.4	11.1
	Female	20	44.8	21.64		
Traditional Method (CG)	Male	30	34.6	14.00		
	Female	10	33.7	16.78		

Source: field experiment, 2025

Table 3 presents the mean and standard deviation of post-test scores for male and female Business Education students exposed to two instructional methods Google Classroom (experimental group) and the Traditional Method (control group) including the interaction between treatment and gender. The

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results indicate that students taught using Google Classroom outperformed those taught with the Traditional Method, irrespective of gender. Male students in the Google Classroom group achieved a mean score of 47.0 (SD = 16.73) compared to 34.6 (SD = 14.00) for males in the Traditional Method group, reflecting a mean difference of 12.4 points. Similarly, female students in the Google Classroom group scored 44.8 (SD = 21.64) versus 33.7 (SD = 16.78) for those in the Traditional Method group, yielding a mean difference of 11.1 points.

The comparable magnitude of improvement for both genders suggests that while the instructional method had a positive effect on performance, the interaction between treatment and gender was minimal. Therefore, gender did not moderate the effect of the treatment. Based on these findings, the interaction effect of treatment and gender on academic performance is not significant. Overall, the results indicate that Google Classroom is an effective instructional tool for teaching Auditing to Business Education students, providing consistent benefits across genders.

Hypotheses Testing

H_{O1}: Google Classroom has no significant effect on the academic performance of business education students in auditing.

Table 4: T-test analysis on academic performance of business education students in auditing.

Group	N	Mean	SD	P-value	Decision
Google Classroom (EG)	60	48.37	18.56	0.0001	Reject H_{O1}
Traditional method (CG)	40	33.73	15.10		

Source: field experiment, 2025

An independent-samples t-test was conducted to compare the academic performance, as measured by post-test scores, of business education students taught using Google Classroom (Experimental Group) and those taught using the traditional method (Control Group). The results, presented in Table 4, indicate that the Experimental Group demonstrated substantially higher academic performance than the Control Group.This difference was found to be statistically significant as the p-value of .0001 is well below the conventional alpha level of .05. Therefore, the null hypothesis (HO1) is rejected. There is sufficient evidence to conclude that Google Classroom has a statistically significant positive effect on the academic performance of business education students in auditing.

H_{O2}: There is no significant difference in the academic performance of male and female business education students who will be taught Auditing using Google Classroom.

Table 5: t-test analysis on academic performance of male and female students (EG)

Gender	N	Mean	SD	p-value	Decision
Male	40	46.10	17.5	0.257	Fail to Reject H_{O2}
Female	20	44.8	20.0		

Source: field experiment, 2025

Table 5 presents the results of an independent samples t-test examining the academic performance of male and female Business Education students taught Auditing via Google Classroom. Male students

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achieved a mean score of 46.10 (SD = 17.50), whereas female students had a mean score of 44.80 (SD = 20.00). The analysis yielded a p-value of 0.257, which exceeds the 0.05 significance threshold, indicating that the observed difference between male and female students' mean scores is not statistically significant. Consequently, the null hypothesis (HO_2) is retained, suggesting that any difference in performance is likely attributable to chance rather than gender. These findings imply that Google Classroom is equally effective for both male and female students, providing a gender-neutral learning environment in the context of Auditing instruction.

H_{O3}: There is no significant interaction effects of treatment and gender on the academic performance of business education students who will be taught auditing

Table 6: Anova analysis treatment and gender on the academic performance

Sources of variation	Sum of sq.	F-statistic	p-value	Decision
Teaching method	2,331.57	8.33	0.005	Not Rejected
Gender	174.71	0.62	0.432	
Interaction	70.82	0.25	0.616	

Source: field experiment, 2025

Table 6 presents the result of the two-way ANOVA analysis on the effect of treatment and gender on the academic performance of business education students in auditing revealed that the teaching method had a significant effect on students' performance ($F = 8.33$, $p = 0.005$). This indicates that students exposed to the experimental method performed better than those in the control group. However, gender did not have a significant effect on performance ($F = 0.62$, $p = 0.432$), suggesting that male and female students performed similarly. Furthermore, the interaction between treatment and gender was not significant ($F = 0.25$, $p = 0.616$), implying that the influence of the teaching method on performance did not depend on gender. Therefore, the null hypothesis stating that there is no significant interaction effect of treatment and gender on the academic performance of business education students was not rejected

Discussion of Findings

The study was conducted to determine the effects of Google Classroom on the academic performance of business education students in Auditing in federal colleges of education in north-west Nigeria.The Study found that Google Classroom had a significant and positive effect on academic performance of business education students in Auditing. This shows that out of the two methods used in this study, Google Classroom proved to be the best. This finding corroborated the position of Al-Emran and Salloum (2017) who reported that the use of Google Classroom improved the academic performance of students as well as encouraged active participation of the learners.

The Study found that there was no significant gender effect on the academic performance of business education students taught Auditing using Google Classroom. In other words, both male and female business education students performed comparably well. This result indicated that the effectiveness of using Google Classroom as an instructional aid does not depend on gender. This is in line with the findings of Damia (2016) that students' academic performance is not determined by gender.

The study found that there was no significant interaction effect of treatment and gender on the academic performance of business education students taught Auditing. This implies that gender did not moderate the effect of the treatment. Based on this finding, the interaction effect of treatment and gender on academic performance is not significant. This is in line with the findings of Epumepere (2021) who revealed that the usage of Google Classroom for academic activities made no significant difference between gender and students' academic performance in business education in colleges of education in Delta State.

Conclusion

Based on the findings of the Study, it was concluded that Google Classroom had positive significant effects on business education students' academic performance in Auditing. This revealed that traditional method of teaching is no longer effective or suitable for teaching Auditing and is not as effective as the use of Google Classroom.

Recommendations

Based on the findings of the Study and the conclusion which was drawn, the researchers made the following recommendations:

1. Business Education lecturers should use Google Classroom in teaching Auditing students in Colleges of Education.
2. Irrespective of gender, business education students should be taught Auditing by lecturers using Google Classroom.
3. Business education lecturers should be trained and re-trained on the use of Google Classroom in teaching students.
4. The National Commission of Colleges of Education (NCCE) should as a matter of urgency call for a meeting of stakeholders to review the course curriculum to be in line with current methods of teaching.

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IMPACT OF STUDENTS' EXPOSURE TO ELECTRONIC MEDIA FACILITIES AT HOME AND INVOLVEMENT OF PARENTS IN THE MANAGEMENT OF STUDENTS' INDISCIPLINE IN PRIVATE POST-BASIC SCHOOLS OF THE METROPOLITAN AREA OF KANO STATE

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Abstract
The study investigated how learners' exposure to electronic media at home and parental involvement in managing media use influence student discipline in private post-basic schools in metropolitan Kano. Using a correlational research design, the study sampled 378 SS2 learners from a population of 16,456 students across 235 schools. Data were collected using a validated and reliable questionnaire and analyzed with descriptive statistics and Pearson correlation. The findings showed that smartphones, internet access, and long screen time were the major sources through which learners accessed negative content at home. Such exposure contributed to sexual misconduct, graffiti, fighting, destruction of school property, and sleeping in class due to poor sleep. Parental management strategies such as co-use, instructive guidance, and screen-time limits were found to be weak and ineffective. The study recommended stricter monitoring of device ownership, reduced screen time, and restricting access to personal media devices at night to curb indiscipline.
***Keywords**: Media facilities, home environment, electronic media, indiscipline, misinformation*

Introduction

Excessive use of electronic media facilities at home is contributing to a serious decline in discipline among learners in private post-basic schools. Many students access harmful content through devices such as phones, tablets, laptops, internet services, and televisions, often choosing negative material that does not support their academic or social development. This exposure encourages aggressive behaviour and disrupts effective classroom teaching. Previous studies, such as Baffa (2021), also confirm that indiscipline is linked to students' access to inappropriate online content and their frequent visits to computer and internet shops with little parental supervision, where they adopt negative behaviours instead of engaging with educational resources.

Indiscipline among learners in private post-basic schools has increasingly been linked to excessive and uncontrolled use of electronic media facilities at home. Students often access harmful content through smartphones, tablets, laptops, and televisions, the internet, and computer game shops. This exposure leads to aggressive behaviour, poor classroom attention, sexual misconduct, indecent dressing, fighting, graffiti, destruction of school property, and sleeping in class due to late-night screen time. Studies in various locations (Baffa, 2021; Anderson, 2021; Kabiru, 2024; Esther, 2021) consistently show that negative media content and low parental supervision contribute significantly to learner indiscipline.

Discipline is essential for effective teaching, learning, and character formation, yet many parents fail to adequately regulate their children's media use. Ineffective management strategies, such as insufficient supervision, lack of technical controls, and poor knowledge of media-monitoring tools, worsen the situation. Although discipline aims to instill self-control, respect for rules, and responsible behaviour, many students now engage in bullying, watching pornography, exam misconduct, theft, and other deviant actions acquired from harmful media exposure.

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Researchers and educators emphasize that indiscipline largely originates from the home, and parents play a critical role as co-managers of learners' behaviour. Effective parental management strategies such as setting screen-time limits, supervising device use, blocking harmful sites, and actively guiding learners—are necessary to reduce the negative influence of electronic media. The researcher was motivated to investigate this issue after observing students skipping classes, loitering, and using smartphones unsupervised during school hours.

Statement of Problem

There is a growing problem of student indiscipline in private post-basic schools in the Kano metropolitan area, largely linked to ineffective parental management of learners' use of electronic media at home. Reported cases of misconduct include watching pornographic content, fighting, drug misuse, challenging teachers' authority, smoking, excessive screen time leading to sleeping in class, graffiti, sexual promiscuity, poor dressing, bullying, use of bad language, and truancy. Studies (ANCOPS, 2021; Garba, 2023) indicate that such behaviours stem from learners' unregulated access to harmful media content, highlighting the inadequacy of parental strategies to supervise and control electronic media use at home. This situation underscores the need to investigate and improve parental management strategies to curb the negative influence of home media on student discipline.

Objective of the Study

1. To identify the electronic gadgets that private post-basic learners access negative information in their homes that influences their discipline issues at school, in the metropolitan area of Kano state.
2. To determine the impacts of private post-basic learners' exposure to electronic media facilities on their discipline issues in the Kano metropolis.
3. To examine the management strategies that parents used to regulate learners' use of electronic media facilities at home to stem indisciplined acts at private post-basic schools in the metropolitan area of Kano.

Research Questions

1. What are the electronic gadgets that private post-basic school learners use in their homes to acquire negative content that influences their undisciplined acts at their homes in the metropolitan area of Kano State
2. What are the impacts of private post-basic school learners' exposure to electronic media facilities on their indiscipline in the school under the study area?
3. What are the strategies parents used to regulate the private post-basic school learners' use of electronic media facilities at home to control their indiscipline behaviours at school in the study area?

Hypotheses

The following null hypotheses guided the study

H_{O1} – There is no statistically significant relationship in the mean between the sources' private post-basic school learners accessing negative information from electronic media facilities at their homes and their indiscipline acts in the schools under investigation

H_{O2} – There is no statistically significant relationship in the means between the impacts of private post-basic learners' exposure to electronic media facilities and their indiscipline in the schools under the study area.

H_{O3} – There is no statistically significant relationship in the means between private post-basic learners' exposure to electronic media facilities at their homes and parental involvement in the management of learners' indiscipline in the metropolitan private post-basic school of Kano state.

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Literature Review

Secondary education in Nigeria aims to equip learners with the skills, knowledge, values, and competencies necessary for meaningful participation in society and further education. However, there has been a significant rise in student indiscipline, particularly in private post-basic schools. Bala (2018) notes that learners often acquire negative information at home through electronic media such as cell phones, computers, computer games, internet services, and television which fosters deviant behaviour and unsafe learning practices. The growing prevalence of indiscipline linked to media exposure at home is a major concern for educators, parents, and other stakeholders in the Nigerian education system.

Garba (2023) highlighted that exposure to electronic media at home significantly affects learners in private post-basic schools, leading to negative behaviours such as fighting, class boycotts, improper dressing, sexual misconduct, truancy, examination malpractice, and challenging teachers' authority (ANCOPS, 2021). These behaviours adversely affect academic performance and tarnish students' reputations both in school and society. Aniebonam (2021) emphasized that parents must adopt effective management strategies to control the negative influences of media exposure. Recommended strategies include setting clear rules and guidelines for media use, establishing standards and consequences for violations, maintaining an orderly home environment, supervising content on children's devices, and demonstrating care and involvement in the child's media use.

Theoretical Framework (TRA)

The Theory of Reasoned Action (TRA), developed by Fishbein and Ajzen (1975), explains how attitudes and social norms influence individuals' behavioral intentions. It is relevant to this study because students' deviant behaviors resulting from negative media exposure can be understood through their attitudes and perceived social expectations. The framework supports the idea that parents, as key social influencers, can guide learners' behavior by applying effective management strategies such as rules, supervision, and clear consequences to shape positive behavioral intentions and reduce indiscipline.

Review of Related Studies

Grey (2022) reported that student indiscipline in New York private high schools is rising due to exposure to electronic media at home. His survey of 25 schools showed that students acquire negative behaviors through smartphones, laptops, computer games, tablets, long screen time, and internet access. These exposures lead to poor classroom attention and various destructive behaviors.

Similarly, Baffa (2021) found that in Gamawa metropolitan private post-basic schools, students' access to electronic media contributes to misconduct such as class boycotting, indecent dressing, exam malpractice, drug use, sexual misconduct, lateness, truancy, and graffiti behaviors that negatively affect academic performance.

Aliyu (2023), studying parental management strategies in Kaduna metropolis, found that effective parental controls such as setting clear rules for media use, supervising children's phone activities, restrictive mediation, and co-viewing media content significantly help in regulating students' exposure to harmful media and reducing indiscipline.

Methodology

A correlational research design was adopted in the study. Shehu (2019) stated that a correlational design investigates relationships between two or more variables without the researcher controlling or manipulating any of them. This design is relevant to this study because the study intends to establish the naturalistic relationship between private post-basic school learners' exposure to electronic media facilities and parental discipline management strategies used to control the negativity at home, which manifests in schools.

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A total of 16,456 SS II learners from 235 Grade B private post-basic schools in Kano metropolis formed the study population, while 378 learners were selected as the sample, based on Paul C. Boyd's (2006) sample size table for populations between 10,000 and 25,000. The researcher used multistage stratified random sampling**,** first dividing the schools into three clusters (A, B, and C) and then selecting three schools from each cluster using non-proportional stratified sampling**,** making nine schools in total. Finally, a proportionate stratified random sampling method was used to select SS II learners from each sampled school.

The researcher purposely used SS11 learners as the respondents because learners at that level have been academically exposed and may be able to handle the questionnaire, while those in SS111 are preparing for their final examination and may not have time to participate in the study, and SS1are new in the school and may not be stable enough to participate as the respondents. The study employed a researcher-developed instrument titled *QLEEMPIDM*, consisting of 15 items across three sections on a four-point Likert scale, validated through expert review and yielding a satisfactory overall reliability coefficient of 0.79 using Cronbach Alpha. Data were analysed using descriptive statistics such as mean and standard deviation to address the research questions, while Pearson's product-moment correlation coefficient was used to test hypotheses at a 0.05 significance level. The investigation is situated within the Kano metropolitan area, focusing exclusively on learners in 235 private post-basic schools to examine the influence of electronic media exposure on student discipline and parental management involvement. The study excludes public schools, school-based disciplinary issues outside media influence, administrative matters, and variables such as gender or school location. Its reliance on purposive sampling also limits the generalisability of the findings beyond the sampled private post-basic schools.

Results

Research question one: *What are the natures of electronic gadgets that private post–basic learners use to access negative information in their homes that influence their indiscipline in the metropolitan area of Kano State?*

Table 1: Mean and standard deviations on the nature of electronic media exposure and influence of learners' indiscipline in private post-basic schools in the Kano metropolitan area.

S/N	Items	SA	A	D	SD	Mem	Std. dev	Decision
1	Accessing information through cellphones at home is associated with indiscipline among learners.in school	150	158	45	25	3.14	872	Agreed
2	I use a computer to connect to the internet freely at home for my desired content and have a relationship with my behaviour at school	140	127	42	69	2.89	1.10	Agreed
3	I enjoy long screen time in my personal room or Parlow at home, watching different content, and it is associated with a lack of quality sleep, which leads me to sleep in class during lessons	144	112	71	51	2.92	1.05	Agreed
4	I spend more time in the computer game shop than in the classroom and other learning activities	128	116	75	59	2.83	1.14	Agreed
5	I access information that has consequences for my behaviors in school through my email	78	56	82	162	2.13	1.18	Disagreed
	Grand Mean Score					2.78		

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Table I shows the responses of learners on the types of electronic media that learners acquire negative information in their homes, which influences their indiscipline acts in private post–basic schools in the metropolitan area of Kano state. The table revealed that the participants disagreed with items as indicated by their mean score of 2.13, which is less than the 2.50 bench-mark set for the study. On the other hand, the participants have agreed with items 1, 2, 3 and 4 as revealed by their mean scores of 3.14, 2.89, 2.92 and 2.83, respectively.

Those that were all above the benchmark of 2.50 indicate that exposure to the types of electronic media facilities at their home is correlated with indiscipline among private post–basic school learners in the Kano metropolitan area.

Research Question 2: *What are the impacts of private post–basic learners' exposure to electronic media facilities on the indiscipline in the school under the study area?*

Table 2: Mean and standard deviation on the relationship between exposure of learners to electronic media at home and their indiscipline acts in private post–basic schools in Kano metropolis

S/N	Items	SA	A	D	SD	Mem	Std. dev	Decision
1	Using a cellphone connected with internet services at home leads to watching pornographic content where learners develop sexual promiscuity, indecency in language and dress, fighting, wrong values, drug misuse, graffiti and criminality, which have Quen sequencies in learners' school activities	104	107	75	92	2.59	1.12	Agreed
2	Long screen time at home leads to negative attitudes like sleeping in class the following morning due to lack of quality sleep in the night, fighting, graffiti, drug misuse, disrespect of law and challenging teachers' authority	124	98	87	69	2.63	1.09	Agreed
3	Misuse of the internet services through personal laptops, tablets may lead to the accessibility of different negative content like confusion of reality, fantasy, wrong values, criminality, carrying weapons, and disrespect of societal law. This has a direct bearing on indiscipline in school	117	92	87	82	2.72	1.07	Agreed
4	Using email to acquire negative content, like bullying, taking French leaves in school	88	96	109	75	2.47	1.10	Disagreed
5	Learners' exposure to electronic media at home leads to the development of negative habits of absenteeism, exam misconduct, and misbehaviors in class	71	89	113	105	2.33	1.17	Disagreed
	Grand Mean Score					1.09		

Table 2 revealed mean scores of 2.47 and 2.33 for items 4 and 5, respectively, which were all below the benchmark (2.50), indicating that the participants disagreed with the items. However, the respondents have agreed with items 1, 2 and 3 as revealed by their mean scores of 2.59, 2.63 and 2.72, respectively, which were all above the benchmark 2.50 set for the study and indicated their relationship between electronic media facilities at home and indiscipline of the learning in the private post–basic schools in Kano metropolis.

Research Question 3: *What are the strategies parents use to regulate the use of electronic media facilities at home by learners of post–basic schools?*

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Table 3: Mean and standard deviation on the relationship between learners' exposure to media facilities at home and parents' management strategies

S/N	Items	SA	A	D	SD	Mem	Std. dev	Decision
1	Co-use of electronic media facilities with parents at home, i.e. watch films and movies together with parents	78	56	82	162	2.13	1.18	Disagreed
2	Restrictive mediation/screen time, limiting the time the learner spends in front of the TV	71	89	113	105	2.33	1.17	Disagreed
3	Active / instructive mediation, speaking about the contents of films and the series to bring out the habit of learning by parents	88	96	109	75	2.47	1.10	Disagreed
4	Monitoring, i.e. controlling the use of cellphones, computers, tablets and the internet at home by parents for learners to have adequate time in school	117	92	87	82	2.72	1.07	Agreed
5	Parental control strategy is yet to be viable; it's shrouded with inadequate knowledge of management strategies to stem indiscipline among learners exposed to media gadgets, how the work is done, and how to apply them.	140	127	42	69	2.89	1.10	Agreed
	Grand Mean Score					2.78		

The results from Table 3 show mixed responses regarding learners' exposure to electronic media and parental discipline management strategies, with respondents disagreeing with three items (mean scores below the 2.50 benchmark) and agreeing with two items (means above 2.50). The study's hypotheses were tested using the Pearson product–moment correlation at a 0.05 significance level. For HO1, Table 4 indicates a significant relationship between the types of electronic media facilities learners use at home and their indiscipline, with n = 378, r = .868, and p = .002, leading to the rejection of the null hypothesis. This finding confirms that the kinds of electronic media used at home significantly influence learners' indiscipline in private post-basic schools in Kano metropolis.

Variable	N	x	std-dev.	DF	R-value	Sig (2 tall)	Decision
Types of electronic media facilities	378	2.91	72				
				376	868	0.02	Rejected (HO_1)
Learners' indiscipline issues	378	2.77	104				

able 4 shows a statistically significant relationship between the types of electronic media facilities learners use at home and their indiscipline in private post-basic schools in Kano metropolis, with n = 378, R = 0.868, and a P-value of 0.002, which is below the 0.05 significance level. This result indicates that the more learners engage with various electronic media devices at home, the more likely they are to display indiscipline at school, leading to the rejection of the null hypothesis (HO2) stating no significant relationship between exposure to electronic media and learners' indiscipline in the schools under study.

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Variable	N	X	std-dev.	DF	R-value	Sig (2 tall)	Decision
Exposure to electronic media facilities	378	2.67	1.06				
				376	.768	.010	Rejected (HO_2)
Impact of learners' indiscipline	378	2.55	1.08				

Significant level

The analysis shows that learners' exposure to electronic media facilities is significantly related to rising indiscipline in private post-basic schools in Kano metropolis. Table 6 indicates a strong positive relationship (n = 378, r = .768, p = .010), meaning that as learners' exposure to electronic media increases, the level of indiscipline also increases; thus, the null hypothesis (HO2) was rejected. The third hypothesis (HO3) examined whether there is a significant relationship between learners' exposure to electronic media at home and parental discipline management strategies, with Table 7 presenting this relationship for further interpretation.

Variable	N	x	std-dev.	DF	R-value	Sig (2 tall)	Decision
Exposure of electronic media facilities	378	2.53	.96				
				.746	.803	.004	Rejected (HO_3)
Parental discipline management strategies	378	2.48	.78				

Significant level

The result presented in Table 7 revealed the relationship between the exposure of learners to electronic media facilities at home and their parents' discipline management strategies. With n = 378, R = 803 and P-value (0.04), which is less than the alpha value (0.05), indicating that exposure of learners to electronic media facilities at home has a significant relationship with the parental discipline management strategies. Hence, the null hypothesis 3 was rejected, implying that the parental discipline management strategies are weak to control learners' indiscipline copying from electronic media at home and spread to private post–basic schools in the Kano metropolitan area.

Discussion of the Findings

The study found a significant relationship between learners' exposure to electronic media at home such as cell phones, televisions, internet access, tablets, laptops, and computer games and various forms of indiscipline in private post-basic schools in Kano metropolis. Excessive media use was linked to cognitive, social, and physical behavioural problems in school. This supports earlier findings by Gray (2022), who also reported that ownership and heavy use of electronic devices led to destructive behaviour and poor classroom attention.

The second finding showed that home exposure to electronic media significantly influences students' misconduct and academic challenges. Behaviours such as sleeping in class due to long screen time, indecent dressing, bad language, sexual misconduct, graffiti, and fighting were identified. These align with Baffa (2021), who found similar forms of indiscipline caused by students' access to media at home.

The third finding revealed a significant relationship between parental management strategies and learners' indiscipline. However, the strategies used—such as technical mediation, limiting screen time, and co-use—were largely ineffective due to poor implementation. This contrasts with Aliyu's (2023)

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study, which reported that effective parental rules and supervision helped reduce media-related indiscipline.

Conclusion

The study concludes that exposure to negative information from electronic media at home significantly contributes to learners' indiscipline in school, as confirmed by the statistical result ($p = 0.02 < 0.05$). Students commonly displayed behaviors such as fighting, drug misuse, classroom disruption, disrespect for authority, and sleeping in class due to excessive screen time. The findings show that harmful content is mainly accessed through phones, computers, television, internet services, tablets, and games. This exposure leads to various forms of misconduct, including indecent dressing, bad language, graffiti, confusion of reality, and other disruptive actions that negatively affect school performance. The study also reveals that parental management strategies such as monitoring, co-use, and technical mediation—are weak or poorly applied because parents lack adequate knowledge of how to effectively regulate media use at home.

Recommendations

1. Control device ownership and screen time: Parents should closely monitor and regulate children's use of smartphones, tablets, laptops, and other devices to prevent exposure to harmful content that may lead to school indiscipline.
2. Ensure adequate sleep by limiting screen time: Parents should set a maximum screen time of about 1 hour and 30 minutes daily to promote healthy sleep and prevent learners from feeling sleepy in class.
3. Address other forms of indiscipline linked to media use: Problematic behaviors such as fighting, destruction of property, indecent dressing, and graffiti should be controlled by blocking access to harmful online content and checking learners' devices when necessary.
4. Use restrictive mediation: Parents should limit the amount of time learners spend on TV or digital media and intentionally select appropriate content, including watching together (co-use) to ensure safety.
5. Apply active or instructive mediation: Parents should discuss the content of films, videos, or online materials with learners to guide their understanding and discourage harmful media influence.
6. Adopt technical mediation: Parents should implement strategies such as disabling internet access at specific times and learning to use technological tools and applications that help monitor, filter, and manage media content accessed by learners.

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STUDENTS HAND-ON EXPERIENCE OF AGRICULTURAL EDUCATION FOR SELF-RELIANCE IN AN ERA OF UNCERTAINTIES IN DELTA STATE

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Abstract
The study investigated the hand-on experience of secondary school students in agricultural education for self-reliance in Delta State. the aim was to provide information that is capable of driving sustainable change in pre-vocational education that can create entrepreneurial spirit in students. The survey research design was adopted in the study. Two research questions and two hypotheses guided the study. A sample of 2700 students was randomly selected using proportionate stratified random sampling technique. Data collected were analysed using percentage to answer the research questions and chi-square statistic to analyse the hypotheses at 0.05 level of significance. the result showed that, majority of schools do not engage their students in hand-on-experience in agricultural education. Hand-on experience in agricultural education was significantly dependent on school location of students. While hand-on experience in agricultural education was not significantly dependent on school type of students. It was recommended among others that, efforts should be made by secondary schools in Delta State to provide students with school farms and conscientious efforts should also be made to equip students with practicable skills in agriculture to cultivate an entrepreneurial spirit in them and make them self-reliant.
key words: Agricultural Education, Hand-on-Experience.

Introduction

The unpredictability, volatility and uncertainty in the global economy have remained heightened five years after the COVID 19 pandemic. Global economy has yet to recover to pre pandemic levels. It is now the new normal to live with the fear of uncertainties and to expect that things could turn at any time. This has been exacerbated by the increasing interconnectedness of national economies, supported by free trade, globalization and social mobilization. According to Robinson and Smith (2024), uncertainties surrounded the global economy were arising from the pandemic, slow growth from the American economy, fluctuating global markets, impacting climate change, geopolitical tensions, rising cyber insecurity, inflation and deepening food crisis.

While the whole world stood still for COVID and even in wars, nonetheless, agriculture and farming cannot stop because, people still need to eat no matter the challenges being faced by the society. Agriculture is very essential to the human race and plays an important role in the economic well-being of the society (Nmims, 2024). It is said to be the primary source of food security to the whole world as it ensures that the society has sustainable food supply, for the maintenance of good health and wellness of the population (Nisha, 2020; Saud, 2022). Its importance in addition to food provision and security, according to Rajalakshmi (2023) includes balancing of the ecosystem, maintaining of social order, provision and enhancement of greener environment, provision of protection against famine, supply of raw materials for manufacturing industry. Maryville (2022) further identified that it is instrumental to economic development (of many societies and serves as one of the highest sources of employment in the world.

Agriculture is prioritized by the federal government in Nigeria, as it is recognized as an essential key to economic growth. The objectives stated in then National policy on science and

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technology education (2018) includes amongst others, "To reposition Nigerian agricultural education system and its programmes to be industry driven to meet societal needs". As part of its commitment to achieve its goals, the Government laid down some strategies imbedded in the policy to aid the achievements. Included amongst these strategies was, "providing entrepreneurship agricultural education for establishment of farms and agro processing industries." The action statement projected by the government on the achievement of these goals was that; "All stakeholders shall engage proactively in agricultural education programmes so as to improve and advance production and productivity that is geared towards sustainable agriculture education." One of the actions taken by the government was to incorporate agricultural education into the curriculum of Nigerian basic and secondary school (Disciplines in Nigeria (DIN)2024). The aim was reported to include amongst others to equip learners with viable and profitable Agro skills for self-reliance and economic enhancement (ovia, 2024).

Agriculture Education in basic and secondary schools as viewed by researchers, provides learners with the opportunity to acquire knowledge, skills, and Competencies in Agriculture (Maryvill, 2022; Ovie, 2024; Saud, 2022; Nisha, 2020). They explained that learners gain in-depth knowledge of the rudiments of Agriculture as they are exposed to understanding the practical and theoretical aspects. They opined that exposure to agricultural education prepares learners for a Vocation in Agriculture and makes them self-reliant. Northeast Agricultural Education Foundation (NAEF) (2024) further reported that Agricultural education does not only teach students about farming but also exposes them to the understanding of food production and plant sciences. They explained that learners also get the opportunity to learn about animal care, biology and sustainable use of natural resources, through Agriculture education. Ovia, (2024) in identifying the importance and benefit of Agricultural Education said it give learners the required skills that will empower them to take up contemporary Agricultural employment opportunities in times of economic insecurity and uncertainty.

Hand-on-experience in Agriculture education in the view of DIN, (2024) implies exposing learners to adequately acquire the necessary practicable skills and knowledge required to proficiently engage in Agriculture. This approach engages learners in practical training, thereby enabling them to apply concepts that are theoretical in a practical setting (DIN, 2024). The West African Examination Council's policy on Science Subjects stipulates that the teaching of Agriculture science syllabus should be on practical basis (WAEC, 2024). Learners are expected to be given a lot of Practical exposure which involves doing-by-themselves. This approach according to Obiyai & Olisa (2022) would facilitate an enhanced educational attainment and improved performance. These practical experiences would facilitate the learner's ability to comprehend what has been learnt in class and also gain mastery of the required skill for engagement (Plexuss, 2024). By gaining expertise through hand-on-experience, learners also acquire confidence, improve in competency and can be gainfully employed after the completion of school.

The embrace of hand-on-experience as averred by Boahin and Hofman (2013) requires changes in the roles of teachers and learners in the teaching learning process. This method entails teachers letting go of the traditional ''chalk to talk'' theoretical model to stand in as the facilitators and coaches in a new learning approach that is more student-centred, active, practical and exploratory. In recognition of the impact of hand on experience in agriculture, Federal university of Agriculture Abeokuta (FUNAAB) (2011), in its Farm Practical Year (FPY) programme adopted the philosophy of "learn by doing" in training beneficiaries in order to afford learners the opportunity of being grounded in the rudiments of Agricultural practices for self-reliance, decent Work & Economic Growth. Some authors pointed out that emphasis in Nigerian schools should not merely be on acquiring paper/academic qualifications, but rather, on the holder possessing required knowledge, practical skills and abilities to perform through hand-on-experience (Ighakpe, 2023; Imobighe , 2013; Boahin, at el. 2013; Okoh, 2011; Seriki, 2011). Boahin et al. (2013) stressed that Practical and exploratory work aids the

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acquisition of knowledge and practical skills that help students to venture into an occupation such as Agriculture.

In explaining the place of hand on experience in the teaching learning process in this era of uncertainty, Health Staff Training Institute (HSTI) 2023) emphasized that it is a necessary tool that provides learners with the route to get involved in the needed live experiences in learning and acquiring of the actual skills needed for self-empowerment and self-reliance. Hand-on-experience in Agriculture as explained by Northeast Agricultural Education Foundation (2024) is meant to expose students in variant practices of Agriculture as a means for self-reliance and National Development. In the bid of advocating hand-on-experience in agriculture in schools, Ighakpe, (2023) explained that it helps in equipping students with first-hand knowledge of how to cultivate agro products and run agribusinesses. He went further to emphasize that this act is important as it helps to cultivate an entrepreneurial mind-set in students. Many researchers have extensively declared that the practical aspect of agriculture in the school curriculum needs to be accorded the same attention as the theory (Maryvill, 2022; Ovie, 2024; NAEF, 2024; Saud, 2022; Nisha, 2020 WAEC, 2024). School farms for agriculture education, as explained by some researchers, represents a learning zone which helps learners succeed in gaining skills that can impact their proficiency in agro skills (Ighakpe 2023; kugedera, 2021; Simmon & Abbey, 2016). School farms serve as a laboratory for having a hand-on-experience learning of various topics such as planting of different crops, weeding of grasses, crop rotation, application of fertilizer, types of mixed cropping, pest control, Inter-Cropping, etc. with the major focus being the development of skills and self-reliance.

Purpose of the Study

The Purpose of this study is to assess the extent to which students in senior secondary schools of Delta State are exposed to hand-on-experience in Agriculture education.

Research Questions

1. What percentage of students are exposed to hand-on-experience in agriculture education in urban and rural secondary schools.?
2. What percentage of students are exposed to hand-on-experience in agriculture education in public and private secondary schools.?

Hypotheses

The study tested the following hypotheses at 0.05 level of significance

1. Exposure to hand-on-experience in agriculture education is not significantly dependent on location of students.
2. Exposure to hand-on-experience in agriculture education is not significantly dependent on type of school.

Methodology

The survey research method was adopted in this study. The population of the study was students in senior secondary school 2 and 3 in public and private schools in Delta State of Nigeria. The total number of SS 2 & 3 secondary school students in Delta State could not be ascertained at the time of the research. A sample of 4500 students was selected using stratified random sampling technique. The population was stratified into the three sanatoria district of Delta State at the time of the study. The secondary schools in each senatorial district were stratified into public and private schools.

Two research questions and two corresponding null hypotheses guided the study. Data were collected using a chart that had a list of different common hand-on-experiences in agricultural science that secondary school student were supposed to be exposed to, while in school according to the Delta State Ministry of Education and WEAC Curriculum. Data collected were analysed using percentage for the research questions and chi-square to test the null hypotheses at 0.05 level of significance.

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Presentation and Analysis of Results

The results were presented according to the research questions and hypotheses tested.

Research Question 1: What percentage of students are exposed to hand-on-experience in agriculture education in urban and rural secondary schools.

Table 1:*Percentage analysis of students' exposure to hand-on-experience in agriculture education in urban and rural secondary schools.*

NO	Exposure to Hand-on-experience	No. of Urban	No. Of Rural.	Urban %	Rural %
1	School Farm	54	755	06.70	93.30
2	Soil types	125	43	00.74	21.76
3	Weeding of farm	32	420	07.07	92.92
4	Organic maturing	67	60	52.76	47.24
5	Fertilizer application	39	230	14.50	85.50
6	Types of Irrigation	15	80	15.79	84.21
7	Crop planting	70	752	08.52	91.48
8	Nursery of vegetables	130	112	53.70	46.30
9	Crop rotation	15	248	05.70	94.30
11	Mixed farming	15	330	04.35	95.65
12	Pest control	17	43	28.33	71.66
13	Maintenance of farm tools	67	175	27.68	72.32
14	Fish ponds	5	67	12.99	87.01
15	Poultry farm	7	15	31.82	68.18
16	Ruminant Animals	3	82	09.89	90.11
17	Non ruminant Animals	3	17	15.00	05.00
18	Field trips to;	-	-	-	-
	a) Commercial farms	149	20	88.16	11.83
	b) Government farms	204	17	92.30	07.70
	Total	**1,044**	**3456**	**23.20**	**76.80**

Table 1 indicates that the percentage of students who were exposed to hand on experience in Agricultural education in urban was 23.20% while that of rural secondary schools 76.80. The result showed that students in rural secondary schools were more exposed than students in urban secondary schools.

Research Question 2: What percentage of students are exposed to hand- on- experience in agriculture education in public and private secondary schools.

Table 2:*Percentage analysis of students' exposure to hand- on- experience in agriculture education in public and private secondary schools.*

NO	Exposure to Hand-on-experience	No. of Public schools	No. of Private Schools	Public School %	Private School %
1	School Farm	443	302	84.18	15.81
2	Soil types	246	208	54.18	45.82
3	Weeding of farm	123	105	53.94	46.82
4	Organic manure	73	32	69.52	30.48
5	Fertilizer application	23	20	53.49	46.51
6	Types of Irrigation	20	48	71.43	28.57

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7	Crop planting	500	437	53.36	46.64
8	Nursery of vegetables	240	198	56.07	43.93
9	Crop rotation	133	104	56.12	43.88
11	Mixed farming	264	27o	49.43	50.57
12	Pest control	31	21	59.61	40.39
13	Maintenance of farm tools	224	152	59.57	40.43
14	Fish ponds	32	5	86.49	13.54
15	Poultry farm	3	9	25.00	75.00
16	Ruminant Animals	7	3	70.00	30.00
17	Non ruminant Animals	0	2	0	100.00
18	Field trips to;	-	-	-	-
	c) Commercial farms	0	257	0	100.00
	d) Government farms	0	100	0	100.00
	Total	**2307**	**2192**	**51.27**	**48.83**

Table 2 indicates that the percentage of students who were exposed to hand on experience in Agricultural education in public secondary schools was 51.27% while that of private secondary schools 48.83%. The result showed that students in public secondary schools were more exposed to hand-on experience of agriculture education than students in private secondary schools.

Hypotheses 1: Exposure to hand- on- experience in agriculture education is not significantly dependent on location of school.

Table 3: *Chi-square test analysis of student's exposure to hand-on-experience in Agriculture education on location of school.*

Variables	N	DF	X^2. calculated	X^2 critical	Decision
Exposure to hand-on-experience School location	18	17	38.52	27.59	Reject

The result of chi-square statistical test of dependence of students' exposure to hand-on-experience in Agriculture education on location of school is presented in table 3. The table revealed that the calculated Chi-square value of 38.52 is more than the critical Chi-square value of 27.59 at .05 level of significance. The null hypothesis is therefore rejected. The result revealed that students' exposure to hand on experience in Agriculture education was significantly dependant on location of school. In other words, secondary school students in rural areas had more exposure to hand-on-experience in Agriculture education than their counterparts in urban areas.

Hypothesis 2: Exposure to hand-on-experience in agriculture education is not significantly dependent on type of school.

Table 4: *Chi-square test analysis of students' exposure to hand-on-experience in Agriculture education on type of school.*

Variables	**N**	**DF**	**X^2. calculated**	**X^2 critical**	**Decision**
Exposure to hand-on-experience School type	18	17	11.32	27.59	Accept

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The result of chi-square statistical test of dependence of students' exposure to hand-on-experience in Agriculture education on type of school is presented in table 4. The table revealed that the calculated Chi-square value of 11.32 is less than the critical Chi-square value of 27.59 at .05 level of significance. The null hypothesis is therefore accepted. The result revealed that students' exposure to hand-on-experience in Agriculture education was not significantly dependant on type of school. In other words, secondary school students in public schools did not have significant more exposure to hand-on-experience in Agriculture education than their counterparts in private schools.

Discussion of Results

This study investigated students' hand-on experience of Agricultural education for self-reliance in an era of uncertainties in Delta State. The study revealed a high percentage of low level of exposure to hand-on experience in Agricultural education for urban secondary school students. The figure for Exposure to school farm in urban schools was as low as 6.7%. The result is disturbing especially when it is realized that urban schools are densely populated due to rural-urban migration. This means that a high segment of students are missing out on the privileges of having hand-on-experiences of Agriculture during their days of schooling (Ighakpe, 2023). They therefore miss the positive opportunities of skill development and self-reliance that exposure to practicable Agriculture education offers (Maryvill, 2022; Ovie, 2024; Saud, 2022; Nisha, 2020 Imobighe , 2013; Okoh, E. 2011; Seriki, 2011; Boahin, at el. 2013).

This study also revealed that secondary schools in rural areas had more exposure to hand-on-experience in Agriculture education than their counterparts in urban areas. This finding is in agreement with that of Henry, Talbert & Morris (2014) observations that rural areas had predominantly agriculture related occupations, therefore students had a lot of exposure to hand-on-experiences in agriculture as they typically had a background in Agriculture from practices around the communities they live in.

It was further revealed by this study that students in private secondary schools were not significantly less exposed to hand-on-experience in agriculture education than students in public schools. This buttressed the findings from some researchers (kugedera, 2021; Simmon, et al 2016) who observed that generally, all schools faced one challenge or the other such as, funding, lack of qualified teachers lack of school farm, animal farm, demonstration plots and others in implementing practical Agriculture which involved exposing students to hand-on-experiences in Agriculture education in Delta State.

Conclusion

From this study the following conclusions can be reached. Firstly, many students in the secondary schools in delta state are not exposed to hand-on-experiences in agricultural education. Under this circumstance, many students are denied the opportunity to acquire useful lifelong skills that can serve as a cushion to economic uncertainty.

Secondly students in urban secondary schools are less exposed to hand-on-experience in agriculture education. This can slowdown their ability to be gainfully engaged if faced with unfavourable employment situations after graduation unlike their counterparts in rural areas who can easily revert to their acquired skills and be gainfully engaged.

Recommendation

From this study, the following recommendations were made;

1. Agriculture departments in secondary schools should have a school farm, school garden or agriculture demonstration plot to enforce students' hand-on-experience of agriculture practice to help student learn the required skills in agriculture that can help them in the era of economic uncertainty

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2. The ministry of education should ensure that all private and public schools own a school farm or demonstration plot as a prerequisite for teaching agricultural science in their schools to enhance the student's skill acquisition and gainful engagement after graduation

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EFFECTS OF VIRTUAL REALITY SIMULATION PACKAGE ON PERFORMANCE IN PHYSICS PRACTICAL AMONG SECONDARY SCHOOL STUDENTS IN KANO NORTH, NIGERIA

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Abstract
The teaching and learning of physics in secondary schools is essential for developing scientific knowledge. However, many students in Nigeria, particularly in rural areas, face challenges due to insufficient laboratory resources and ineffective teaching methods. This study examines the impact of a Virtual Reality (VR) simulation package on the performance of secondary school students in physics practicals in Kano North, Nigeria. The main aim is to determine whether VR can improve students' understanding and engagement in practical physics, tackling ongoing issues like inadequate laboratory facilities and limitations in instructional methods. Using a quasi-experimental design, the research involved an experimental group that used VR simulations and a control group that received traditional instruction. Data were gathered through a Physics Performance Test (PPT), which evaluated students' cognitive and psychomotor skills. The findings indicated that the experimental group showed a significant increase in posttest scores, with an average performance gain of 40.4 points, compared to 30.4 points in the control group. The study also looked into performance differences by gender, showing that both male and female students benefited from VR, although the differences were not statistically significant. These findings suggest that VR can effectively mitigate resource constraints in physics education, provide immersive learning experiences, and foster a more equitable learning environment. The research advocates for integrating VR technology into the Nigerian educational curriculum, emphasizing the need for infrastructural support and teacher training to maximize its potential.
Keywords: *Virtual reality, Physics Education, Secondary school students, Practical learning, Educational Technology*

Introduction

The teaching and learning of physics, especially in secondary schools, is essential for fostering scientific knowledge and driving technological progress. Engaging in practical work in physics is particularly important, as it offers students hands-on experience, reinforces theoretical concepts, and cultivates critical thinking and problem-solving skills. However, according to Ibukun and Ezeani (2020), many Nigerian secondary schools - especially those in rural areas in Kano North, physics practical sessions are often hindered by numerous challenges. These include inadequate laboratory equipment, poorly trained personnel, overcrowded classrooms, and insufficient time allocation for practical activities. As a result, students are frequently limited to theoretical instruction, which can lead to poor understanding and disinterest in the subject (Achimugu *et al*., 2023).

In recent years, technology has increasingly been recognized as a tool for overcoming these educational challenges (Radianti et al., 2020). One such technological innovation is Virtual Reality (VR), which creates immersive and interactive environments that simulate real-world experiences. VR simulations in education offer a novel approach to learning, enabling students to engage with content in ways that traditional methods cannot. In physics practicals, VR can replicate experiments and allow students to manipulate variables, observe outcomes, and receive immediate feedback, all within a safe and resource-efficient environment (Durotimi, 2025).

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Globally, research has shown that VR-based learning can significantly enhance students' engagement and academic performance. Studies have indicated that VR increases motivation, deepens conceptual understanding, and supports different learning styles. Despite these benefits, the adoption of VR in Nigerian schools remains minimal, often due to lack of awareness, infrastructure, and policy support (Abdul-Salaam, 2024). This study aims to investigate the potential of VR simulations to enhance performance and engagement in physics practicals among secondary school students in Kano North, Nigeria. By comparing the effectiveness of VR-based instruction with traditional teaching methods, the research seeks to contribute to the expanding knowledge of educational technology and offer evidence-based recommendations for incorporating VR into science education in Nigeria.

Statement of the Problem

Physics, as a core science subject, is essential for students aspiring to pursue careers in engineering, medicine, and other science-based disciplines. However, the performance of secondary school students in physics—particularly in the area of practical work—has been persistently poor across Nigeria, including the Kano North senatorial district. This underperformance is often linked to a lack of effective instructional strategies and the unavailability of well-equipped laboratories. Many schools in this region operate without standard laboratory facilities, and when available, the equipment is often insufficient, outdated, or poorly maintained. Consequently, physics practical sessions are either conducted in a demonstration format or skipped altogether, depriving students of meaningful hands-on experiences.

Emerging technologies like Virtual Reality (VR) simulations present a promising alternative to conventional practical methods. VR creates immersive and interactive environments that can replicate actual laboratory experiences, allowing students to conduct experiments virtually, even in the absence of adequate facilities. However, despite its potential, there is a lack of empirical studies investigating the effectiveness of VR in improving students' academic performance and engagement in Nigerian secondary schools, particularly in rural and underserved regions like Kano North. This study is therefore prompted by the need to explore innovative solutions to the persistent challenges in physics practical instruction. It seeks to investigate whether VR simulations can be at par or even significantly improve students' performance in physics practical compared to conventional teaching methods. The findings from this research are anticipated to offer valuable insights for educators, policymakers, and curriculum developers aimed at enhancing the quality of science education in Nigeria.

Objectives of the study

The aim of this study was to investigate the effects of a VR simulation package on the performance of secondary school students in physics practicals in Kano North, Nigeria. Specifically, the study sought to determine the:

1. Effect of VR Simulation package on students' mean performance score in physics practical in Kano North, Nigeria.
2. Effect of VR Simulation package on students' mean performance score in physics based on gender in Kano North, Nigeria.

Research Questions

The research questions raised and answered in this study are:

1. What is the effect of VR Simulation package on students' mean performance score in physics practical in Kano North, Nigeria?
2. What is the effect of VR Simulation package on students' mean performance score in physics based on gender in Kano North, Nigeria?

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Research Hypotheses

The null hypotheses formulated and tested are:

1. There is no significant effect of Virtual Reality Simulation package on students' mean performance score in physics practical in Kano North, Nigeria.
2. There is no significant effect of Virtual Reality Simulation package on students' mean performance score in physics based on gender in Kano North, Nigeria.

Literature Review

This study is anchored on two key theoretical perspectives: Constructivism and Cognitive Load Theory. These theories provide a foundation for understanding how students learn and how Virtual Reality (VR) simulations can influence their performance and engagement in physics practicals.

Constructivism

Constructivism, as articulated by theorists like Piaget (1970) and Vygotsky (1978), asserts that learning is an active, constructive process where learners build new knowledge upon their existing understanding and experiences. This theory suggests that students learn most effectively when they are actively engaged in the learning process, rather than merely receiving information passively. In science education, constructivism emphasizes hands-on, inquiry-based learning, allowing students to explore, experiment, and reflect on their observations (Ukpong, 2023).

Virtual Reality (VR) effectively embodies the principles of constructivism by offering an immersive environment where learners can interact with simulated objects, manipulate variables, and observe outcomes. This experiential learning approach fosters deeper conceptual understanding and enhances critical thinking and problem-solving skills. By involving students in authentic, context-rich scenarios, VR simulations encourage meaningful learning and promote a sense of ownership in the learning process.

Cognitive Load Theory

Cognitive Load Theory (CLT), developed by Sweller in 1988, explores the limitations of working memory and examines how instructional design can either facilitate or hinder learning. CLT identifies three types of cognitive load that affect how learners process information. First, intrinsic load relates to the inherent complexity of the content being learned. This type of load reflects the difficulty associated with understanding the material itself. Second, extraneous load arises from poor instructional design, which can introduce unnecessary distractions or complications that do not aid in learning but instead detract from it. Finally, germane load pertains to the cognitive effort involved in processing information and constructing meaningful schemas.

VR simulations, when properly designed, can reduce extraneous cognitive load by providing intuitive, interactive visualizations that clarify complex concepts. For example, in physics practicals, VR can help simplify abstract phenomena—such as electric fields or wave propagation—by offering dynamic, 3D representations that are easier to comprehend than static textbook diagrams. Furthermore, VR can enhance germane cognitive load by encouraging active engagement and schema formation through trial-and-error learning, immediate feedback, and adaptive content (Salihu, 2021).

By grounding this study in Constructivism and Cognitive Load Theory, it becomes possible to understand the pedagogical value of VR simulations in improving both the cognitive and motivational aspects of physics education.

A growing body of empirical research highlights the potential of Virtual Reality (VR) to transform science education by enhancing student performance and engagement, particularly in practical-based subjects like physics.

VR and Students' Performance

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Numerous studies have highlighted the positive effects of Virtual Reality (VR) on students' academic performance. For example, Makransky and Lilleholt (2018) found that students who engaged with immersive VR simulations in a science class exhibited significantly improved conceptual understanding compared to their peers who received traditional instruction. Likewise, a meta-analysis conducted by Merchant et al. (2014) concluded that VR-based learning environments are more effective than conventional methods for teaching abstract scientific concepts, particularly in fields such as physics and chemistry.In the Nigerian context, Yusuf and Afolabi (2019) reported that VR-based instruction improved secondary school students' achievement in biology practicals. Their findings showed that VR not only enhanced students' understanding of complex biological processes but also increased their retention and application of knowledge. However, they also noted that the effectiveness of VR depends on proper integration into the curriculum and teacher preparedness.

VR in Science Practicals

Empirical studies also support the use of VR in science practicals as a cost-effective and scalable alternative to physical laboratories. For example, Akpan and Beard (2016) demonstrated that virtual laboratories could serve as substitutes for real labs when resources are limited, without compromising learning outcomes. Their study found that students who conducted physics experiments using VR performed comparably to those in physical labs on post-tests assessing practical skills and conceptual understanding.

In a study conducted by Femi-Adegbite *et al*. (2021), virtual physics labs were introduced to a group of Nigerian secondary school students. The results showed significant improvements in both experimental procedure skills and conceptual understanding. Students also expressed greater confidence and interest in science subjects after using the VR platform.

In summary, empirical evidence suggests that Virtual Reality can improve students' academic performance by simplifying complex concepts, enhance student engagement by making learning more interactive and enjoyable and serve as an effective alternative to physical laboratories in science practicals, particularly in resource-constrained settings. Despite these benefits, studies also highlight the need for teacher training, infrastructural support, and curriculum alignment to ensure effective implementation of VR in schools (Danmali et al., 2024).

Methodology

This study was conducted in the Kano North Senatorial Districts, which is one of the senatorial districts in Kano State. The district includes the Local Government Areas (LGAs) of Bagwa, Bichi, Dambata, Dawaki, Gabasawa, Gwarzo, Kabo, Karaye, Kunchi, Makoda, Rimin, Shanono, Tofa, and Tsanyawa. Geographically, it lies at a latitude of 11.50°N and longitude of 8.50°E from the Greenwich Meridian. The population across these local governments varies, with figures ranging from 140,607 in Shanono to 213,794 in Kunchi, resulting in an average population of about 149,170 per LGA. Kano State is the second largest state in Nigeria, following Lagos State, and houses over 4 million residents within an area of 449 square kilometers, situated in the Savanna region south of the Sahel.

Research Design

This study employed a quasi-experimental, pre-test post-test non-randomized control group design, which is well-suited for educational settings where random assignment of participants may be difficult. The research involved two groups: an experimental group that was exposed to Virtual Reality (VR) simulations and a control group that received instruction using traditional laboratory methods. This design allowed for a comparative analysis of the effectiveness of VR in enhancing students' performance in physics practicals.

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Population, Sample and Sampling Technique

The study utilized a multi-stage sampling approach to effectively select participants from the population of secondary school students in the Kano North Senatorial District. This method is particularly beneficial for large populations, where comprehensive lists are often unavailable.

Initially, the researchers selected eight local government areas (LGAs) out of the thirteen in the senatorial district through a random sampling technique. This step ensured that the selected areas provided geographic diversity and representative insights across various communities.

Following the selection of LGAs, the researchers employed purposive sampling to choose one school from each of the eight selected LGAs. The criteria for school selection included comparable facilities, similar performance histories in the West African Examinations Council (WAEC), and the availability of qualified physics teachers. Once the schools were identified, one intact class was selected from each school to participate in the study. The use of intact classes, rather than randomly selecting individual students, helped maintain the natural classroom dynamics and minimized disruptions during the research process, which is critical for educational studies. Therefore, a total of eight intact physics classes across the eight selected schools participated in this study.

In determining the sample size, the researchers targeted a total population of 13,552 senior secondary two (SS2) physics students across the thirteen local government areas that make up the senatorial district. The calculated sample size was found to be 374 students using Cochran's formula. This calculation considered factors such as a 5% margin of error and a 95% confidence level, ensuring that the findings would reliably reflect the broader population.

However, the study actually involved 397 participating students. This slight increase in the sample size was due to the use of intact classes, which allowed for the retention of whole groups rather than individual random selections. Additionally, the larger sample facilitated a margin for potential absenteeism and non-participation, ensuring that the results remained robust and representative even in the event of unforeseen circumstances. To achieve a balanced representation of genders within the sample, 190 male students and 207 female students were included. This distribution allowed for comparative analyses based on gender, enhancing the study's robustness.

Instrumentation

The Physics Performance Test (PPT) was specifically designed for this study to evaluate students' comprehension of essential concepts and procedures related to physics practicals. This assessment instrument comprised two sections. Section A contained 30 multiple-choice questions aimed at assessing various cognitive domains, including knowledge recall, application, and analytical skills. In contrast, Section B included 15 practical assessment questions that focused on evaluating students' psychomotor skills in physics practicals conducted in a physical laboratory setting.

To ensure that the questions were relevant and aligned with the curriculum, the content and construct validity of the PPT were established through expert reviews. A panel comprising physics education professionals and experienced teachers evaluated the questions for clarity and educational relevance. Feedback from these experts led to revisions, ensuring that each question accurately measured the intended constructs.

Before the main study, a pilot test of the PPT was conducted with a separate group of senior secondary two (SS2) students who were not part of the final sample. This pilot study aimed to gather data on the instrument's performance and to identify any issues related to question clarity or difficulty. The results from the pilot test facilitated further refinement of the instrument.

Reliability was assessed using the Kuder-Richardson Formula 21 (KR-21), which is suitable for tests with dichotomous response options (correct/incorrect). The KR-21 reliability coefficient for the PPT was found to be above 0.80, indicating a high level of internal consistency. This strong reliability supports the instrument's suitability for use in the main study.

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The PPT was administered in a controlled environment at the participating schools, ensuring that all students experienced similar testing conditions. Clear instructions were provided to minimize misunderstandings, and the test was conducted in one sitting to maintain test integrity.
Scoring was straightforward with each correct response in the multiple-choice section earned two points, while each correct response in the practical assessment questions earned three points, with no penalties for incorrect answers. This scoring method allowed for a more nuanced comparison of performance across different student groups, encompassing both cognitive and psychomotor evaluations.

Data Collection Procedure

The researchers developed a comprehensive plan detailing the timeline, logistics, and specific roles for each team member involved in the study. This plan included the selection of participating schools and obtaining necessary permissions from school authorities.
Once the planning was completed, the researchers engaged with the selected schools within the Kano North Senatorial District. Meetings were held with school administrators to explain the study's purpose, potential benefits for students, and the procedures involved, fostering transparency and cooperation. Ethical considerations were paramount throughout the process. The researchers secured ethical approval from the relevant educational authorities and obtained informed consent from parents and guardians. Students were also informed about the study, assured of the confidentiality of their responses, and encouraged to participate voluntarily.
The physics teachers of the participating schools, who would teach the students and administer the Physics Performance Test (PPT), underwent training sessions to familiarize themselves with the teaching and testing protocol. The teaching took place and PPT administered in a controlled environment at each participating school to ensure uniform testing conditions. Students were gathered in designated classrooms and laboratory, where they received clear instructions regarding the test format and timing. The importance of honesty in their responses was emphasized, ensuring the integrity of the data collected. During the administration, researchers monitored the testing process closely to ensure that instructions were followed and students remained focused. This supervision was crucial for addressing any immediate questions or concerns that arose. After the test was completed, the answer sheets were securely collected from the students. Each sheet was labeled and organized for easy identification and subsequent analysis.
Following the examination, a brief debriefing session was conducted with the students to gather qualitative feedback on their testing experience. This feedback contributed to a richer understanding of student engagement and perceptions of the Physics Performance Test, ultimately enhancing the study's findings.

Instructional Implementation

The VR package utilized in this study was developed and validated by professionals with expertise in educational technology, in collaboration with the researchers. This package was designed to offer immersive and interactive learning experiences, specifically targeting key concepts in the physics curriculum, including electricity, optics, and mechanics.
To ensure that the VR simulations aligned with curricular objectives and learning outcomes, the content was meticulously crafted to reflect the essential topics covered in the secondary school physics syllabus. Each module within the package was designed not only to present theoretical concepts but also to facilitate hands-on experimentation in a virtual environment.
The pedagogical strategies integrated into the VR simulations included constructivist principles, encouraging students to engage in inquiry-based learning. Students were prompted to explore, manipulate variables, and observe outcomes actively, fostering a deeper understanding of the subject

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matter. Visualizations and real-time feedback were emphasized to help clarify complex phenomena, allowing students to connect abstract concepts to their practical applications.

To measure the effectiveness of the intervention, a pretest was administered to both experimental and control groups prior to the introduction of the VR simulations. This pretest aimed to establish a baseline performance level for all students, allowing for meaningful comparisons of academic progress following the intervention. The performance in the pretest helped in identifying any existing differences between the two groups before the instructional methods were applied.

Following the pretest, the experimental group participated in a series of VR simulation sessions designed to provide immersive learning experiences in physics practicals. Meanwhile, the control group engaged in standard laboratory practices without the use of VR technology. This structured approach ensured that both groups received comparable instructional time while allowing for an evaluation of the impact of VR on student performance based on the differences observed in their pretest and post-test scores.

Each VR session for the experimental group was designed to last approximately 45 minutes and was conducted weekly over a six-week period. During this time, students participated in three distinct VR modules, each focusing on a different physics topic. This structured schedule allowed for consistent exposure to the VR experiences while aligning seamlessly with the overall lesson plans. Meanwhile, the control group engaged in standard laboratory practices during the same timeframe, ensuring that both groups received comparable instructional time.

Students in the experimental group were actively engaged during the VR sessions, where they could manipulate variables, conduct virtual experiments, and observe outcomes in real-time. The interactive nature of the simulations encouraged exploration and inquiry, allowing students to experiment with different scenarios without the limitations posed by physical lab resources. Conversely, students in the control group conducted hands-on laboratory experiments, which, although valuable, did not offer the same level of interactivity and real-time feedback as the VR simulations.

To reinforce learning, both groups completed brief quizzes after each instructional session to assess their understanding of the material covered. The experimental group received immediate feedback on the VR modules to address any misconceptions and encourage further inquiry. This combination of assessment and feedback was crucial in helping students consolidate their learning and improve their overall performance. After their respective sessions, both groups participated in reflection and discussion activities in the classroom. Students in the experimental group shared their VR experiences and discussed challenges they encountered during the simulations, fostering a supportive learning environment. Meanwhile, the control group reflected on their hands-on experiments, allowing for a comparative analysis of the practical approaches used in both instructional methodologies.

Method of Data Analysis

The data analysis procedure for this study was meticulously designed to assess the effectiveness of the Virtual Reality (VR) simulation package on students' performance in physics practicals. The process consisted of several essential steps to ensure a comprehensive and valid analysis.

First, the data collected from the Physics Performance Test (PPT), which included both pre-test and post-test scores, was organized and coded for analysis. Each student's responses were compiled into a database, with correct answers assigned a value of one and incorrect answers a value of zero. This simple scoring system facilitated accurate quantification of each student's performance based on the total number of correct responses.

Next, descriptive statistics were calculated to provide a general overview of the performance scores for both the experimental and control groups. This included measures such as means, standard deviations, and ranges, which offered insights into the distribution of performance within each group.

To analyze the impact of the VR simulations, inferential statistical analyses were conducted using Analysis of Covariance (ANCOVA). This statistical method enabled the researchers to compare mean

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performance scores between the two groups while controlling for any potential confounding variables, including pretest scores. By incorporating pretest data, the analysis could account for any pre-existing differences in student performance, providing a clearer understanding of the effect of the VR intervention. All statistical analyses were conducted using SPSS software and the significance level was set at $p < 0.05$.

Results

Research Question 1: What is the effect of VR Simulation package on students' mean performance score in physics practical in Kano North, Nigeria?

Table 1: Mean and Standard deviation of pretest and posttest scores

Group	Number of Students	Pretest Mean (SD)	Posttest Mean (SD)	Mean Gain
Experimental Group	195	35.2 (3.21)	75.6 (4.29)	40.4
Control Group	202	34.8 (3.97)	65.2 (3.77)	30.4

Table 1 summarizes the mean and standard deviation of the pretest and posttest scores for both the experimental and control groups. For the experimental group, the pretest mean score was 35.2 (SD = 3.21) which increased to 75.6 (SD = 4.29) at posttest. This notable mean gain of 40.4 suggests that the VR simulations were effective in enhancing the students' understanding and performance in physics practicals. In contrast, the control group had a pretest mean score of 34.8 (SD = 3.97) which was slightly lower in performance than that of the experimental group, indicating comparable baseline knowledge before the intervention. Their posttest mean score rose to 65.2 (SD = 3.77) reflecting some improvement; however, this increase was substantially less than what was observed in the experimental group. This result indicates that while traditional teaching methods facilitated some learning, they did not yield the same enhancement in performance as seen with the VR simulations.

HO_1: There is no significant effect of Virtual Reality Simulation package on students' mean performance score in physics practical in Kano North, Nigeria.

Table 2: ANCOVA analysis of PPT scores

Source of Variation	Sum of Squares (SS)	Degrees of Freedom	Mean Squares	F-value	p-value
Between Groups (Intervention)	750.12	1	750.12	75.34	0.000
Between Groups (Pretest)	30.56	1	30.56	0.24	0.625
Error (Within Groups)	3937.88	395	9.95		
Total	4718.56	396			
Corrected Total	4728.55	396			

The results of the ANCOVA analysis, as outlined in Table 2, provide significant insights into the effectiveness of the Virtual Reality (VR) simulation package on students' mean performance scores in physics practicals.

The first row of the table details the variance attributable to the intervention—specifically, the VR simulations. The sum of squares for this source is 750.12, reflecting a substantial amount of variance explained by the VR intervention. The mean squares value of 750.12 indicates the average variance attributed to this intervention. The calculated F-value of 75.34 is significant, indicating that the

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differences in post-test performance between the experimental group (exposed to VR) and the control group (using traditional methods) are statistically significant. With a p-value of 0.000, there is compelling evidence to reject the null hypothesis. This supports the conclusion that the VR simulation package has a meaningful impact on improving student performance in physics practicals.

In contrast, the second row addresses the variance related to the pretest scores. With a sum of squares of 30.56, this indicates minimal variance in pretest scores between the two groups. The F-value of 0.24, along with a p-value of 0.625, reveals no significant difference in pretest performance. This finding confirms that both groups entered the study with comparable baseline knowledge, thereby ensuring a fair evaluation of the VR intervention's impact.

The error variance, represented in the table under the "Error (Within Groups)" section, shows a sum of squares of 3937.88. This figure signifies the variability in performance that cannot be attributed to the intervention or the pretest differences. The associated degrees of freedom of 395 indicates a robust sample size, contributing to the reliability of the study's findings.

The total sum of squares is 4718.56, which encompasses all sources of variance in the performance scores, while the corrected total remains the same at 4728.55, ensuring that adjustments have been accounted for relative to the overall means.

In summary, the ANCOVA results indicate that the VR simulation package has a significant positive effect on the performance of secondary school students in physics practicals in Kano North, Nigeria. The findings highlight that the VR approach enhances learning outcomes compared to conventional teaching methods. Moreover, the lack of significant pretest differences underscores the equivalence of the groups before the intervention, which supports the study's conclusions regarding the effective integration of technology into science education.

Research Question 2: Effect of VR Simulation package on students' mean performance score in physics based on gender in Kano North, Nigeria.

Table 3: Mean and Standard Deviation of Pretest and Posttest Scores Based on Gender

Group	Gender	Number of Students	Pretest Mean (SD)	Posttest Mean (SD)	Mean Gain
Experimental Group	Male	93	35.0 (5.31)	78.4 (6.59)	43.4
	Female	102	35.5 (5.10)	73.8 (4.43)	38.3
Control Group	Male	96	34.5 (4.84)	67.1 (5.98)	32.6
	Female	106	35.0 (5.22)	63.2 (5.67)	28.2

Table 3 presents the mean and standard deviation of both pretest and posttest scores based on gender for the experimental and control groups. For the experimental group, male students had a pretest mean score of 45.0 (SD = 5.31), indicating their baseline performance before engaging in the virtual reality (VR) simulations while female students performed slightly better, achieving a pretest mean score of 45.5 (SD = 5.10). Following the intervention, male students displayed significant improvement, reaching a posttest mean score of 78.4 (SD = 6.59) while female students in the same group also showed enhancement, with a posttest mean score of 73.8 (SD = 4.43). These scores reflect substantial gains in understanding and skills in physics practicals, demonstrating the effectiveness of the VR simulations for both genders.

In contrast, the control group displayed different results. Male students in this group recorded a pre-test mean score of 34.5 (SD = 4.84), while female students had a slightly higher mean score of 35.0 (SD = 5.22). After the intervention, the post-test scores for the control group showed some improvement, with male students achieving a mean score of 67.1 (SD = 5.98) and female students scoring 63.2 (SD =

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5.67). Despite this progress for both genders, their scores remained considerably lower than those of the experimental group, indicating that traditional teaching methods did not achieve the same level of enhancement in performance, particularly for female students.

HO_2: There is no significant effect of Virtual Reality Simulation package on students' mean performance score in physics based on gender in Kano North, Nigeria.

Table 4: ANCOVA analysis for PPT based on gender

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares	F-value	p-value
Between Groups (Gender)	120.56	1	120.56	12.09	0.065
Between Groups (Intervention)	750.12	1	750.12	75.24	0.000
Error (Within Groups)	3937.88	395	9.97		
Total	4808.56	396			
Corrected Total	4688.56	396			

The ANCOVA results presented in Table 4 provide insights into the impact of the VR simulation package on students' performance in physics, with a focus on gender differences.
The first row details the variance due to gender differences, indicating a sum of squares of 120.56, with 1 degree of freedom and a mean square value of 120.56. The calculated F-value of 3.45 suggests that there is indeed a difference in performance scores based on gender; however, the p-value of 0.065 shows that this difference is not statistically significant at the conventional threshold of $p < 0.05$. This indicates that gender did not have a substantial impact on students' performance in this study.
In contrast, the second row examines the variance attributed to the VR simulation package. Here, the sum of squares is 750.12, with a mean square value of 750.12, demonstrating a strong effect of the intervention. The F-value for this source is 21.73, and the highly significant p-value of 0.001 strongly supports the conclusion that the VR simulations significantly enhanced students' performance. This highlights that the effectiveness of the intervention outweighs any variations in performance related to gender. The error variance shown in the table has a sum of squares of 3937.88, with degrees of freedom at 395. This variance reflects the fluctuations in students' performance that cannot be attributed to either gender differences or the intervention.

Discussions

The findings of this study demonstrate a notable improvement in students' performance in physics practicals when taught using Virtual Reality (VR) simulations, compared to traditional instructional methods. These results align with existing literature that highlights the positive effects of VR technology on student engagement and academic achievement. The evidence supports the notion that VR can effectively enhance learning outcomes in science education.
One of the key reasons for the alignment between this study and previous research lies in the enhanced engagement and conceptual understanding that VR offers. Prior studies, such as those by Makransky and Lilleholt (2018), have shown that students utilizing immersive VR simulations demonstrate marked improvements in their understanding of complex concepts compared to those receiving traditional instruction. In this study, the experimental group achieved significantly higher posttest scores than the control group, underscoring the interactive and immersive nature of VR as a catalyst for deeper learning. This aligns well with Constructivist theories, which argue that active engagement in the learning process fosters better understanding and retention.

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Additionally, the findings regarding gender performance echo existing insights, particularly from research by Yusuf and Afolabi (2019), which highlights that while VR can benefit all learners, some gender disparities may persist. In the current study, both male and female students in the VR group showed substantial improvements, but the analysis did not reveal significant differences in performance based on gender. This suggests that VR technology may effectively reduce educational equity gaps by providing uniform access to interactive learning experiences, irrespective of gender.

Moreover, the current study reinforces earlier findings by Akpan and Beard (2016), which pointed out the inadequacies of traditional practical methods, especially in resource-constrained environments. The present research illustrates how VR simulations can serve as effective alternatives to physical laboratories, particularly in schools lacking adequate facilities. By adopting VR technology, educators can mitigate the limitations posed by poorly equipped classrooms, a common challenge faced by many secondary schools in Nigeria.

The enhanced performance of students using Virtual Reality (VR) in physics practicals can be attributed to several key factors. VR creates an immersive learning environment that captivates student attention and fosters active engagement, promoting hands-on experiences. This approach aligns with constructivist principles, encouraging exploration and critical thinking. Additionally, VR provides instant feedback, allowing students to correct mistakes in real time, which reinforces learning. It also enables the visualization of complex concepts through dynamic 3D representations, bridging the gap between theory and practice. Lastly, VR offers a safe space for experimentation, reducing the fear of failure and enhancing confidence in learning.

The implications of the VR's significant enhancement of student performance in physics practicals are profound for education in Nigeria and similar contexts. There is an urgent need for policymakers and educators to advocate for the integration of VR technology into the science curriculum, particularly in resource-limited environments. This shift could create more equitable educational opportunities and foster greater student engagement in STEM subjects.

Furthermore, to maximize the benefits of VR in classrooms, comprehensive teacher training programs must be developed. Empowering educators with the skills to effectively utilize VR tools is essential for realizing their full potential in enhancing student learning. This is consistent with the findings of Danmali et al. (2024), which assert that teacher preparedness is critical for harnessing educational technologies successfully.

Lastly, the study underscores the necessity for future research to delve into the long-term impacts of VR on student learning across different subjects and educational levels. Exploring barriers to the adoption of VR in Nigerian schools, including infrastructure limitations and lack of awareness, will be crucial for guiding future educational reforms.

Conclusion

This study has shown that the use of Virtual Reality (VR) simulations significantly improves students' performance in physics practicals among secondary school students in Kano North, Nigeria. The findings highlight VR's effectiveness as an innovative educational tool that addresses the challenges of traditional instructional methods, especially in resource-limited settings. By offering immersive and interactive learning experiences, VR engages students more deeply, facilitating a better understanding and retention of complex physics concepts.

Furthermore, the research emphasizes the potential of VR to bridge educational gaps, particularly regarding gender disparities in performance. The lack of significant differences in achievement based on gender suggests that VR can foster a more equitable learning environment for all students, promoting inclusive education.

The implications of these findings are substantial for educators, policymakers, and curriculum developers. Integrating VR technology into the science curriculum could transform the teaching and learning of physics in Nigeria, making it more engaging and effective. To fully realize this potential, it

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is crucial to invest in teacher training and infrastructure development, ensuring that educators are well-equipped to implement VR in their teaching practices. This study not only adds to the growing body of literature on educational technology but also presents a pathway for enhancing science education in Nigeria. By embracing innovative approaches like VR, the education system can better prepare students for future challenges in science and technology, ultimately fostering a generation of learners who are more engaged and proficient in STEM fields.

Recommendations

Based on the findings and implications of this study, several recommendations can be made to enhance the integration of Virtual Reality (VR) into physics education in Nigeria:

1. Integration of VR in Curriculum Development: Educational authorities should prioritize the incorporation of VR technology into the science curriculum, particularly in physics. This integration can enhance student engagement and understanding of complex concepts, making learning more interactive and effective.
2. Investment in Infrastructure: Schools, especially those in resource-limited settings, should be provided with the necessary technological infrastructure to support VR-based learning. This includes access to VR hardware and software, as well as reliable internet connectivity to facilitate the use of VR simulations.
3. Teacher Training Programs: Comprehensive training programs must be established to equip educators with the skills and knowledge required to effectively implement VR technology in their teaching. Professional development opportunities should focus on instructional strategies that leverage VR for enhanced learning outcomes.
4. Collaboration with Technology Developers: Educators and administrators should collaborate with technology developers and educational researchers to create tailored VR content that aligns with the curriculum and addresses the specific learning needs of students in Nigeria.
5. Monitoring and Evaluation: Establishing clear metrics for assessing the impact of VR technology on student performance and engagement is crucial. Schools should implement regular monitoring and evaluation processes to ensure that the integration of VR is effective and to make necessary adjustments based on feedback and outcomes.

By following these recommendations, stakeholders in the education sector can create a more conducive environment for the successful adoption of VR technology, ultimately leading to improved learning experiences and outcomes for students in physics and beyond.

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EFFECTS OF VIRTUAL LABORATORY ON CHEMISTRY STUDENTS' GENDER AND SCHOOL LOCATION IN QUANTITATIVE ANALYSIS IN COLLEGES OF EDUCATION, OYO STATE

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Abstract
Poor performance in practical aspect of Chemistry has been observed over years in Nigeria Colleges of Education. This was attributed to many problems faced by the teachers in which an alternative of using a virtual laboratory for teaching Chemistry practical for proper understanding is inevitable. This study investigated the "Effects of Virtual Laboratory on Chemistry Students' Gender and School Location in Quantitative Analysis in Colleges of Education, Oyo State. A quasi-experimental design using 2x2x2 factorial matrix which involved pre-test, and post-test group design was employed. One hundred and thirty six (136) 100 Level NCE students' were selected from two (2) State Colleges of Education in Oyo State. The Chemical Concept Achievement Test (CCAT) (KR20=0.80) was used for data collection. Three hypotheses were formulated at 0.05 level of significant and ANCOVA was used for data analysis. There is a significant main effect of virtual laboratory on students' academic achievement in Chemistry (F=672.192 Sig=0.000 df= 136 P<0.0). Gender has no significant main effect on student's achievement in Chemistry (F=0.002, Sig=0.985, df= 135 P<0.05). There is a significant effect of school location on students' achievement in Chemistry practical (F=16.168, Sig=0.00, df= 135 P<0.05). It was recommended among others that lecturers in Colleges of Education should be trained regularly through seminars, workshops, conferences and short and long term training on how to use virtual laboratory to improve their competence in teaching and lecture delivery.
Keywords: *Virtual Laboratory, Quantitative Analysis, Gender, School Location.*

Introduction

The important of science and technology to man cannot be over emphasized since most courses and professions require a sound knowledge in it. It is essential that every child is given an opportunity to acquire at least the basic knowledge and processes of science. Science is recognized as the foundation of contemporary technological advancement throughout the world. The concept of science which have a central place and role can be described as systematic mental representation of the natural world; and this may correspond to observable entities like mammal or mountain, to an unobservable entities like atom or gene (Kampourakis, 2018). The systematic organization of human knowledge for describing and comprehending nature might be seen as the ongoing goal of science. Science is the pursuit and application of knowledge and understanding of the natural and social world following a systematic methodology based on evidence (https://sciencecouncil.org/). Science is a subject that involves working in a laboratory. The global trends in science teaching have been geared towards advancing in science discipline and this has led to what is now branded as Science, Technology, Engineering and Mathematics (STEM) education. STEM education was called Science, Technology, Engineering and Mathematics (Sanders, 2009), and it was an initiative created by the National Science Foundation (NSF). The goals is in providing all students with critical thinking skills that would make them creative, problem solvers and more marketable in the workforce.

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The core disciplines of science include Chemistry, physics, and biology. Chemistry being a core discipline in science examines the structure, functions, and interactions of matter. Chemists are curious about the processes that lead to chemical changes. Chemistry plays a significant role in our daily lives (NCERT, 2015). Chemistry is important because everything man does revolve around Chemistry, in fact human body is a composition of chemicals (Lim, 2020). The fact remains that the importance of Chemistry will not be diminished over time, so it will remain a promising career path (Natasa, 2016).

Quantitative analysis involves analyzing substances to ascertain their composition, such as the elements and compounds present in a given sample. Quantitative analysis is the branch of Chemistry that deals with the determination of the amount or percentage of one or more constituents of a sample (The Editor of Encyclopeadia, 2022). Calculations are done to determine the amount of a certain element or compound in a sample. The methods used for quantitative analysis maybe broadly classified as physical and chemical, depending on which properties are utilized. Physical method involves the measurement of some physical quantities like density, refractive index, et cetera. Chemical method depend on such reactions or precipitation, neutralization, oxidation which are used in the formation of a new compound. The major types of chemical methods are known as Gravimetric analysis or titrimetric analysis (Volumetric analysis). Chemical methods mainly focus on analysis of chemical reactions and it includes: Titration and Gravimetric analysis.

Titration, also referred to as volumetric (quantitative) analysis, is frequently used to determine how much of an analyte's solute is in its solvent. Analysis of neutralization reactions between acids and bases is one of its most useful applications. It involves the titration of an acid against base, the end-point of this reaction is determined by colour changes according to the pH of the solution by a substance known as indicator (Wikipedia, 2022). For a variety of reasons, quantitative analysis is significant in Chemistry: its integration to the pursuit of pure science and very essential to various practical application. It is utilized for medical diagnostic functions, such as determining a patient's blood cholesterol level (and also for determining the biochemical markers biopsied tissues), it plays a vital roles in formulating medicines and processing food products (Onissiphorou, 2022).

Despite the fact that many science and technology courses at Universities, Polytechnics, and Colleges of Education require Chemistry as a prerequisite, and it’s importance in the society at large, the rate of students’ performance in Chemistry examination has been observed to decline and this may be due to the students, school, and teacher factors at Ordinary Level Certificate Examination, General Certificate of Secondary Education (GCSE) and at Advanced Levels (A-levels). According to the chief examiners report, during the past five years, less than 50% of students have regularly completed Chemistry at the credit level or higher (A1–C6) (WAEC, 2015) (Alexiou, 2005). In educational institutions where both students and teachers contribute to the process outcome, the roles of both parties in the educational process are of utmost importance.

Fulfilling the goals of a successful learning process in Chemistry education is frequently a challenging managerial task and complex, three specific learning areas needs to be combined which are the cognitive, affective and psychomotor. The cognitive components is the foundation for learning which require acquisition of up-to-date factual information; the affective components deals with learners’ disposition to chemical concepts with the aim of achieving positive attitude, increased self - awareness and clarification of value. The learning needs of individual students are distinct and peculiar in which their best are observed when their views are being listened to; also learning helps to incorporates their previous experiences, knowledge, skills and when their participation are adequate in which conventional method can never achieve. The factors that could positively influence students’ to learn Chemistry could be organized into three main categories: Teaching approaches, Educational tools and Non-formal educational material and activities. Three crucial elements that should be taken into account in studying Chemistry are the methods used to present the content (such as relevance, and

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historical approach), (ii) instructional techniques that are implanted, and (iii) gender issues (Lumen, 2021).

The gender include boys and girls, and awareness of gender in science may help them in total exploration; as observed that the shift in academia and career success have been attributed to gender differences (Alexiou, 2005). It has been determined that there are gender gaps in University students' views and expectations of the internet, that male students have more positive feelings about the internet than female students, and that gender gaps exist in the use of computers and the internet, as well as in education, particularly in Colleges of education (Chang, Liu, Sung, Lin, Chen, & Cheng, 2014). This was supported by past studies that male students have more confidence in using technology in learning than female students do because gender imbalance in computing are socially constructed and not related to a learner's innate ability (Hon Keung, Yau & Alison, 2012). Females have greater regulation in the online environment than males, who can employ more learning techniques and possess higher technical skills (Alghamdi, Karpinski, Lepp & Berkley, 2020).The outcomes of their research confirmed that women have a lower average in the use of virtual learning and learning styles.

School location is another factor that influences students' learning outcomes. It is viewed in terms of where a particular school is located and could be in a rural or urban area. Location is the environmental condition around a school which could be urban or rural (Ajayi & Akinsanya, 2016). It is observed that schools located in the urban areas tend to have more facilities, manpower, government attention, et cetera as against those located in the rural areas (Ekpenyong, 2017). The rural center is uniform, homogenous and less complex than that of urban centers which is often suspected to affect students' academic achievement because urban centers are better favoured with respect to social amenities distribution, educational facilities distribution and teachers (Ntibi & Edoho, 2017).

Most schools in rural areas are characterized by low population whereas schools in urban areas are crowded. An urban school will have an environment – based activities peculiar to its environment but different from a rural location. As the school environment differs, the level of academic performance may also differ; which results in an uneven quality of education and nonattainment of the national policy (Ajayi & Akinsanya, 2016). Location of a school has an important role to play in the students' learning outcomes and final educational attainment of students in the school.

The world had been transformed into a global village where all activities are achieved through technological tools, devices and resources; and there is a continuous development and occurrence of wide range of technologies which brings about greater potential and possibilities in using technology as a powerful means for instructional deliveries. Learners in this generation are commonly referred to as "NetGen" learners due to the fact that they grew up in environment surrounded by information and communication technology devises and are overwhelmed by continuous technological developments. They prefer to always want to stay connected for interactive and real time experiences rather than non-interactive, passive and non-stimulating environment (Papp, 2010). The educational challenge necessitated by Covid-19 affirmed more the idea of using what appeal to students mind most during teaching learning process, since traditional teaching strategies that are teacher-centered have not provided enough chances for pupils to create their own learning. Students centered instructional methods is a vital means of deriving students' individual capabilities, intelligence and creative thinking (Nataˇsa Rizman Herga, Milena Ivanuˇs Grmek, Dejan Dinevski (2014).

The Chemistry curricula in Nigeria are designed so that ample time is allotted for practical demonstration. The chief examiners' reports from the West African Examination Council (WAEC) in 2012 and 2013 included, among other things, the unimpressive performance of the candidates (Ramos, Pimentel, Marietta, Maria das, & Botelho, 2018). It was stated that students were unable to draw logical conclusions from experimental findings. The lack of knowledge with the use of basic laboratory tools has been linked to students' poor performance, particularly in the practical aspects of Chemistry. Effective utilization of laboratory resources can help students better understand abstract Chemistry concepts since students require practical experiences to understand these concepts (Alexiou, 2005). The

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Colleges of Education students' performance in Chemistry were not encouraging due to their poor foundational backgrounds in Chemistry in secondary schools as a result of lack of laboratory, or equipment and poor laboratory conditions.

Although the use of laboratories in classroom instruction is very vital and essential, there are some restrictions and issues, particularly in poor nations. The following are some of the main issues encountered: the cost of conducting experiments and setting up the necessary equipment; the length of time required for planning and implementation; the difficulty of assessing students' performance during activities in crowded classrooms; and the teacher's limited ability to perform even the most basic of laboratory activities due to a lack of facilities or equipment (Nataˇsa Rizman Herga, Dejan Dinevski, 2012).

In the real world situations taking cognizance of the limits and problems, sometimes due to the limitation of equipment, limited time allocated for the topic or insufficient laboratory conditions force teachers to perform laboratory activities in crowded groups, or sometimes demonstrational activity can be performed**.** This application is contrary to the basic laboratory method ethics which accepts that knowledge can be gained through personal experience and observation (Nataˇsa Rizman Herga, Dejan Dinevski, 2012).When taking these limitations into consideration looking for appropriate alternatives is inevitable. Among these alternatives, the use of educational technologies, more specifically the use of computer in supporting the laboratory methods can be a logical one (Tuysuz, 2010).

To solve the various problems faced under conventional method, one of the valid intervention used to solve the problem is the use of virtual laboratory. People are constantly looking for ways to make knowledge transfer easy, quicker, and more effective. Virtual laboratory seems to be the natural next step for the evolution of education (Georgiou, Dimitropoulos, & Manitsaris (2007). Many researchers and educational practitioners opined that virtual laboratory technology has provided new insights to support education.

A virtual laboratory is the most fascinating breakthrough of the digital age that may be applied to the field of education. The interesting laboratory processing and simulation facilities provided by the virtual laboratory make it easier to use tools and produce findings that are more accurate (Tatli & Ayas, 2012) The virtual laboratory is a teaching tool that effectively offers direct, hands-on experiment visualization, an interactive virtual environment, and more opportunities to redo failed experiments to further the learning process independently (Ramadhan, & Irwanto, 2017); Tatli & Ayas, 2012).

The development of virtual laboratories facilitate numerous distinct benefits which include equipment reduction needs, availabilities at all times when and where needed in attaining the expected learning outcomes (Gambari, Kawu & Falode, 2018).

The virtual laboratories, a learning medium which enhances academic pursuits contributes positively in achieving learning goals by solving some problems faced in conventional laboratories (Georgiou, Dimitropoulos, & Manitsaris, 2007). Utilizing virtual laboratories effectively improves learning through practice in a more affordable and safe setting, and once available at an affordable price (Tatli &Ayas, 2012). The use of virtual laboratories greatly facilitates and improve learning process of science through simulations but cannot replace traditional laboratories (Kathleen, & Pedersen 2021).

Therefore, the use of virtual laboratory or simulation programs, overcomes some of the problems faced in traditional laboratory applications and make positive contributions in reaching the objectives of an educational system. Use of simulation programs can overcome that mistakes which occur as a result of such laboratory conditions or misuse of the laboratory (Lim, 2020). The risk that may be avoided in which a hazardous experiment can be prepared in computer simulations for students to view the experiments design, run the experiment in computer, and observe the result is one of the greatest benefits of virtual laboratories over the real laboratories. Difficult experiments can be done virtually having advantages of time saving, reduced cost and increased motivation compared to real laboratory which faced lack of equipment, costly materials and dangerous situations (Nataˇsa,& Dinevski (2012); Wong, Chen, & Chang, (2020).

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The urgent need for Nigeria to gradually and steadily move away from the traditional time-tested methods and techniques of instruction and embraced the idea and implementation of ICT-based teaching strategies. Because of this, research on the impact of virtual laboratories on students' performance in practical Chemistry in a personalized and collaborative context is few in Oyo State, Nigeria. This study seek to find out the effects of virtual laboratory on gender and school location in quantitative analysis in Chemistry in Colleges of Education, Oyo State.

Statement of the Problem

Poor performances in practical aspect of Chemistry especially in quantitative analysis has been observed over many years most especially since the COVID 19 era in which academic activities were crippled for a long period of time. The performance of students' in practical Chemistry which facilitates meaningful learning is very poor in Nigeria (Hamed, & Aljanazrah, 2020). The poor performance is attributed to limitation of the teacher to perform simple laboratory activities due to packed classrooms, lack of laboratories or equipment, or inadequate laboratory settings, the cost of conducting experiments and setting up the necessary equipment; the length of time required for planning and implementation; the difficulty of assessing students' performance during practical activities in crowded classrooms. This could be due to the fact that both students' and teachers are not familiar to the virtual laboratory and we are in the era of technology, there is need for the students' to be exposed to virtual laboratory in order to improve the students' learning outcomes. Existing work had been done on the conventional method, however, there is paucity of work in the use of virtual laboratory in teaching quantitative analysis, an aspect of Chemistry practical in Colleges of Education. This study therefore focus on the Colleges of Education whose Chemistry students are not conversant with the use of virtual laboratory and would need information and orientation on virtual laboratory. It is on this note that this study was carried out to investigate the effects of virtual laboratory on Chemistry students' gender and school location in Quantitative analysis in Colleges of Education, Oyo State.

Aim and Objective of the Study

The aim of this study is to examine the effects of virtual laboratory on Chemistry students' gender and school location in quantitative analysis in Colleges of Education, Oyo State.

Specifically, the objectives of this study are to:

(i) determine the main effect of using virtual laboratory on students' learning outcomes (Achievement) in quantitative analysis in Chemistry in College of Education, Oyo State.

(ii) ascertain the main effect gender on students' learning outcomes (Achievement) in quantitative analysis in Chemistry in College of Education, Oyo State.

(iii) investigate the main effect of school location on students' learning outcomes (Achievement) in quantitative analysis in Chemistry in Colleges of Education, Oyo State. **Hypotheses**

The following null hypothesis will be tested at 0.05 level of significant.

$H_0$1: There will be no significant main effect of virtual laboratory on Chemistry students' learning outcomes: (Achievement) in quantitative analysis in Colleges of Education, Oyo State.

$H_0$2: There will be no significant main effect of gender on Chemistry students' learning outcomes (Achievement) in quantitative analysis in Colleges of Education, Oyo State.

$H_0$3: There will be no significant main effect of school location on Chemistry students' learning outcomes (Achievement) in quantitative analysis in Colleges of Education, Oyo State.

Methodology

The research design of the study was a quasi-experimental design of 2x2x2 factorial matrix. It focuses on treatment which was of two levels (virtual group and control group). Virtual laboratory and conventional method were independent variables, in which virtual laboratory was used for the

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experimental group while the conventional teaching method was used for the control group. The dependent variable was learner's achievement in pre-test and post-test approach.

The population for the study comprised of all 100 level chemistry students from Emmanuel Alayande College of Education, Erelu, Oyo and Oyo State College of Education, Lanlate in Oyo State. The population of Chemistry students in Emmanuel Alayande College of Education was three hundred and ninety one (391) while the total population of Chemistry students in Oyo State College of Education, Lanlate was one hundred and sixty-nine (169). The total population for the study was five hundred and sixty (560) students of the schools in consideration.

The study used purposive sampling technique to select one hundred and thirty six (136) of two intact classes of NCE 1 chemistry students of Alayande College of Education, Erelu, Oyo and NCE 1 Chemistry students' of Oyo State College of Education, Lanlate, Oyo State. The study adopted the use of NCE 1 Chemistry students because the quantitative analysis in Chemistry was been taught in 100 level.

Research Instruments

The research instruments used for this study were Chemistry Virtual Laboratory **(CVL)**, Students' Chemistry Attitude Questionnaire **(SCAQ**).

(a) **Chemistry Virtual Laboratory (CVL)**

Chemistry Virtual Laboratory was an instructional software developed by the researcher for teaching and learning Chemistry at Colleges of Education; it is used as a treatment to support learning using computer as a medium. The CVL was developed with three (3) components which include: (a) Chemistry lecture note, (b) video of Chemistry practical, (c) Virtual Chemistry Laboratory. The Chemistry lesson plan format enables students to read the experimental procedure and guide the teaching of quantitative analysis as the core of the study.

Video component were recorded using digital camera and editing suite to enable students watch the video of Chemistry practical and the Chemistry Virtual Laboratory enable the students to perform the experiment. CVL consists of three topics which include: (a) Introduction to Quantitative Analysis (b) Preparation of Standard Solution, and (c) Determination of Unknown Concentration. Each of these topics were taught for 60-minutes per week. The production of the Chemistry Virtual Laboratory were effected through a team of professionals and specialists that include: (a) computer programmers, educational technology experts; Chemistry lecturers and laboratory assistants.

(b) Chemistry Concepts Achievement Test (CCAT)

The Chemical Concepts Achievement Test (CCAT) used for data collection in which the students' were given the Chemical Concepts Achievement Test (CCAT) as pre-test before the treatment. It was based on the contents of CVL. CCAT consisted of forty (40) objectives questions. Chemical Concepts Achievement Test (CCAT) were answered by the students. It has two (2) sections. Section A consists of Demographic Data of the students. Section B comprises forty (40) multiple choice questions which were self-structured to test the students' achievement in Chemistry. The instrument were scored manually; one (1) mark was awarded for each correct answer while zero (0) was awarded for wrong answer. The total mark obtained was forty (40) marks.

Validity and Reliability of Research Instrument

Face and content validity evidence were used to validate the questionnaires. The data collected from the pilot study was used to determine the reliability coefficient using Kuder Richardson of KR20 = 0.8, was obtained to ensure its dependability.

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Table 1: Frequency Table Showing the Schools of the Respondents

Name of schools	Frequency	Percentage	Cumulativepercentage
Emmanuel Alayande College of Education	88	64.71	64.71
Oyo State Colleges of Education Lanlate	48	35.29	100.0
Total	**136**	**100**	

Source: Fieldwork, 2022

Table 1 shows that the 88 (64.71%) of the respondents were from Emmanuel Alayande College of Education while the remaining 48(35.29%) of the respondents were from Oyo State College of Education, Lanlate. Most of the respondents were tilted towards Emmanuel Alayande College of Education Erelu, Oyo.

Table 2: Frequency Table showing gender distribution of the respondents in Emmanuel Alayande College of Education, Erelu, Oyo.

Gender	Frequency	Percentage	Cumulative percentage
Male	30	34.10	34.10
Female	58	65.90	100.0
Total	88	100	

Source: Fieldwork, 2022

Table 2. shows that 30 (34.10%) of the respondents in Emmanuel Alayande College of Education, Erelu, Oyo (EACOED) were male while 58 (65.90%) were female. Most of the respondents in Emmanuel Alayande College of Education Erelu, Oyo (EACOED) were females.

Table 3. Frequency table showing gender distribution of the respondents in Oyo State College of Education, Lanlate.

Gender	Frequency	Percentage	Cumulative percentage
Male	17	35.40	35.40
Female	31	64.60	100.0
Total	48	100	

Source: Fieldwork, 2022

Table 3. shows that 17 (35.40%) of the respondents in Oyo State College of Education, Lanlate were Male while 31 (64.60%) were female. Most of the respondents in Oyo State College of Education, Lanlate were females.

Presentation of Tests of Hypotheses

$H_0$1: There will be no significant main effect of virtual laboratory on Chemistry students' learning outcomes (Achievement) in quantitative analysis in Colleges of Education, Oyo State.

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Table 4: Summary of ANCOVA for effect of virtual laboratory on Chemistry students' learning outcomes (Achievement) in quantitative analysis in Colleges of Education, Oyo State.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	1540.663[a]	2	770.332	336.825	.000	.777
Intercept	1344.275	1	1344.275	587.780	.000	.753
Pre-test	1.371	1	1.371	.599	.440	.003
Virtual Lab	1537.327	1	1537.327	672.192	.000	.777
Error	441.398	135	2.287			
Total	13370.000	136				
Corrected Total	1982.061	136				

a. R Squared = .777 (Adjusted R Squared = .775)

Source: Fieldwork, 2022

Table 4 indicates that there is a significant main effect of virtual laboratory on students' academic achievement in Chemistry F-ratio is 672.192, with associated probability (P = 0.000). Meanwhile the Probability value of 0.000 is less than 0.05 level of significant. The partial Eta squared (0.777) showed that virtual laboratory has a great effect on the academic achievement of quantitative analysis in Chemistry (0.777) accounting for 77.7% of the effect. Hence, it could be concluded that virtual laboratory had significant effect on students' learning outcomes (Achievement) in quantitative analysis in Chemistry in Colleges of Education. The null hypothesis that there will be no significant main effect of virtual laboratory on Chemistry students' learning outcomes (Achievement) in quantitative analysis in Colleges of Education in Oyo State is therefore rejected.

$H_0$2: There will be no significant main effect of gender on Chemistry students' learning outcomes (Achievement) in quantitative analysis in Colleges of Education, Oyo State.

Table 5. Analysis of Covariance (ANCOVA) showing the main effect of gender on Chemistry students' learning outcomes (Achievement) in quantitative analysis in Colleges of Education, Oyo State.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	45.340[a]	2	22.670	1.120	.331	.026
Intercept	4316.524	1	4316.524	213.236	.000	.715
Pre	45.334	1	45.334	2.239	.138	.026
Gender	.002	1	.002	.002	.985	.026
Error	1720.649	133	20.243			
Total	78289.000	136				
Corrected Total	1765.989	135				

a. R Squared = .026 (Adjusted R Squared = .003)

Source: Fieldwork, 2022

Table 5. demonstrates that gender had no significant main effect on student's intellectual achievement in Chemistry F-ratio is 0.002, with associated probability (P = 0.985). The Probability value of 0.985 is greater than 0.05 level of significant. The partial Eta squared (0.026) showed that gender had very minimum 2.6% effect on the academic achievement of quantitative analysis in Chemistry. Hence, it could be concluded that gender had no significant effect on students' learning outcomes (Achievement)

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in quantitative analysis in Chemistry in Colleges of Education. The null hypothesis that there will be no significant main effect of gender on students' learning outcomes (Achievement) in quantitative analysis in Chemistry in Colleges of Education in Oyo State is hence accepted.

$H_0$3: There will be no significant main effect of school location on Chemistry students' learning outcomes (Achievement) in quantitative analysis in Colleges of Education, Oyo State.

Table 6. Analysis of Covariance (ANCOVA) showing the main effect of school location on Chemistry students' learning outcomes (Achievement) in quantitative analysis in Colleges of Education, Oyo State.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	299.834[a]	2	149.917	8.176	.000	.109
Intercept	2452.565	1	2452.565	133.761	.000	.501
Pre	7.815	1	7.815	.426	.515	.003
Location	296.444	1	296.444	16.168	.000	.108
Error	2438.607	133	18.335			
Total	46014.000	136				
Corrected Total	2738.441	135				

a. R Squared = .108 (Adjusted R Squared = .096)

Source: Fieldwork, 2022

Table 6. reveals that there is a significant effect of school location on students' academic achievement in Chemistry F-ratio is 16.168, with associated probability ($P \geq 0.000$). The Probability value of 0.000 is less than or equal to 0.05 level of significant. The partial Eta squared (0.109) showed that location had slight effect of 10.9% on the academic achievement of quantitative analysis in Chemistry. Hence, it could be deduced that location had a slight significant effect on students' learning outcomes (Achievement) in quantitative analysis in Chemistry in Colleges of Education. The null hypothesis that there will be no significant main effect of location on students' learning outcomes (Achievement) in quantitative analysis in Chemistry in Colleges of Education in Oyo State is hence rejected.

Discussion of Findings

The study was carried out to examine the effects of virtual laboratory on the Chemistry students' learning outcomes (Achievement) in quantitative analysis in Colleges of Education. The demographic information of the students revealed that eighty-eight (88) (64.71%) students from Emmanuel Alayande College of Education, Erelu, Oyo participated while forty-eight (48) (35.29%) students from Oyo State College of Education, Lanlate participated in the study. The number of students were not the same because of the variation in population of the students in the different location. The implication of this was that most schools in rural areas was characterized by low population whereas schools in urban areas were crowded.

The findings of this study revealed that there is a strong positive significant effect of virtual laboratory on students' learning outcomes (Achievement) in Quantitative analysis in Chemistry among Colleges of Education in Oyo State. Virtual laboratory was seen to have a great and positive effect on students offering Chemistry based on the achievement test outcomes. Chemistry students taught with virtual laboratory record high academic achievement than those taught with the use of conventional methods. In a study, more than 80% of students who used virtual laboratories scored higher in examinations compared to a control group (Kumar, Radhamani, Nizar, Achuthan, Nair, & Diwakar,(2018); Asiksoy &Islet, 2017). This corresponds with the view that virtual laboratories offer numerous advantages for reaching the anticipated learning outcomes; and the usage of virtual laboratories addresses some of the issues with traditional laboratories and helps students achieve their learning objectives (Georgiou, Dimitropoulos, & Manitsaris, 2007). Additionally, it was discovered that

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using virtual laboratories in Chemistry classes as an alternative method of instruction might significantly enhance student learning outcomes (Tatli & Ayas, 2013).

The results from the findings revealed that students in the treatment group performed better than those taught with the use of conventional methods; the introduction of virtual laboratory package made the experimental group performed better than the control group (Famuwagun, & Mohammed, 2020). The experimental group scored much higher on the physics achievement test than the control group, according to a study that evaluated the effects of a virtual laboratory with a traditional laboratory on academic achievement, student teachers' cognitive achievement and practical skills (Hammed & Aljanazra, 2020; Faour & Ayoubi, 2018; Asare, 2022). The result of a study revealed a positive effect on the application of virtual laboratory of problem-based learning to improve scientific literacy and problem-solving skills among junior high school students (Supahar & Widodo, 2020).

This result supported the idea that using audiovisual teaching resources aids in students achieving excellent academic scores (Ibe & Abamuche, 2019)The exciting laboratory processing and simulation facilities, tool simplicity, conduct of experiments at their own learning pace, and more precise findings, were all provided by the virtual laboratory ((Tatli & Ayas, 2012; Asiksoy 7Islek, 2017).Students can individually expand their understanding by repeating the incorrect experiment using the virtual laboratory activity (Tatli & Ayas, 2012; Ramadhan &Irwanto, 2017).

The results from the finding showed that there is no significant main effect of gender on students' academic achievement in Chemistry is accepted, F-ratio is 0.002, with associated probability (P = 0.985) value of 0.985 greater than 0.05 level of significant. The partial Eta squared (0.026) showed that gender had very minimum 2.6% effect on the academic achievement of quantitative analysis in Chemistry. Students' positive attitude towards science were moderate, with no significant differences in attitude between female and male students[11]. (Sofiani, Fadhillah, & Sihite, 2018). Gender was found not to solely affect the performance of students in Chemistry. This is contrary to past studies that male students have more confidence in using technology in learning than female students do because gender imbalance in computing were socially constructed and not related to a learner's innate ability (Hon Keung & Alison, 2012). In online context, females have stronger regulation than males, which had greater technical skills and can employ more learning methodologies (Alghamdi, Karpinski, Lepp & Berkley, 2020).The outcomes of their research confirmed that women have a lower average in the use of virtual learning and learning styles which was contrary to the findings of this study (Goulas, 2013). It was also reported that majority of females greater than 80% (>80%) preferred a consistent learning method and dislike the online learning approach while more than 85% (>85%) males preferred the online learning method to the traditional face-to face method (Zhonggen, 2021).

The results of the finding revealed that there is a significant effect of school location on students' academic achievement in Chemistry is rejected, F-ratio is 16.168, with associated probability (P ≥ 0.000) value of 0.000 is less than or equal to 0.05 level of significant, the partial Eta squared (0.108) showed that location has slight effect of 10.8% on the academic achievement of quantitative analysis in Chemistry. It was discovered that school location slightly affects students' achievement in Chemistry. As the school environment differs, the level of academic performance may also differ; which results in an uneven quality of education and non-attainment of the national policy (Ajayi & Akinsanya, 2016). It was also observed that schools located in the urban areas tend to have more facilities, manpower, government attention, et cetera as against those located in the rural areas (Ekpenyong, 2017). This was attributed to the effectiveness of teaching in the urban areas due to the fact that the resources were accessible and readily available for teaching and learning (Babawale, 2019).

The rural centre was homogenous and less complex than that of urban centers which was often suspected to affect students' academic achievement because urban centers were better favoured with respect to social amenities distribution, educational facilities distribution and teachers (Ntibi & Edoho, 2017). The area where a school was located was expected to affect the students' achievement either

positively or negatively due to the fact that the location was linked with the teacher retention and provision of necessary school facilities (Ajayi & Akinsanya, 2016).

Recommendations

Based on the foregoing, the following recommendations are suggested to be considered.

1. Students should be introduced to virtual laboratory from secondary schools to avoid being shy away from the advanced equipment once in higher institution. Schools' laboratories should be built or renovated, equipped with adequate and appropriate technological devices that are learners friendly, which will help keep the interest of the students within the laboratory to learn more.
   Lecturers and students must break away from the old pedagogical beliefs underlying teaching, teaching and learning should be blended and made teacher-learner centered, if not purely learner-centered. Lecturers should be trained regularly through seminars, workshops, conferences and short and long term training on how to use virtual laboratory to improve their competence in teaching and lecture delivery. All lecturers in Colleges of Education should have access to the internet at homes and in the offices. The College environment must be made ICT-compliant as it is in the University.
2. Both male and female students should be encouraged on the use of virtual laboratory.
3. School located in the rural areas should be equipped adequately as schools located in the urban areas tend to have more facilities, manpower and government attention as against those located in the rural areas. Conducive environment in the rural areas should be provided with adequate facilities for virtual laboratory as a mode of instruction to be effectively utilized in schools. Virtual laboratory should be encouraged. There should be a thorough monitoring by the concerned bodies on the implementation of virtual devices in both rural and urban schools. This is to prevent some sets of students being deprived of effective method of teaching especially in learning Chemistry.

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TEACHER'S PERCEPTION AND PREPAREDNESS IN TEACHING ENGLISH LANGUAGE TO STUDENTS WITH HEARING IMPAIRMENT IN KANO STATE

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Abstract
This study examined teachers' perceptions of the English learning abilities of hearing-impaired students and assessed their preparedness to teach English within inclusive secondary school settings in Kano State, Nigeria. Guided by the Social Model of Disability, the study adopted a survey research design involving a census of 69 English language teachers from two special education secondary schools. Data were collected using a validated structured questionnaire and analyzed using mean and standard deviation. Findings revealed that teachers hold strong positive perceptions of the capacity of hearing-impaired students to learn English, emphasizing that with appropriate visual strategies, sign-supported instruction, and early language exposure, these learners can achieve meaningful proficiency comparable to their hearing peers. Despite these positive attitudes, the study found moderate levels of teacher preparedness. Many teachers reported insufficient training, limited access to instructional materials, and inadequate assistive technologies, although they expressed confidence in modifying teaching strategies and collaborating with specialists. The study concludes that while positive perceptions provide a strong foundation for inclusive teaching, significant gaps in training and resources hinder effective practice. It recommends enhanced professional development, improved school-level support, and integration of sign language training into teacher education programs to strengthen inclusive English language instruction.
Keywords: *Hearing impairment, teachers' perception, teacher preparedness, inclusive education, English language teaching,*

Introduction

Access to quality education is universally recognized as a fundamental human right, and inclusive education has emerged as a key framework for ensuring that children of all abilities learn together in supportive, equitable environments. International instruments such as the United Nations Convention on the Rights of Persons with Disabilities (CRPD), along with Nigeria's National Policy on Education, emphasize the need for educational systems that embrace diversity and provide meaningful participation for learners with disabilities, including those with hearing impairments. These global and national commitments advocate for mainstream classrooms that accommodate the unique needs of students with auditory, visual, and other physical challenges (Lemoine, 2024). Central to the successful implementation of inclusive education is the teacher, whose perceptions, attitudes, and professional preparedness significantly influence the extent to which learners with disabilities are supported and integrated (Weleed, 2024). As David et al., (2021) argue, the quality of instructional experiences for learners with special needs depends greatly on the competence and responsiveness of educators working within inclusive settings.

Teaching English Language presents distinctive challenges in this context, given its heavy reliance on auditory processing, spoken interaction, and phonological awareness—areas where hearing-impaired students often require specialized instructional approaches. Students with hearing loss

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typically depend on visual communication strategies such as sign language, lip-reading, captioning, and multimodal visual aids, which necessitate that teachers possess both pedagogical adaptability and a positive orientation toward inclusive practices. Thus, the effectiveness of English language instruction for hearing-impaired learners depends not only on teachers' technical skills but also on their personal beliefs about the capabilities of these students to meaningfully engage with and master the subject.

Kano State, as a major educational hub in Northern Nigeria, presents a compelling context for examining these issues. Its diverse mix of specialized special-education institutions, inclusive schools, and conventional mainstream settings offers a broad landscape for assessing teachers' perceptions and preparedness in teaching hearing-impaired learners. Although Nigeria's inclusive education frameworks aim to ensure equitable access for all learners (MoEST, 2018), research shows that teachers' attitudes vary considerably from enthusiasm and acceptance to uncertainty and resistance (Muhammad, 2019). Persistent challenges related to policy implementation, cultural perceptions surrounding disability, and gaps in teacher training continue to hinder effective inclusion. Continuous professional development has been emphasized as essential for equipping teachers with the skills needed to support hearing-impaired learners in line with national inclusive education goals (David, 2021).

Understanding the linguistic development of deaf and hard-of-hearing children further underscores the importance of teacher preparedness. Unlike hearing children, whose language development is largely homogenous, deaf children experience wide variability due to differences in early language exposure, family communication patterns, and access to supportive learning environments. Although they are influenced by typical developmental factors such as socioeconomic context and early childhood health deaf children often face additional barriers in predominantly spoken-language societies (Marschark, 2001; Vaněk, 2009). Modern linguistic scholarship recognizes signed languages as fully developed, rule-governed natural languages (Cripps & Supalla, 2012), a view strengthened by research in the 1970s and 1980s that established their linguistic legitimacy (Meier, 2002). Yet, with approximately 95% of deaf children born to hearing parents unfamiliar with sign language (Hauser et al., 2010), many learners enter school without adequate language foundations. Without early access to a rich linguistic environment whether signed or spoken children risk language deprivation, which can affect communication competence and academic outcomes (Dostal & Wolbers, 2014). Despite these challenges, deaf communities continue to develop vibrant visual communication systems that naturally fulfil human communicative needs, just as spoken languages do (Vanek, 2009). Against this backdrop, this study investigates teachers' perceptions of the English learning abilities of hearing-impaired students and examines their level of professional preparedness to teach English effectively within inclusive settings in Kano State. By understanding these factors, the study aims to support ongoing efforts to strengthen inclusive education and improve learning outcomes for students with hearing impairments.

Statement of the Problem

Despite national and international commitments to inclusive education, students with hearing impairments in Kano State continue to face significant barriers in English language classrooms. English instruction relies heavily on auditory processes, yet many teachers lack the specialized training, strategies, and resources required to effectively teach learners who depend on visual modes of communication. In addition, misconceptions about the academic capabilities of hearing-impaired students persist, influencing teachers' attitudes and limiting the use of inclusive pedagogical practices. These challenges ranging from inadequate professional preparation to negative perceptions contribute to poor learning outcomes and hinder meaningful participation of hearing-impaired students in English language learning. This study therefore seeks to examine teachers' perceptions of the English learning potential of hearing-impaired students and assess their level of preparedness to teach them effectively in Kano State.

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Objectives of the Study

1. To examine teachers' perceptions of the ability of hearing-impaired students to learn English.
2. To assess the level of training and professional preparedness among teachers for teaching English to students with hearing impairments.

Research Questions

1. What are the perceptions of teachers regarding the capacity of hearing-impaired students to learn English?
2. How prepared are teachers both in terms of training and resources to teach English to hearing-impaired students?

Literature Review

Teachers' Perception and Preparedness in Teaching English to Hearing-Impaired Students: A review

Teachers' perceptions significantly influence the instructional practices, expectations, and learning outcomes of students with hearing impairments, especially in English language classrooms where auditory processing traditionally dominates. Research shows that teachers who believe in the abilities of deaf learners are more likely to adopt supportive, visually oriented strategies such as sign-supported instruction, bilingual bicultural approaches, and structured scaffolding (Weleed, 2024; Marschark & Hauser, 2012). Studies affirm that hearing-impaired students can learn English effectively when provided early access to an accessible language and appropriate instructional support (Dostal & Wolbers, 2014; Cripps & Supalla, 2012). In Nigeria, teachers familiar with sign language and inclusive pedagogy often express positive attitudes toward deaf students' capacity to learn English (Muhammad, 2019). However, misconceptions persist, with some teachers assuming that deaf learners inherently struggle due to limited access to phonology and oral communication assumptions often tied to cultural beliefs about disability (Antia & Jones, 2018; Ajodhia-Andrews, 2016; Abdulrahman, 2017). Teacher training is a major determinant of perception: educators with preparation in deaf education or sign language show greater confidence in deaf learners' potential, whereas those without such training tend to feel unprepared and underestimate student ability (Luckner & Ayantoye, 2020; Adewumi & Oyeleye, 2019; Obosu et al., 2020).

Communication barriers also shape perceptions, as teachers unfamiliar with sign language may misinterpret delayed spoken English as a cognitive deficit rather than a consequence of limited language exposure (Hauser et al., 2010). Research emphasizes that deaf children develop language differently but not less effectively, and that misunderstanding these differences often leads to negative expectations (Marschark, 2001; Vaněk, 2009). Conversely, teachers who are proficient in sign language or experienced with deaf learners frequently report strong visual-learning abilities, conceptual reasoning, and literacy potential among hearing-impaired students (Gaustad, 2015). Inclusive school environments further strengthen positive perceptions by providing visual materials, interpreters, and bilingual programs that enhance teachers' confidence in deaf students' ability to acquire English (Marschark & Spencer, 2016; Adewumi & Oyeleye, 2019). Despite substantial research globally, there remains limited localized evidence on how English language teachers in Kano State perceive the learning capacity of hearing-impaired students. This study therefore fills a critical gap by examining teachers' perceptions and professional preparedness within the linguistic, cultural, and educational context of Kano State.

Theoretical framework

The study adopts Social Model of Disability. The Social Model of Disability, developed by Mike Oliver in 1983, argues that disability does not arise solely from an individual's impairment but from the social,

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institutional, and environmental barriers that limit their participation. Its core tenet is that people are disabled more by attitudinal barriers (such as negative teacher perceptions), institutional barriers (such as inadequate training), and environmental barriers (such as inaccessible teaching methods) than by their physical condition. This makes the model particularly relevant to inclusive education, where hearing-impaired students' challenges often stem from poor teacher preparedness, limited communication support, and inappropriate instructional strategies rather than the hearing impairment itself. A key strength of the model is that it shifts responsibility from the learner to the educational system, encouraging reforms such as teacher training, accessible pedagogy, and equity-focused policies. It also empowers learners by emphasizing capability rather than deficit. However, critics argue that the model underplays the real functional limitations associated with certain impairments and sometimes oversimplifies the interaction between medical and social factors. Despite this limitation, the Social Model remains a powerful framework for analyzing how teacher attitudes and institutional readiness shape the learning experiences of hearing-impaired students.

Methodology

This study adopted a survey research design, which is appropriate for obtaining the perceptions and preparedness levels of teachers regarding the teaching of English to hearing-impaired students. The study was conducted in special education school Tudun Maliki and Special education school Kuka Bulukiya secondary schools across Kano State, Nigeria. The population of the study consisted of 69 English language teachers who currently teach or have experience teaching hearing-impaired students. Given the relatively small population size, a census sampling technique was employed, allowing all 69 teachers to participate in the study to ensure comprehensive data coverage and improved reliability. Data were collected using a structured questionnaire designed to elicit information on teachers' perceptions of the learning capabilities of hearing-impaired students, as well as their professional preparedness in terms of training, resources, and instructional strategies. The instrument underwent face and content validation by experts in special needs education and educational measurement to ensure clarity, relevance, and appropriateness of the items. The collected data were analyzed using descriptive statistics, specifically mean scores and standard deviations.Bottom of Form

Data Presentation

Table 1: Distribution of response on perception of teachers

S/N	Statement	N	Mean	SD	Remark
1	Hearing-impaired students are capable of learning English effectively when taught with appropriate methods	69	4.26	0.62	Agree
2	Hearing impairment does not limit a student's intellectual ability to learn English	69	4.10	0.72	Agree
3	Hearing-impaired students can achieve good English literacy skills with proper instructional support.	69	4.18	0.65	Agree
4	Visual teaching strategies can help hearing-impaired students learn English successfully.	69	4.31	0.59	Agree

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5	Hearing-impaired learners can understand English grammar when supported with sign-based explanations	69	4.05	0.78	Agree
6	With early language exposure, hearing-impaired students can learn English at levels comparable to hearing peers.	69	4.12	0.70	Agree
7	Hearing-impaired students are motivated to participate actively in English lessons when communication barriers are removed	69	4.20	0.66	Agree
8	Sign language can effectively support the teaching of English concepts to hearing-impaired students.	69	4.28	0.60	Agree
9	Many hearing-impaired students possess strong visual-learning abilities that enhance their English learning	69	4.22	0.63	Agree
10	Hearing-impaired students have the capacity to perform well in English examinations when given equal learning opportunities	69	4.08	0.75	Agree

The results in Table 1 reveal that teachers hold generally positive perceptions regarding the capacity of hearing-impaired students to learn English. Mean scores across all ten items range from 4.05 to 4.31, indicating a strong level of agreement among respondents. The highest-rated statement *"Visual teaching strategies can help hearing-impaired students learn English successfully"* (M = 4.31, SD = 0.59) highlights teachers' strong confidence in the effectiveness of visual and multimodal instructional approaches. Similarly, teachers expressed strong belief in the value of sign language as a supportive tool for teaching English concepts (M = 4.28, SD = 0.60), as well as in the general capability of hearing-impaired learners to acquire English when taught with appropriate methods (M = 4.26, SD = 0.62).

Teachers also agreed that hearing-impaired students possess strong visual-learning abilities (M = 4.22, SD = 0.63) and are motivated to participate actively in English lessons when communication barriers are removed (M = 4.20, SD = 0.66). Perceptions regarding the intellectual capacity of hearing-impaired learners were equally positive, as respondents affirmed that hearing impairment does not limit a student's ability to learn English (M = 4.10, SD = 0.72), and that such students can perform well in examinations when afforded equal opportunities (M = 4.08, SD = 0.75).

Overall, the pattern of responses suggests that teachers in Kano State hold optimistic views about the linguistic potential of hearing-impaired learners. They recognize that effective teaching methods particularly visual strategies, sign-supported instruction, and early language exposure play a crucial role in enabling these students to achieve meaningful English proficiency. This generally strong positive perception provides a supportive foundation for inclusive English language instruction within the study area.

Table 2: Distribution of response on preparedness of teachers

S/N	Statement	N	Mean	SD	Remark
1	I have received adequate training to teach English to hearing-impaired students.	69	3.12	0.88	Undecided
2	I am confident in using sign language or other visual communication methods during English lessons.	69	3.25	0.90	Agree

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3	I understand how to adapt English curriculum materials for hearing-impaired learners.	69	3.18	0.86	Undecided
4	I can effectively modify my teaching strategies to meet the needs of hearing-impaired students.	69	3.30	0.82	Agree
5	My school provides sufficient instructional materials for teaching English to hearing-impaired learners	69	2.89	0.95	Disagree
6	I have access to assistive technologies needed to support English instruction for hearing-impaired students	69	2.78	0.97	Disagree
7	I regularly participate in workshops or training related to inclusive or special needs education.	69	3.01	0.92	Undecide
8	I feel adequately prepared to assess the English proficiency of hearing-impaired learners.	69	3.14	0.87	Undecide
9	I collaborate with specialists (e.g., interpreters, special educators) when teaching hearing-impaired students.	69	3.22	0.84	agree
10	My school environment supports inclusive teaching practices for hearing-impaired learners	69	3.05	0.89	Undecide

The results presented in Table 2 indicate that teachers' preparedness to teach English to hearing-impaired students is moderate, with mean scores ranging from 2.78 to 3.30. Overall, the findings suggest partial readiness, marked by strengths in pedagogical flexibility but significant gaps in training, resources, and institutional support. Teachers expressed confidence in their ability to modify teaching strategies for hearing-impaired learners (M = 3.30, SD = 0.82) and showed agreement regarding their capacity to use sign language or visual communication methods during lessons (M = 3.25, SD = 0.90). They also reported a willingness to collaborate with specialists such as interpreters and special educators (M = 3.22, SD = 0.84), indicating openness to interdisciplinary instructional support.

However, several key areas reflected uncertainty or inadequate preparation. Respondents were undecided about having received adequate training to teach hearing-impaired students (M = 3.12, SD = 0.88) and about their ability to adapt English curriculum materials effectively (M = 3.18, SD = 0.86). Similar uncertainty was observed regarding participation in training workshops related to inclusive education (M = 3.01, SD = 0.92) and preparedness to assess the English proficiency of hearing-impaired learners (M = 3.14, SD = 0.87). These results indicate gaps in professional development and specialized instructional competence.

More concerning, teachers disagreed that their schools provide adequate instructional materials (M = 2.89, SD = 0.95) and access to assistive technologies needed for English instruction (M = 2.78, SD = 0.97). These low scores highlight significant infrastructural and resource constraints that may hinder effective teaching in inclusive settings.

Collectively, the findings suggest that while teachers demonstrate positive attitudes and some pedagogical readiness, their overall preparedness is limited by insufficient training, inadequate learning resources, and poor access to assistive technologies. Strengthening teacher capacity and improving school-level support systems will therefore be essential for effective English language instruction for hearing-impaired students in Kano State.

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Discussion of findings

The finding that teachers in Kano State hold strong positive perceptions of hearing-impaired students' ability to learn English aligns with existing research showing that deaf learners can acquire English effectively when taught through visual, sign-supported, and bilingual approaches (Dostal & Wolbers, 2014; Cripps & Supalla, 2012). Nigerian studies similarly report that teachers with exposure to inclusive methods tend to recognize the linguistic potential of deaf learners (Muhammad, 2019). This consistency suggests growing awareness among teachers of the effectiveness of accessible instructional strategies.

However, a critical interpretation reveals that positive perceptions alone do not guarantee effective practice. Prior research shows that many teachers who express supportive attitudes still lack the training or resources needed to implement inclusive methodologies (Obosu et al., 2020). The Social Model of Disability further underscores that learners succeed when instructional barriers not the impairment are addressed. While teachers in this study reject deficit-based assumptions and acknowledge deaf students' visual strengths, these perceptions may remain aspirational unless matched by adequate professional preparation and institutional support.

The second finding that teachers in Kano State overwhelmingly believe hearing-impaired students can successfully learn English aligns strongly with existing literature but also reveals important gaps. Research confirms that deaf learners possess the cognitive capacity to acquire English when taught through visually accessible methods such as sign-supported instruction and bilingual approaches (Dostal & Wolbers, 2014; Cripps & Supalla, 2012). Teachers' strong agreement with these ideas reflects a shift toward capability-based views consistent with the Social Model of Disability, which attributes learning challenges to environmental barriers rather than the impairment itself (Oliver, 1983). However, although teachers recognize the value of visual strategies and agree that hearing impairment does not limit intellectual ability, studies in Nigeria show that many still lack adequate training and resources to implement these beliefs effectively (Adewumi & Oyeleye, 2019). This suggests that positive perceptions may not yet translate into consistent classroom practice. The finding that teachers view hearing-impaired learners as strong visual thinkers also supports research indicating that deaf students excel when instruction matches their communication strengths (Gaustad, 2015), but without sufficient institutional support, these strengths may remain underutilized. Overall, while teachers' perceptions are encouraging and theoretically aligned with inclusive principles, they highlight a critical tension: attitudes are positive, but practical preparedness often remains limited underscoring the need for targeted training and improved instructional support.

Conclusion

This study examined teachers' perceptions and preparedness in teaching English to hearing-impaired students in Kano State. The findings reveal that teachers generally hold strong, positive beliefs about the capacity of hearing-impaired learners to acquire English, emphasizing that with appropriate visual, sign-supported, and accessible instructional methods, these learners are capable of achieving meaningful proficiency comparable to their hearing peers. These perceptions align with contemporary research and the Social Model of Disability, which underscores that learning challenges faced by hearing-impaired students often stem from environmental and instructional barriers rather than inherent limitations. Despite these encouraging perceptions, the findings also show that many teachers feel inadequately prepared to translate these beliefs into effective classroom practice. Limited training in deaf education, insufficient access to instructional materials, and lack of assistive technologies remain persistent challenges. This gap between positive attitudes and limited preparedness suggests that while teachers recognize the potential of hearing-impaired learners, systemic constraints hinder effective implementation of inclusive English language instruction.

Recommendations

1. **Strengthen Teacher Training in Deaf Education**-The Ministry of Education and school administrators should provide regular professional development programs on sign language, visual pedagogy, and inclusive English teaching strategies to enhance teachers' competence.
2. **Provide Adequate Instructional Materials and Assistive Technologies**-Schools should invest in essential resources such as visual aids, captioned materials, digital learning tools, and hearing-assistive technologies to support effective English instruction for hearing-impaired students.
3. **Integrate Sign Language Training into Teacher Education Programs**-Colleges of education and universities should embed Nigerian Sign Language (NSL) courses into English teacher training curricula to improve communication and instructional delivery.

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THE EFFECT OF DIGITAL TECHNOLOGY ON INDUSTRIAL WORKFORCE IN INDUSTRIES IN CROSS RIVER STATE, NIGERIA

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Abstract
The effect of digital technology around the globe on both humans and other physical environments cannot be overstated. Technology has widely affected general ways of life and events. The level of technology has continued spreading to many developing nations, which is not only affecting human lives but has a great impact on employment and business activities as well. This situation is analysed from two perspectives in this paper; concerning the negative and positive effects. This paper concentrates only on the results of the questionnaires and the descriptive analysis. *The findings are presented using graphs and charts. For validity purposes, the respondents' demographical data were analysed first. Out of the 195 respondents, 120 (61.5%) were males and 75 (38.5%) were females. 33.33% of the respondents fall within 28–37 age group, 27.69% are in the 38–47, 24.62% fall within 48–57 while 9.23% and 5.13% fall within 18–27 and above 58 age groups respectively.*
The study gives a short overview on how work was done before and after the advent of digital technology, and with the help of collecting problems resulting from modern technology, it suggests possible ways of minimizing the negative effects of the technology, especially in Cross River State struggling to adapt to new changes.
Keywords: Digital Technology, Industries, Industrial Workforce

Introduction

Technology may have diverse definitions but always means the same thing. It can be viewed as the set of knowledge, skills, experience and technicalities adopted by humans to ensure easy carrying out of activities through creations of diverse tools, equipment and machines that aids the change and transformation of human activities. The origin of technology can be traced back to Stone Age and through the present digital communication time. It changes from time to time due to increase in human's knowledge in making different innovations that lesser their works. Many natural resources are transformed into tools and equipment such as machines and engines that make human activities look easy and satisfactory. Today, the world has witnessed many products of technology such as smartphones, locomotives, computers, cars, trains, airplanes, bulbs, tablets, microchips and artificial intelligence amongst many others, whose presence have not only made lives easier but also faster and more accurate in carrying out complex tasks and achieving positive results.

The effect of digital technology has infiltrated into industrial systems, education, aviation, transportation, commerce, security and military services amongst many others. This has helped the activities of different agencies but it also has replaced the number of humans needed to perform numerous tasks. To some extent, this reduced the numbers of employees in many agencies, thereby creating more struggles for people to secure employment which results in increasing unemployment rates, Yakubu, et al. (2022). The industrial sector has witnessed a great achievement through digital technology that has positively shaped its activities. The performance of the industry in Nigeria has

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recently increased and is providing better services to their numerous customers even far away from the workplaces. In addition, Quresh et al. (2018) described online industrial activities as time saving and also an evolution of services through the use of improved technology, and Idowu *et al.* (2018) stated that Nigerian industries are discovering through the use of modern technology they can get competitive advantage over their numerous competitors. From the educational aspects of the country, it has positively enhanced the delivery of information services that has brought various levels of development in education. The modern technology has brought great achievements in the transport services within the country through information and communication services. This can be seen through the automated cataloguing, acquisition and circulating systems. This has led to improved services and management of the sector in the country's institutions where the technology had been adopted. The usage of internet services in the universities and colleges has made research to be easily carried out compared to the previous usage of printed materials for searching information. Lewis (2017), considered that it is beyond doubts that the application of Information and Communication Technology has provided the best innovation in changing sectors and managerial roles in an unprecedented shape. Al-Qallaf (2016) noted that "today, provide access to eclectic e-collections, create and maintain digital content, support e-learning, provide real time e-reference, negotiate contracts and licensing agreements and struggle with the economics of electronic information".

The business industrial sector is also witnessing a vast usage of the technology for its commercial activities that enable buying and selling online through creations of websites and various social media for easy transactions. However, despites the huge advantages brought by technology into the business sectors, there exists a militating controversy against technology usage amongst employees in their workplace and which influences the behaviours of employees to work. Joyce et al. (2018) pointed out that this has been a major conflicting point between management and employee at various levels. Katzenbach, et al, (2016) noted that, despite the fact that the advent of the modern technology is not intending to replace workers, it will be good to note that those without the basic technological knowledge and skills and also unwilling to learn, will surely be replaced soon. Zezulka et al. (2016) suggested that the production and logistic system of an organization in this digital age must be adjusted to meet the new trend of the technologies. He added that the current systems of production should be customers centred, meeting with the requirement of the implementation of industry 4.0. The main goal of the European Green Deal is the digitalization of industry as a condition of reaching the targets set in the deal. The industry 4.0 implementation will result in better usage of infrastructure, energy, logistics and transportation achieving sustainable manufacturing.

In the agricultural sector there is no overstatement in saying that the usage of mobile phones and internet has made getting agricultural information and market prices operations of agricultural products and access to veterinary and extension workers easier. This has really brought development in most developing nations that were relying on obsolete technologies in the farming sectors. Kashem (2015) pointed out that the Philippines adopted the usage of mobile phones and other tools with the help of Information and Communication Technologies farmers can take the decisions on when and where to sell their products. However, while the farmers use new technologies on their farms, farm's labourers suffer the effect of job loss as a majority of the farm works are replaced by the use of machines and herbicides. communication technologies among farmers to feed their extension officers about related development on their farms and also seek information about farm inputs as well as market prices of their products. Nowadays farmers have access to information about modern agricultural inputs, new technologies and also market for their products. The role of the Digital Technologies is vital in the economic development and ensuring market effectiveness, productivity and competitiveness (Noor Sharifah, 2015). Technology usage has to do with acceptance and continuous use of a given technology and this has to do with the employee's behaviour toward the technology. According to Demaerschalk et al. (2014) employee behaviour means the reaction of an employee to a certain situation at his/her workplace. Adding to the employees' behaviour Ehikhamenor (2013) noted that employee and

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organisation cultures shape and nurture employees' behaviours and he further portrayed as a norm of every organisation that each employee must behave well in order to be promoted to the next cadre. deploying new technology to an organisation for an activity. It shows that once the technology is adopted it will influence the performance or behaviour of the employee, which in turn improves the organisation productivity, and this justifies the investment made in the technology by the management. However, where the new technology is rejected or abused by the employees it will negate the expectations of the managements. There is no doubt that once a new technology is introduced to an organisation that tends to supplement human efforts, it creates fears in the mind of the employees who assume that the change in jobs' description will result in their retrenchment or being redundant at work. A good example can be taken from the introduction of artificial intelligence that replaces human works and whenever a new technology that relates to robots is introduced the fear remains that some works are going to be assigned to the robots (Forson, 2014). Like in many developed countries of the world, Nigeria is shifting from using conventional skills and labour into sophisticated technical orientation in its operations in most of its agencies. This results from modernization of the technology and its improvement in the country. This has greatly influenced the smooth and fast running of tasks within appreciable time frames, but at the same time it has affected interactions and many affairs at the of workplace and workforce . However, many people who are not able to run the new technology always live at the fear of losing their values or jobs at large (Griep et al., 2021).

This shift in technology created fear in many workers of possibility of losing their jobs and in the unemployed of not getting chance to be reemployed as the thought of the Artificial Intelligence to replace most operations still grieves many individuals who still believe that it will increase the rate of unemployment in the country. There is a huge anxiety that most jobs will be taken over by the usage of Artificial intelligence or any other sophisticated technology that requires fewer human attention. There is no doubt that Nigeria like many other African and developing countries faces some challenges, but there are lots of opportunities attached to the challenges, through the opportunities requiring systematic tackling through adopting the new movement of the digital economy (Atiku et al., 2018). According to Gillwald, et al. (2018) Digital Technologies has created almost 2.5 billion jobs in Nigeria in the past few years. In addition, there was unofficial prediction by a Nigerian business typhoon (Dangote) that "five of the twelve million jobs needed in Africa soon must be created in Nigeria. This is in line with the efforts seen between the Nigerian youths in welcoming and utilising the new technologies over decades. It is of great importance to note that technology has played vital roles in jobs creation in Nigeria and other developing countries, but this opportunity is only for those that are adjusted to the new innovations. The job creation in the fast-changing global economy entails enhancing entrepreneurship and governments to really harness the benefits that the new innovations bring so as to enable the improvement of the local workforce in their countries. Many benefits are derived from the ability of the digital economy in connecting people with businesses, organisations and governments in providing not only services, but also opportunities to employ smart users of the technology. To build and sustain the Nigerian economy there should be greater effort done in utilising the digital economy in all its agencies (Odum et al., 2018).

The aim of this paper is to evaluate the effects of the digital technology on industrial workforce in industries in Cross River State.

Objectives are the study

1. To examine the effect of digital technology on workplace in Cross River State.
2. To evaluate the effect of digital technology on the workforce in Cross River State

Research Questions

1. Does digital technology have positive effect on workplace in Cross River State?
2. What are the negative impacts of digital technology on workforce in Cross River State?

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Research hypotheses

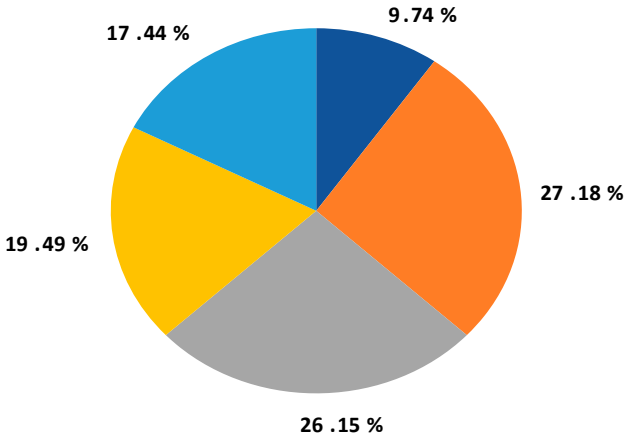
1. H0: Qualification does not affect the ability to adapt a digital technology.
2. H1: Qualification affects the ability to adapt a digital technology.

The research is designed through semistructured interviews and questionnaires. The sample framework adopted includes employees from the Flour Mill Industry, Calabar Municipality Local Government Area and UniCem Cement industry, Mfamosing, Akamkpa Local Government Area of Cross River State in Nigeria.

The data were collected through pre-tested interview guide that obtained the respondents information. A total of two hundred copies of questionnaires were administered, fifty from each local government area. The questionnaires were administered randomly amongst employees of the study area. Out of the two hundred questionnaires administered, one hundred and ninety-five were successfully retrieved.

Data collected were edited, coded and analysed through Descriptive statistical methods (frequencies)and cross tabulation were used for categorical variables. Hypothesis was set to test the relationship between qualification

Figure 1



Distribution of the respondents by their academic qualification (%)

Primary Secondary Diploma/National Certificate of Education

Bachelor Degree MSc/Ph.D

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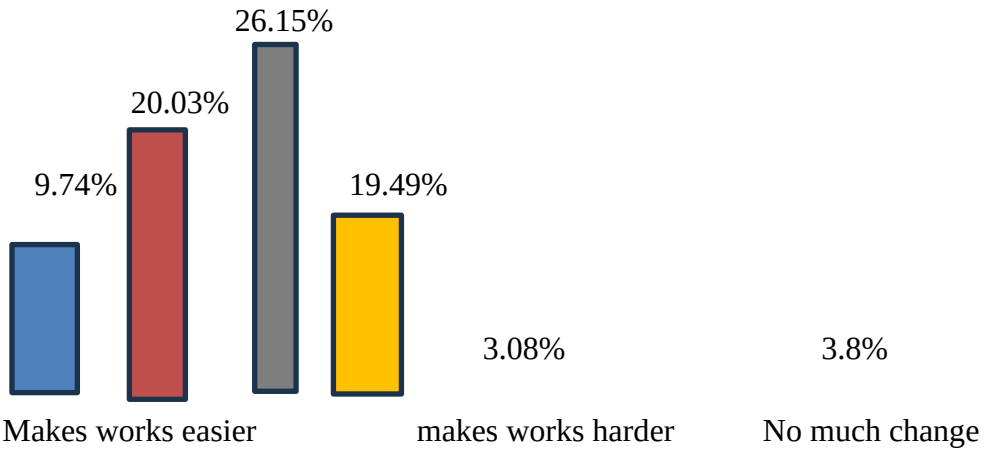


Figure 2

Effect of Digital Technology on Employee Performance (%)

Primary Secondary Diploma/National Certificate of Education

Bachelor Degree MSc/Ph.D

The hypothesis was set to test the relationship between qualification and ability to adapt to modern technologies. The hypothesis was tested by Pearson's Chi Square Test. If P value is less than 0.05, the result is considered to be significant. This shows that there exists relationship between the variables under consideration (95% true that there was not accidental relationship).

This paper concentrates only on the results of the questionnaires and the descriptive analysis. The findings are presented using graphs and charts. For validity purposes, the respondents' demographical data were analysed first. Out of the 195 respondents, 120 (61.5%) were males and 75 (38.5%) were females. 33.33% of the respondents fall within 28–37 age group, 27.69% are in the 38–47, 24.62% fall within 48–57 while 9.23% and 5.13% fall within 18–27 and above 58 age groups respectively.

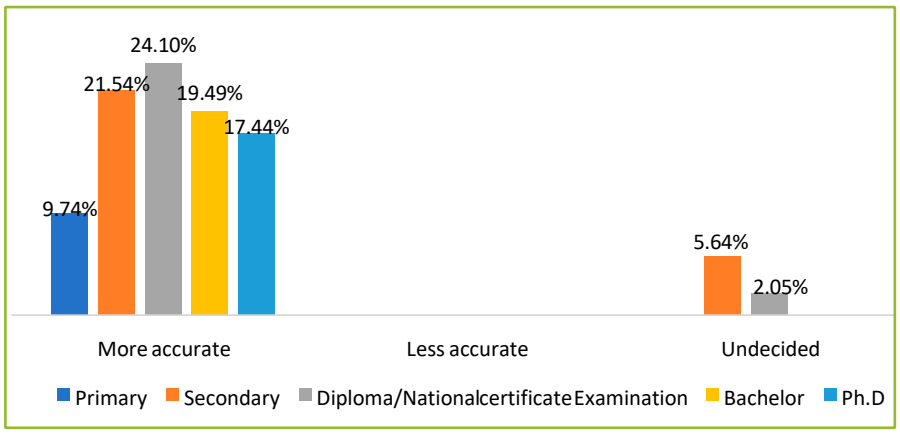
Discussion of the Result

The results are presented and discussed based on the analysis of the information obtained from the respondents and they are presented in charts, diagrams and tables: 27.18% of the respondents are secondary school graduates, where 26.15% have Diploma or National Certificate of Education (Figure 2). 19.49% have Bachelor degree, 17.44% have either Master degree or Doctorate degree while 9.74% of the respondents have primary certificate as their highest qualification.

Figure 2 shows the effect of digital technology on the employees' performance, 94% of the respondents admitted that technology has really made work easier, whereas 6% considered the digital technology has made work harder or no change at all to the nature of works. It is good to note that those that form the major parts of the workforce from diploma to doctorate level all admitted the simplification of work through the use of digital technology in their places of work.

Figure 3

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Effect of Digital Technology on work accuracy (%)
Figure 4

Effect of Digital technology on job responsibilities (%)

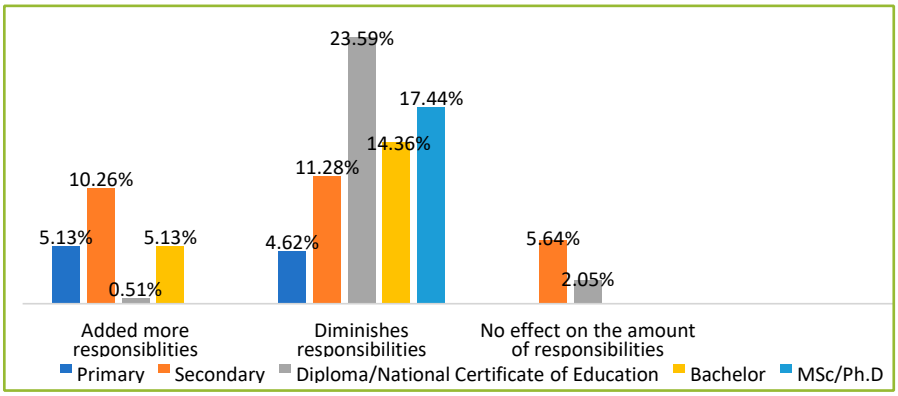
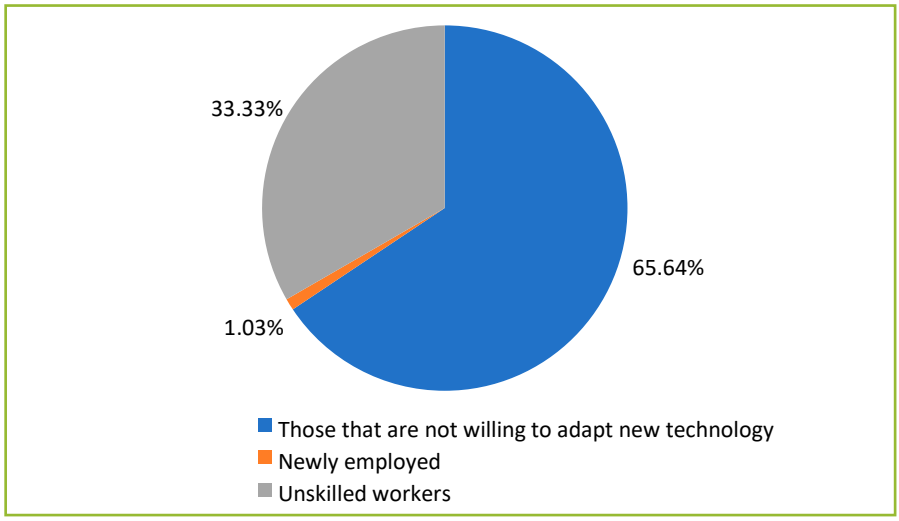


Figure 3 shows that 92% of the respondents across all qualification admitted that the usage of digital technology such as computers, the Internet, software has definitely increased accuracy at work and only less than 8% have not decided on the accuracy.

Figure 4 shows the responses on responsibilities of work. Where 7.69% considered the use of the digital technology has no any effects on their responsibilities while 21.03% considered the digital technology has added more responsibilities to them, 65.28% of the respondents discovered that the new technology has reduced their responsibilities at works. Majority of those that admitted technology has lessened their responsibilities fall within the higher qualifications.

Figure 5

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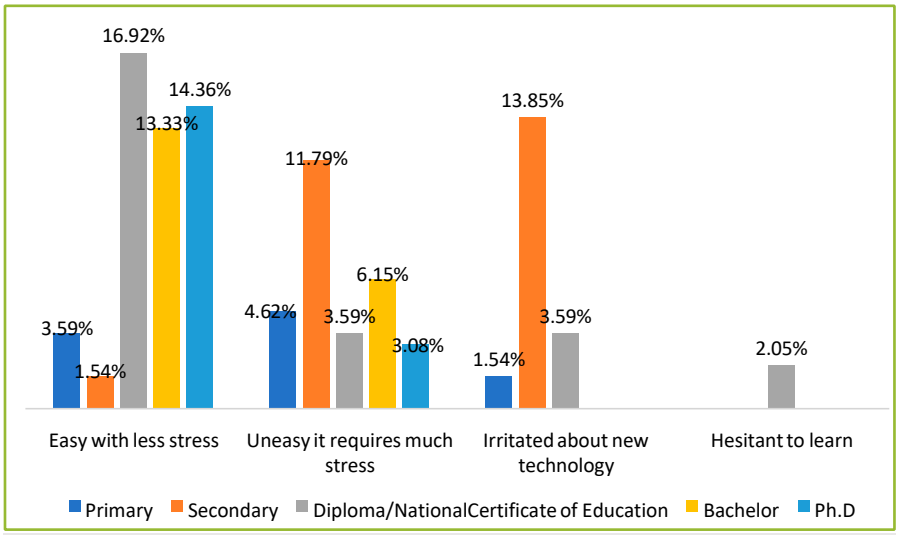


Figure 6 Ability in adapting new technology (%)

Figure 6 revealed the respondents' views about losing their jobs due to introduction of any digital technology. 65.64% of the respondents believed that only those employees that are not willing to adapt to the new technologies may likely to lose their jobs at the cost of a digital technology. 33.33% of the respondents thought that unskilled workers may likely lost their jobs at the expense of new technology while only 1.03% considered new employees to likely lost their jobs to new technology.

Table 1 Ranking the effects of digital technology on employees

Effects	Strongly agreed (%)	Agreed (%)	Undecided (%)	Disagreed (%)	Strongly disagreed (%)
It reduces the number of employees	31.3	59.5	1.5	6.2	1.5
Contributes to early retirement of staff	13.3	18.5	13.8	30.3	24.1

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Contributes to retrenchment of workers	13.3	72.3	11.3	3.1	0.0
Leads to displacement of employees	11.3	55.9	20.5	5.6	6.7
It increases employment opportunities	0.0	53.8	19.0	21.5	5.6
Increases the level of employee's job insecurity	4.1	90.8	3.1	2.1	0.0
It results in the loss of unskilled workers in the industry	10.3	86.7	3.0	0.0	0.0
It dehumanizes the work organization	12.3	80.5	7.2	0.0	0.0
High level of redundancy at work	9.2	85.6	3.1	2.1	0.0
Technological usage boost productivity	16.9	83.1	0.0	0.0	0.0
Technological change significantly raises employee skills and performance	22.1	77.9	0.0	0.0	0.0

Table 1 revealed the perception of the respondents in respect to the effects of digital technology on various employment aspects. 54.4% of the respondents either disagreed or strongly disagreed that the introduction of new technology will result to early retirement of employees and 53.8% agreed that technology creates new employment opportunities.

In addition, over 65% of the respondents viewed new technology in Nigeria has the tendencies of displacing and retrenching employees from their work. Over 95% of the respondents considered that the new technology dehumanises the works thereby creating high level of redundancy at work and also over 95% of the respondents viewed that there is tendency of losing unskilled workers due to the used of new technology and this increases the level of employees' insecurity at work. Over 97% of the respondents unanimously agreed or strongly agreed that technology increases organisation productivity and also significantly increases employees' skills and performance.

Table 2: Relationship between Qualification and ability to adapt digital technology Chi-Square Tests

	Value	Df	Asymptotic significance (2-sided)
Pearson Chi-square	99.518a	12	0.000
Likelihood ratio	115.428	12	0.000
Linear-by-linear association	41.716	1	0.000
N of valid cases	195		

Table 2 shows the Pearson's chi-square test for the hypothesis qualification does not affect the ability to adapt to new technology. The test significantly proved that there is a relationship between

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qualification and ability to adapt to new technology. The P value is less than 0.05, which means the confident level is above 95%. This means that the highly qualified individuals are more willing to adapt to the new technology than the lower educated employees who considered technology as uneasy or irritating to learn. The null hypothesis is rejected. Qualification was used to know the employees' ability in adapting to new technology at work through a set hypothesis, which was tested and decision was taken on the null hypothesis.

Conclusion and Recommendation

As a conclusion, it is clear that the digital technology has both positive and negative effects in providing employment. While it displaces people from their work places it can be seen at the same time it creates other opportunities to reabsorb them into other sectors as the technology itself comes with jobs creation but only for those that are ready to adapt to the new technology. Those at the higher risk of losing their jobs are those with less education qualification that occupy the unskilled labour where technology can reduce their numbers to greater extend. The ability to adapt to new technology is very important as no one can easily ascertain what will happen tomorrow. A good example can be seen with the pandemic that has changed the faces of works and education to online bases.

However, where the technology is found challenging works and education have crippled. Nigeria following the announcement of the lockdown by the presidential task force on Covid-19 from March 2020, had to close schools till the end of September due to the fact that it lacks the technology to continue with online education. This really implies that with digital economy trend, many developing nations that will not speedily meet up and adopt the new technology driving it, are at doom of facing many economic challenges coupled with high unemployment rates and increase in social vices. Despite that, technology enhances satisfaction, effectiveness and jobs quality and sustainable competitive advantage, and eff orts should be put in place by the Nigerian agencies and parastatals to ensure that adoption of new technology in all industrial sectors as it does not result in direct loss of jobs and retrenchment of employees. All agencies, parastatals and sectors should ensure that humans are trained to meet any new technology being introduced, for without human resource performance, other resource accomplishments such as raw-materials, capital and technology among many others have no meaning.

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ASSESSING THE LEVERAGES TOWARD ENHANCING SECURITY AWARENESS AND PROTECTION OF INFORMATION RESOURCES IN ACADEMIC LIBRARIES IN KANO STATE, NIGERIA

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Abstract
This study examined the security challenges affecting university libraries in Kano State, Nigeria, and explored the potential of Artificial Intelligence (AI) technologies in mitigating these challenges. Using a survey design, data were collected from 329 respondents across three universities, including library staff, academic staff, and students. Findings revealed that theft, mutilation of information resources, inadequate surveillance, weak access control, poor staff monitoring, insufficient funding, and structural weaknesses significantly undermine library security. Respondents strongly agreed that AI technologies such as AI-enabled CCTV, predictive analytics, RFID integration, and machine-learning-based decision support could enhance both physical and digital security. The study is grounded in the Routine Activity Theory and Technology Acceptance Model, highlighting the roles of capable guardianship and staff adoption in preventing security breaches. The findings underscore the need for an integrated approach combining AI-driven solutions, staff training, policy enforcement, and infrastructural improvements to protect valuable library resources.
***Keywords**: University libraries, Security challenges, Theft and mutilation, Artificial Intelligence,*

Introduction

Information resources are fundamental to teaching, learning, and research, and their protection remains a core responsibility of academic libraries. As noted by Kwanya (2019), safeguarding these resources is essential to sustaining the mission of higher education institutions. Although university libraries employ conventional security measures such as access control, CCTV surveillance, and security personnel, persistent challenges including theft, vandalism, and inadequate funding continue to undermine collection integrity, particularly in developing countries (Lavanya, 2017; Simukali, 2019). In Kano State, Nigeria, these challenges remain pronounced and affect both physical and digital information resources.

The emergence of Information and Communication Technologies (ICTs) has introduced improved security mechanisms such as RFID systems, electromagnetic detection gates, and automated monitoring tools. These systems have been shown to reduce resource loss and strengthen collection management (Greenwood & McKean, 2015; Cruz, 2013). However, many libraries still rely heavily on manual, reactive security practices due to limited funding, lack of technical expertise, and low staff awareness (Osayande, 2011; UNESCO, 2015). As a result, security breaches persist even where electronic systems have been installed (Uzuegbu & Okoro, 2012). In today's digital environment, the complexity of security threats highlights the potential of Artificial Intelligence (AI) to transform library security operations. AI-powered tools offer capabilities such as real-time surveillance, predictive analytics, behaviour recognition, and automated access control, enabling proactive detection and mitigation of risks (Akor, 2019). Despite these possibilities, the level of awareness, readiness, and adoption of AI-driven security solutions in university libraries in Kano State remains largely unknown. Furthermore, staff attitudes significantly influence the successful implementation of electronic and AI-based security practices. Positive attitudes enhance accountability and reinforce compliance, while negative attitudes such as indifference or negligence can weaken security efforts (Albarracin & Shavitt, 2018; Allport, 2015). Given recurring incidents of theft, mutilation, and unauthorized access in

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academic libraries across Nigeria (Akinola, 2020; Abubakar & Aduku, 2016), understanding the attitudes and awareness levels of library personnel is crucial.

Given these challenges and emerging technological opportunities, there is a critical need to assess the existing security issues confronting university libraries in Kano State and to examine how Artificial Intelligence can be leveraged to enhance security awareness and protect valuable information resources. This study therefore evaluates the current security challenges in the region's academic libraries and explores the potential role of AI in strengthening information resource protection.

Statement of the Problem

University libraries in Kano State, Nigeria, continue to face major security concerns, particularly the theft and mutilation of information resources, which affect the integrity, accessibility, and preservation of academic collections. Despite the deployment of traditional security measures such as CCTV surveillance, physical security officers, and manual tracking systems, cases of unlawful removal, defacement, and destruction to library resources remain frequent. These issues are worsened by low budget, weak implementation of library policies, uneven staff supervision, and structural vulnerabilities inside library facilities. While Artificial Intelligence (AI) technologies provide potential solutions for proactive surveillance, predictive risk assessment, and decision assistance, the amount of awareness, preparedness, and implementation of such technologies in university libraries in Kano State remains poorly unexplored. This study consequently intends to evaluate the present security concerns in these libraries and explore the potential application of AI technology to better the protection of information resources.

Objectives of the Study

1. To assess the current security challenges faced by university libraries in Kano State, Nigeria.
2. To explore the potential role of Artificial Intelligence (AI) in enhancing security measures in the study area.

Research Questions

1. What are the major security challenges related to theft and mutilation of information resources in university libraries in Kano State, Nigeria?
2. How can AI technologies be applied to address these security challenges effectively in the study area?

Literature Review

Security Challenges Affecting Library Information Resources

Academic libraries face a broad spectrum of security challenges that threaten the preservation, accessibility, and long-term sustainability of their information resources. Across many developing countries including Nigeria these challenges have persisted for decades and have become increasingly complex due to changes in user behaviour, rising resource scarcity, and emerging digital vulnerabilities (Momodu, 2002; Jato, 2005).

1. Theft of Information Resources -Theft remains the most pervasive security threat in academic libraries. Numerous studies confirm that the unauthorized removal of items particularly high-demand textbooks, reference works, and journals poses a continuous challenge (Akinola, 2020). As documented by Maidabino and Zainab (2011), Nigerian university libraries consistently report substantial material losses resulting from inadequate surveillance, insufficient staff monitoring, and porous access control systems. The problem is further intensified in environments where library resources are limited and demand significantly outweighs supply, leading some users to resort to unethical means of obtaining materials (Ajegbomogun, 2004).

2. Mutilation and Defacement- Closely associated with theft is the widespread issue of mutilation tearing pages, removing illustrations, defacing text, or marking books in ways that render them

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incomplete or unusable. Abubakar and Aduku (2016) note that such practices compromise the utility, longevity, and integrity of collections. In Nigeria, mutilation is often attributed to the scarcity of essential reading materials, weak enforcement of borrowing rules, and limited awareness of ethical information use among students (Akor, 2019). These behaviours align with earlier findings by Ugah (2007), who identifies material damage as a major obstacle to effective resource accessibility.

3. Funding Constraints and Inadequate Security Infrastructure -Financial limitations represent a critical underlying factor that exacerbates security lapses in university libraries. As emphasized by Kwanya (2019) and Simukali (2019), many African academic libraries operate under stringent budget constraints that prevent investment in modern security technologies such as RFID systems, biometric access controls, and advanced surveillance devices. The literature consistently shows that shrinking library budgets—combined with rising operational costs—create structural vulnerabilities. In such circumstances, libraries often rely heavily on outdated equipment, poorly maintained buildings, and manual surveillance practices that are ill-suited to contemporary threats (Ugah, 2007).

4. Insufficient Staff Training and Low Security Awareness - Library security also depends significantly on staff competence, vigilance, and adherence to protocols. However, several studies report a widespread lack of training among library personnel, particularly regarding the use of electronic security systems and risk-mitigation strategies (Osayande, 2011; Uzuegbu & Okoro, 2012). This skills deficit results in weak enforcement of regulations, irregular monitoring routines, and delayed responses to breaches. Earlier research by Jato (2005) similarly highlights behavioural issues among users—such as hiding books, refusing to return overdue materials, and flouting library policies—which staff may not be adequately trained to address. UNESCO (2015) describes manual checks and basic CCTV systems still used in many libraries as reactive, inconsistent, and insufficient to manage current security demands.

5. Digital Security Threats - As libraries increasingly digitise their collections and integrate electronic resources, new threats related to cybersecurity have emerged. These threats include hacking, unauthorized access to databases, password sharing, automated data scraping, and system manipulation. Akor (2019) argues that digital theft has become an urgent issue in Nigerian university libraries, particularly as many institutions lack robust firewalls, encryption tools, or skilled IT personnel capable of implementing cybersecurity best practices. Without adequate safeguards, digital repositories become susceptible to breaches that threaten data integrity, confidentiality, and availability.

6. Weak Implementation of Security Policies - Even where security policies exist, implementation is often weak or inconsistent. Allport (2015) and Albarracin and Shavitt (2018) emphasize the pivotal role of user attitudes in policy compliance, noting that impatience, poor reading culture, and disregard for borrowing procedures often undermine enforcement. In many Nigerian institutions, security policies remain poorly communicated, infrequently updated, or inadequately enforced—allowing breaches to recur without corrective action.

7. Building Design and Environmental Vulnerabilities - Physical infrastructure also plays a critical role in shaping the security profile of academic libraries. Poor building design including unmonitored corners, inadequate lighting, poorly secured emergency exits, and insufficient visibility creates opportunities for concealment and unauthorized movement within library spaces. Greenwood and McKean (2015) argue that effective security requires structural features such as controlled access points, clear sightlines, and secure storage areas. However, many Nigerian university libraries lack such architectural provisions due to aging facilities and limited capital investment (Ifidon, 2000).

Application of Artificial Intelligence (AI) in Enhancing Library Security

Artificial Intelligence (AI) is increasingly recognized as a transformative tool capable of addressing many of the longstanding challenges faced by academic libraries. While AI has traditionally been explored for improving cataloging, discovery services, and user support, recent scholarship highlights

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its growing relevance in strengthening security and surveillance systems (Mandal, 2024). Integrating AI into library security provides innovative and proactive solutions across multiple domains.

1. Intelligent Surveillance and Behaviour Detection - A key application of AI lies in enhancing surveillance through computer vision and machine-learning algorithms. When integrated with CCTV systems, AI can automatically detect suspicious activities such as unusual crowding, prolonged loitering, or abnormal handling of materials. These tools generate real-time alerts, reducing dependence on continuous manual monitoring. Research demonstrates that AI-enhanced surveillance improves detection accuracy and reduces false alarms compared to traditional human-only monitoring systems (Siguo-Bi et al., 2022). AI–IoT security architectures, in which cameras, sensors, and edge analytics work collaboratively, offer further improvements by enabling automated incident analysis and environmental awareness.

2. AI-Enhanced RFID and Inventory Control - AI significantly augments traditional theft-prevention mechanisms such as RFID. When integrated with machine-learning models and IoT sensors, RFID systems can support predictive inventory auditing, detect anomalous borrowing or removal patterns, and automate shelf status reconciliation. Evidence from prior research indicates that AI-enabled RFID systems improve loss-detection rates, speed up stocktaking processes, and generate intelligent alarms capable of distinguishing between routine and suspicious behaviours (Singh & Mahajan, 2014). These advantages are particularly valuable in settings facing staff shortages or heavy user traffic.

3. Predictive Analytics for Risk Assessment - AI also strengthens preventive security through predictive analytics. By analysing circulation data, access logs, historical incident reports, and user behaviour patterns, AI systems can identify high-risk times, vulnerable zones within the library, or specific user categories associated with recurring violations. Such insights support targeted patrols, informed decision-making on resource allocation, and strategic placement of surveillance equipment (Siguo-Bi et al., 2022). In resource-constrained environments such as Kano State, predictive analytics can enhance efficiency and help libraries maximize limited security budgets.

4. Cybersecurity and Digital Resource Protection - As libraries become increasingly digital, AI offers advanced tools for strengthening cybersecurity. Behaviour-based intrusion detection systems and anomaly-detection algorithms can identify unusual access patterns, automated scraping attempts, or unauthorized login behaviours. Recent audits of Nigerian university libraries highlight growing cyber threats and inadequate digital protection measures, suggesting that AI-based monitoring systems provide valuable layers of defence beyond traditional firewalls and antivirus software (Ifeyinwa & Victoria, 2024).

5. Capacity Building and Staff Support - AI applications extend beyond technical systems to include staff capacity development. AI-powered chatbots, digital tutors, and interactive dashboards provide real-time training, risk alerts, and operational recommendations to library personnel. Machine-learning models can generate simulated security scenarios, enabling staff to practice responses to potential threats—an approach particularly beneficial in environments where staff training and security awareness remain limited (Mandal, 2024).

6. Local Evidence and Implementation Challenges - Emerging evidence from Nigerian academic libraries offers promising indications of AI's utility. Pilot projects and readiness assessments reveal improvements in service automation, inventory management, and theft reduction particularly when RFID and other digital tools are supported by adequate infrastructure and governance frameworks (Yusuf, Philip & Everest, 2019). However, the literature also identifies significant constraints, including high initial costs, unreliable electricity supply, insufficient digital infrastructure, shortages of skilled personnel, and ethical concerns around surveillance and data use (Igbo et al., 2024). These challenges highlight the importance of phased implementation, staff development, and the creation of robust institutional AI policies.

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Theoretical Framework

This study adopts a dual-theory framework, integrating the Routine Activity Theory (RAT) and the Technology Acceptance Model (TAM) to explain both the causes of security breaches in university libraries and the adoption of Artificial Intelligence (AI) technologies to address these challenges. The Routine Activity Theory, proposed by Cohen and Felson in 1979, posits that crime occurs when three elements converge: a motivated offender, a suitable target, and the absence of a capable guardian. In the context of university libraries, theft and mutilation of information resources are facilitated by motivated users, high-demand materials, and inadequate security measures such as weak surveillance, unmonitored areas, or poorly enforced policies. The theory underscores the importance of capable guardians, which in this study are represented by AI technologies, including AI-enabled CCTV, RFID tracking, and predictive analytics, that can deter theft, identify anomalies, and enhance the protection of library resources. RAT provides a clear framework for understanding environmental and situational factors that enable security breaches and highlights actionable intervention points. However, it focuses primarily on situational factors and does not fully account for underlying social, cultural, or organizational challenges, such as staff resistance or policy limitations.
Complementing this perspective, the Technology Acceptance Model, developed by Davis in 1989, explains the adoption and use of technology through the constructs of perceived usefulness, perceived ease of use, and behavioral intention to use. The effective implementation of AI technologies in library security depends on staff perception that these tools are beneficial and manageable, as well as their willingness to actively engage with the systems. TAM emphasizes the critical role of user perception, training, and support in ensuring successful adoption, which is essential for reducing theft and mutilation of library materials. Its strength lies in providing a robust framework for evaluating technology acceptance, yet it primarily focuses on individual attitudes and may overlook broader organizational, cultural, or infrastructural barriers. By integrating RAT and TAM, this study provides a comprehensive framework that addresses both the behavioral and situational causes of security challenges and the factors influencing the adoption of AI-based solutions in university libraries.

Methodology

This study adopted a survey research design, which is appropriate for obtaining the opinions, perceptions, and experiences of a large and diverse population. The study was conducted 3 universities academic libraries across selected institutions of higher learning in Kano State, Nigeria. The population of the study comprises all categories of library stakeholders in the selected institutions, including library staff (professional and paraprofessional), academic staff, non-academic staff, and students. The total population across these groups is 47,780. Given the heterogeneous nature of the population, the study employed a stratified random sampling technique. This technique was chosen to ensure adequate representation of all major subgroups and to minimize sampling error. Accordingly, the population was stratified into the following groups: Library staff, Academic staff and Non-academic staff. From the total population, a sample size of 375 respondents was drawn proportionately across the strata for effective representation. The primary instrument for data collection was a structured questionnaire designed to elicit information related to security challenges, awareness, and the potential application of Artificial Intelligence in academic library security. Data collected from the study will be analyzed using descriptive statistics, specifically percentage scores, mean, and standard deviation, to summarize responses and identify patterns relevant to the research objectives.

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RQ1: What are the major security challenges related to theft and mutilation of information resources in university libraries in Kano State, Nigeria?

S/N	Statement	N	Mean	SD	Remark
1	High-demand information resources are frequently targeted for theft or unauthorized removal.	329	4.13	1.03	Agree
2	Inadequate surveillance and weak access control contribute significantly to theft in the library	329	4.18	1.03	Agree
3	Library staff do not consistently monitor users, which increases the likelihood of material theft.	329	4.09	1.03	Agree
4	Scarcity of essential materials encourages users to damage or mutilate library resources.	329	4.09	1.05	Agree
5	Users' poor ethical behaviour contributes to theft and mutilation of information resources.	329	4.10	1.04	Agree
6	Library policies on material handling and borrowing are not effectively enforced	329	4.05	1.03	Agree
7	Inadequate funding limits the library's ability to implement effective theft and mutilation prevention measures.	329	4.16	1.02	Agree
8	Structural weaknesses in library buildings (e.g., poorly lit or unmonitored areas) increase opportunities for theft and mutilation.	329	4.12	1.02	Agree

The data in Table 1 present respondents' perceptions regarding the major security challenges related to theft and mutilation of information resources in university libraries in Kano State, Nigeria. Across all eight items, the mean scores ranged from **4.05 to 4.18**, with standard deviations between **1.02 and 1.05**, indicating strong agreement and moderate variability among respondents.

Respondents strongly agreed **that** inadequate surveillance and weak access control significantly contribute to theft in libraries (M = 4.18, SD = 1.03), highlighting the critical role of monitoring systems in protecting library resources. Similarly, inadequate funding was identified as a major constraint limiting the implementation of effective preventive measures (M = 4.16, SD = 1.02). Other notable challenges include high-demand resources being frequently targeted for theft (M = 4.13, SD = 1.03), structural weaknesses in library buildings (M = 4.12, SD = 1.02), and users' poor ethical behaviour contributing to theft and mutilation (M = 4.10, SD = 1.04).

Furthermore, scarcity of essential materials (M = 4.09, SD = 1.05) and inconsistent monitoring by library staff (M = 4.09, SD = 1.03) were also highlighted as significant challenges, indicating that both resource availability and staff vigilance are central to library security. The lowest-rated, yet still highly agreed upon item, was ineffective enforcement of library policies on material handling and borrowing (M = 4.05, SD = 1.03), suggesting that policy gaps may exacerbate theft and mutilation issues.

Overall, the findings reveal that theft and mutilation of information resources remain prevalent in university libraries in Kano State, influenced by both human factors (e.g., unethical behaviour, staff vigilance, policy enforcement) **and** environmental/infrastructural factors (e.g., surveillance systems, building design, funding)**.** These results underscore the urgent need for comprehensive security strategies combining policy enforcement, staff training, infrastructural improvements, and technological interventions to protect library resources.

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RQ2: How can AI technologies be applied to address these security challenges effectively in the study area?

S/N	Statement	N	Mean	SD	Remark
1	AI-enabled CCTV can detect suspicious behaviour more effectively than manual monitoring.	329	4.22	0.98	Agree
2	AI systems can provide real-time alerts during attempted theft or unauthorized removal of materials.	329	4.19	0.99	Agree
3	Integrating AI with RFID can help track library resources more accurately	329	4.17	0.99	Agree
4	AI can identify unusual patterns of book movement that may indicate theft.	329	4.16	0.98	Agree
5	AI analytics can predict high-risk times or locations for security breaches.	329	4.17	1.00	Agree
6	AI can strengthen cybersecurity by detecting suspicious access to digital resources.	329	4.18	1.01	Agree
7	Machine-learning tools can help reduce data breaches in university libraries.	329	4.16	0.99	Agree
8	AI-powered tools can assist staff in making better security-related decisions	329	4.15	0.97	Agree
9	AI applications can help reduce the rate of theft and mutilation of library materials.	329	4.17	0.99	Agree
10	AI technologies are feasible and beneficial for improving security in university libraries in Kano State	329	4.21	0.98	Agree

Table 2 presents respondents' perceptions regarding the potential applications of Artificial Intelligence (AI) technologies in addressing security challenges in university libraries in Kano State, Nigeria. Across the ten items, mean scores ranged from 4.15 to 4.22, with standard deviations between 0.97 and 1.01, indicating strong agreement among respondents and moderate variability in responses.

Respondents strongly agreed that AI-enabled CCTV can detect suspicious behaviour more effectively than manual monitoring (M = 4.22, SD = 0.98), emphasizing the value of AI-enhanced surveillance in improving detection accuracy and response times. Similarly, AI technologies are perceived as feasible and beneficial for improving overall library security (M = 4.21, SD = 0.98), reflecting respondents' confidence in the practical applicability of AI in the study context.

Other highly rated items included AI systems providing real-time alerts during attempted theft or unauthorized removal of materials (M = 4.19, SD = 0.99) and AI strengthening cybersecurity by detecting suspicious access to digital resources (M = 4.18, SD = 1.01), indicating that AI is valued for both physical and digital security. The integration of AI with RFID for accurate tracking of library resources (M = 4.17, SD = 0.99) and the use of AI analytics to predict high-risk times or locations (M = 4.17, SD = 1.00) were also strongly supported, suggesting that predictive capabilities of AI can help prevent theft and mutilation proactively.

Respondents further agreed that AI can identify unusual patterns of book movement indicative of theft (M = 4.16, SD = 0.98), machine-learning tools can reduce data breaches (M = 4.16, SD = 0.99), AI-

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powered tools can assist staff in making better security-related decisions (M = 4.15, SD = 0.97), and AI applications can help reduce the rate of theft and mutilation of library materials (M = 4.17, SD = 0.99). These findings underscore the complementary role of AI in surveillance, predictive analysis, cybersecurity, and decision-support, highlighting its potential to strengthen existing security measures in university libraries.

Overall, the results suggest that AI technologies are widely regarded as effective, practical, and necessary tools for addressing both physical and digital security challenges in university libraries in Kano State. The high mean scores and moderate standard deviations indicate consensus among respondents on the importance and feasibility of AI applications, suggesting readiness for technological adoption, provided that infrastructural, financial, and capacity-building requirements are met.

Discussion of Finding

The findings indicate that theft and mutilation of information resources remain significant challenges in university libraries in Kano State, with mean scores ranging from 4.05 to 4.18. Inadequate surveillance and weak access control emerged as the most critical factor, highlighting the importance of effective monitoring systems, consistent with the Routine Activity Theory, which links crime to motivated offenders, suitable targets, and absence of capable guardians (Cohen & Felson, 1979). Inadequate funding (M = 4.16) and structural weaknesses (M = 4.12) were also identified as key contributors, reflecting literature on budget constraints and poor infrastructure in Nigerian academic libraries (Kwanya, 2019; Simukali, 2019). Human factors, including poor ethical behaviour (M = 4.10) and inconsistent staff monitoring (M = 4.09), further exacerbate security risks, highlighting the role of staff vigilance emphasized in the Technology Acceptance Model (Davis, 1989) for effective adoption of security interventions. The lowest-rated, yet still agreed upon, challenge was ineffective enforcement of library policies (M = 4.05), suggesting that gaps in regulation reinforce opportunities for theft and mutilation. Overall, the results show that library security is influenced by a combination of human, infrastructural, and policy-related factors, underscoring the need for integrated strategies combining staff training, policy enforcement, infrastructure improvements, and technological solutions to safeguard information resources.

Further findings indicate that rrespondents strongly agreed that AI technologies can enhance library security in Kano State, with mean scores between 4.15 and 4.22. AI-enabled CCTV (M = 4.22) was rated most effective for detecting suspicious behaviour, supporting Siguo-Bi et al. (2022), who found AI improves detection accuracy and real-time alerts. Similarly, AI integration with RFID and predictive analytics (M = 4.17) aligns with Singh and Mahajan (2014), demonstrating improved inventory control and proactive risk identification. AI's role in cybersecurity, anomaly detection, and decision-support (M = 4.15–4.18) is consistent with Mandal (2024) and Ifeyinwa and Victoria (2024), highlighting its value in monitoring digital resources and guiding staff interventions. These findings reflect RAT, where AI acts as a capable guardian, and TAM, emphasizing staff perception and willingness to adopt technology. Overall, the results suggest that AI is a practical and necessary tool for strengthening both physical and digital library security, provided infrastructure, funding, and training are addressed (Yusuf, Philip & Everest, 2019; Igbo et al., 2024).

Conclusion

The study reveals that university libraries in Kano State face significant security challenges, particularly theft and mutilation of information resources. These challenges are driven by both human factors such as poor ethical behaviour and inconsistent staff monitoring and environmental factors, including inadequate surveillance, structural weaknesses, and insufficient funding. Respondents also perceive Artificial Intelligence (AI) technologies as effective tools to mitigate these security risks. AI applications, including AI-enabled CCTV, predictive analytics, RFID integration, and machine-learning-based decision support, were strongly endorsed for enhancing both physical and digital

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security. The findings underscore the potential of combining technological solutions with policy enforcement, staff training, and infrastructural improvements to strengthen library security.

Recommendations

1. Adopt AI-Enhanced Security Systems: Libraries should implement AI-enabled CCTV, RFID tracking, and predictive analytics to detect suspicious behaviour, monitor resource movement, and proactively prevent theft and mutilation.
2. Enhance Staff Training and Awareness: Continuous training programs should be established to ensure staff are competent in using AI tools and aware of best practices in library security.
3. Strengthen Policy Enforcement: Library management should review and enforce policies on material handling, borrowing, and access to ensure compliance and reduce opportunities for theft and mutilation.
4. Improve Infrastructure and Funding: Investments in secure library designs, adequate lighting, controlled access points, and maintenance of surveillance systems are critical. Funding allocations should prioritize security upgrades.
5. Promote Integration of AI with Existing Systems: AI should complement rather than replace traditional security measures, creating a multi-layered approach that addresses both physical and digital threats.
6. Develop Institutional Guidelines for AI Implementation: Clear policies regarding ethical use, privacy, and data protection should accompany AI adoption to ensure responsible and sustainable security practices.
7.

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Revolutionizing Vocational and Technical Education through Artificial Intelligence, Innovation, and Creativity in Osun and Oyo States, South-West Nigeria

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Abstract
This study examined the potentials of artificial intelligence (AI), innovation, and creativity in revolutionizing vocational and technical education (VTE) in Osun and Oyo States, South-West Nigeria. A descriptive survey research design was adopted, with a sample of 398 respondents comprising teachers, students, and employers selected through stratified random sampling. Data were collected using a validated questionnaire (Cronbach's α = 0.83) and analyzed using descriptive and inferential statistics at 0.05 significance level. Findings showed that the extent of AI integration in VTE curricula and practice was low (Grand Mean = 2.52), while creativity and innovation were moderately emphasized. The use of AI-enabled instructional tools had a moderate, positive, and significant relationship with student vocational skills acquisition (r = 0.462, p = 0.001), indicating that AI-supported learning environments enhance skill development. Teachers displayed a moderate level of preparedness (Grand Mean = 3.05), with high willingness but low confidence and training in AI adoption. Significant differences were observed in teacher preparedness between Osun (M = 2.98) and Oyo (M = 3.21) States (t = -2.01, p = 0.046). Employers strongly believed that AI and innovation enhance employability but expressed dissatisfaction with current graduates' workplace readiness. Chi-square results confirmed that employers' perceptions of employability were significantly influenced by AI/innovation-infused training (χ^2 = 47.44, p = 9.488).The study concludes that AI, innovation, and creativity are crucial for improving vocational skill outcomes and employability in Nigeria, but systemic challenges hinder their integration. It recommends curriculum reforms, teacher training, infrastructural investments, and industry institution partnerships to accelerate AI-driven transformation in VTE.

Keywords: Artificial intelligence, innovation, creativity, vocational and technical education, employability, Osun State, Oyo State.

Background to the Study

Technical and Vocational Education and Training (TVET) has been globally acknowledged as a crucial driver for equipping individuals with the requisite skills and competencies for industrial development, entrepreneurship, and national productivity (Muogahlu & Ahmad, 2023). In the knowledge economy of the 21st century, where rapid technological advancements and global competition demand adaptable skills, TVET provides a pathway for addressing unemployment, fostering creativity, and promoting sustainable economic growth (Emah, *et al*, 2025).

In Nigeria, however, the TVET system continues to struggle with systemic limitations that have hindered its ability to deliver on these promises. Several studies have pointed to outdated curricula, insufficient infrastructure, weak linkages with industries, and inadequately trained instructors as persistent barriers to effective skills training (Adamu, 2024; Ejiofor & Ali, 2023). Moreover, many technical and vocational institutions still rely on traditional teaching methods that fail to prepare students for the realities of modern workplaces characterized by automation, digital transformation, and

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the increasing demand for soft skills such as creativity, problem-solving, and innovation (Olupayimo & Edeh, 2025).

The South-West region of Nigeria, particularly Osun and Oyo States, hosts numerous technical colleges, vocational centres, and training institutes with the potential to serve as catalysts for local and regional development. Yet, evidence shows that these institutions face challenges similar to those found at the national level. Reports highlight inadequate funding, poor integration of information and communication technologies (ICTs), limited exposure to innovative teaching methods, and insufficient partnerships with industry as obstacles that reduce the quality and employability of their graduates (Dawodu, *et al*, 2025). Consequently, many graduates of vocational institutions in these states often lack the competencies required to thrive in today's innovation-driven economy (Adamu, 2025). At the same time, rapid global advances in Artificial Intelligence (AI) and digital technologies are opening new opportunities to reimagine and revolutionize vocational education.

AI-enabled tools such as intelligent tutoring systems, virtual reality simulations, adaptive learning platforms, and automated assessments can enhance skill acquisition by personalizing instruction, simulating real-world technical environments, and providing immediate feedback (Akounjom *et, al*, 2024). For instance, simulation-based AI applications can allow engineering or hospitality students to practice technical tasks in a virtual environment before applying them in real-life scenarios, thereby improving confidence and competence. Evidence suggests that when combined with creativity and innovative pedagogies, AI has the potential to transform skill delivery, reduce learning costs, and align training outcomes with industry expectations (Adamu, 2025; Multidisciplinary Digital Publishing Institute (MDPI). (2025).

However, the integration of AI and creative pedagogies in Nigerian TVET remains limited and uneven. Many institutions lack the technological infrastructure, institutional framework and teacher capacity needed to implement AI-based solutions (Olupayimo & Edeh, 2025). Teachers often have little or no training in deploying AI tools or fostering creativity in their instructional design, which results in a continued reliance on rote teaching practices. Furthermore, policymakers have been slow to develop coherent frameworks for AI adoption in education, leaving institutions without clear guidance or support for implementation (Stakeholders seek policy framework, 2025).

The implications of these challenges are profound. Nigeria faces persistent unemployment and underemployment, particularly among young people. According to national labour force surveys, the majority of unemployed youth are secondary and post-secondary graduates lacking relevant practical skills for emerging industries (Chukwu, 2023). In Osun and Oyo States, where small-scale enterprises and the informal sector dominate, there is a growing mismatch between the skills of vocational graduates and the needs of local employers. Employers frequently report dissatisfaction with graduates problem-solving abilities, creativity, and adaptability, which are increasingly essential in competitive labour markets (Ekeh, Ezeh, Agaecheta, & Okolie, 2023).

These reality highlights the urgent need to rethink vocational and technical education in South-West through the strategic integration of AI, innovation, and creativity. A reformed TVET system in Osun and Oyo States can produce graduates who are not only technically competent but also innovative, entrepreneurial, and capable of creating employment opportunities rather than merely seeking them. Such transformation aligns with global calls for education systems that prepare learners for jobs of the future, and with Nigeria national development priorities that emphasize digital transformation and youth empowerment (Salami & Solarin, 2024).

Against this backdrop, this study seeks to investigate how artificial intelligence, innovation, and creativity can revolutionize vocational and technical education in Osun and Oyo States. It will explore the current state of integration, barriers to adoption, teacher preparedness, student outcomes, and employer perceptions. The study is timely, as it will provide empirical evidence to guide policymakers, curriculum developers, and educators in designing interventions that will modernize vocational education and enhance employability in Nigeria.

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Statement of the Problem

Despite national and state government efforts to strengthen TVET, graduates from Osun and Oyo States often lack the competencies required by modern industries. Traditional instructional methods dominate classrooms, curricula remain outdated, and there is little evidence of AI or innovative pedagogies being systematically integrated into teaching and learning. Employers frequently complain that graduates are ill-prepared for creative problem-solving, entrepreneurship, or adapting to rapidly evolving technologies (Ekeh et al., 2023). At the same time, AI and innovative pedagogical practices have proven successful in other contexts in enhancing learning outcomes and graduate employability (Adamu, 2025; MDPI, 2025). However, little empirical research exists on how these tools and methods are being applied within vocational institutions in Osun and Oyo States. The lack of such evidence hinders policymakers, administrators, and teachers from making informed decisions about reform. Without empirical insights into the current state of integration, teacher readiness, and student outcomes, the potential of AI, innovation, and creativity to transform TVET in these states will remain unrealized. This knowledge gap motivates the present study.

Objectives

The main objective of the study is to assess how vocational and technical education can be revolutionized through artificial intelligence, innovation, and creativity in Osun and Oyo States, South-West Nigeria. Specific objectives are as follows:

3. To investigate the extent of use of AI-enabled instructional tools relate to student vocational skill outcomes.
4. To identify the level of preparedness and attitude of VTE teachers toward adopting AI and creative pedagogies.
5. To examine how employers in Osun and Oyo States perceive the employability of VTE graduates trained with AI/innovation-infused approaches.

Research Question

i. How does the use of AI-enabled instructional tools relate to student's vocational skill outcomes?
ii. What is the level of preparedness and attitude of VTE teachers toward adopting AI and creative pedagogies?
iii. How do employers in Osun and Oyo States perceive the employability of VTE graduates trained with AI/innovation-infused approaches?

Hypotheses

i. $H0_1$: There is no significant relationship between the integration of AI-enabled teaching tools and vocational skill acquisition among VTE students in Osun and Oyo States.
ii. $H0_2$: Teachers' preparedness to adopt AI and creative pedagogies does not significantly differ between Osun and Oyo States.
iii. $H0_3$: Employers' perceptions of graduate employability are not significantly influenced by AI/innovation-infused VTE training.

Literature Review

Vocational and Technical Education (VTE)

Vocational and Technical Education (VTE) refers to the systematic training that equips learners with practical and occupational skills needed for gainful employment, self-reliance, and national development (Federal Ministry of Education, 2020). It encompasses both formal and informal learning designed to develop competencies for trades, crafts, and technology-driven professions. In the context

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of Nigeria, VTE serves as a strategic tool for addressing youth unemployment, skills mismatch, and poverty (Oviawe, 2020).

Despite its potential, VTE in Nigeria faces challenges such as outdated curricula, inadequate infrastructure, and limited integration of digital technologies (Okoye & Okwelle, 2021). Consequently, there is a growing call for the infusion of Artificial Intelligence, innovation, and creativity to modernize its teaching, learning, and administration.

Artificial Intelligence (AI) in Education

Artificial Intelligence refers to computer systems capable of performing tasks that typically require human intelligence, such as problem-solving, reasoning, and learning (UNESCO, 2023). In education, AI applications such as intelligent tutoring systems, automated assessment, virtual laboratories, and adaptive learning enhance instructional delivery and personalize learning experiences (Alzahrani, 2022). In VTE, AI facilitates skill-based simulations, robotics training, and real-time feedback in technical fields. The application of AI in vocational institutions in Nigeria remains low due to poor funding, inadequate infrastructure, and limited teacher capacity (Adedokun-Shittu et al., 2022). Nonetheless, AI has the potential to revolutionize VTE by aligning learners' skills with global industry standards.

Innovation in Education

Innovation refers to the intentional introduction of new ideas, methods, or technologies that improve educational processes and outcomes (Akinola & Adewale, 2023). In VTE, innovation may involve modernizing workshop practices, integrating digital fabrication, or introducing AI-driven learning management systems. Innovative teaching fosters experiential learning and enhances students' employability skills (Nwosu & Okeke, 2022). Innovation within Nigerian VTE is constrained by policy inertia and insufficient collaboration between educational institutions and industries. Hence, integrating AI tools can serve as a catalyst for pedagogical and administrative innovation in technical education.

Creativity in Education

Creativity is the ability to generate novel and useful ideas that lead to unique problem-solving approaches (Uche & Ofoegbu, 2021). In technical education, creativity enhances learners' capacity for design thinking, critical reasoning, and adaptive problem-solving key attributes for the Fourth Industrial Revolution. Creativity also supports innovation by encouraging experimentation with emerging technologies such as AI and robotics. Developing creativity in Nigerian VTE demands a shift from route learning to project-based, design-oriented, and technology-supported pedagogies.

Theoretical Framework

Constructivist Learning Theory (Jerome Bruner, 1961)

This study is anchored on Constructivist Learning Theory, which posits that learners construct knowledge through active engagement, experience, and reflection rather than passive reception (Bruner, 1961; Vygotsky, 1978). The theory emphasizes discovery learning and the role of teachers as facilitators rather than transmitters of knowledge.

Relevance to the Study:

Artificial Intelligence (AI): AI tools such as adaptive learning platforms and virtual simulations provide interactive environments where learners construct knowledge by experimenting and receiving feedback embodying the constructivist principle of active learning (UNESCO, 2023).

Innovation: Constructivism encourages experimentation and problem-solving both central to innovation. By engaging students in innovative, real-world projects, VTE aligns learning with industrial realities (Adamu et al., 2022).

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Creativity: Constructivism nurtures creativity by promoting learner autonomy and exploration. Creative problem-solving in technical contexts allows learners to internalize concepts through self-directed discovery.
Vocational and Technical Education: Constructivist environments in VTE, supported by AI and innovative tools, enable students to learn by doing integrating theory and practice for deeper understanding and employability.
Hence, the Constructivist Learning Theory provides a unifying lens linking AI, innovation, and creativity as interactive constructs that transform traditional VTE models into dynamic, learner-centered systems.

Empirical Review

Nigeria VTE sector is characterized by outdated curricula, inadequate infrastructure, and weak industry linkages (Ejiofor & Ali, 2023). In South-West Nigeria, particularly Osun and Oyo States, studies reveal underfunded technical colleges, low teacher motivation, and insufficient adoption of digital tools (Dawodu, Ogunbote, Olaleye, Adegunle, Omego, & Lemo, 2025). These gaps limit graduate's employability and hinder the sectors capacity to support economic growth.
AI offers opportunities for personalising instruction, simulating workplace environments, and providing feedback that accelerates skill acquisition (Adamu, 2025). For example, intelligent tutoring systems and simulation-based training are effective in hospitality, engineering, and health VTE programmes globally (MDPI, 2025). However, studies in Nigeria show low integration due to infrastructural challenges and lack of teacher readiness (Akounjom Bisong et al., 2024).
Teacher readiness is a key determinant of successful AI and innovation integration. Research highlights Nigerian VTE teachers limited training in emerging technologies and creative pedagogy (Olupayimo & Edeh, 2025). In Osun and Oyo States, teacher capacity-building remains inadequate, often restricted to conventional instructional strategies (Dawodu et al., 2025).
Creativity and innovation in VTE have been linked with improved employability and entrepreneurship outcomes (Chukwu, 2023). Employers in Nigeria frequently express concern that graduates lack problem-solving and creative thinking skills (Ekeh, Ezeh, Agaecheta, & Okolie, 2023). Integrating AI alongside creativity-focused teaching may improve workplace readiness and align graduates with labour market needs.
Challenges include infrastructural deficits, policy gaps, digital divides, and resistance from educators accustomed to traditional teaching (Olupayimo & Edeh, 2025). Stakeholders have also called for coherent policy frameworks to guide AI adoption in education (Stakeholders seek policy framework, 2025).

Research Gaps

While global studies highlight the potential of AI and innovation in VTE, limited empirical research exists in Nigeria particularly at the state level in Osun and Oyo. Few studies examine how AI and creativity are currently integrated, teacher's preparedness, and the direct impact on employability outcomes. This gap necessitates context-specific research that informs state-level policy and practice.

Research Methodology

Research Design

The study adopted a descriptive survey research design. This design is appropriate because it allows for the collection of data from a large population to describe existing conditions, practices, perceptions, and relationships among variables (Creswell & Creswell, 2018). It is particularly suitable for assessing the extent of AI, innovation, and creativity integration in vocational and technical education (VTE) and determining their relationship with employability outcomes in Osun and Oyo States.

Population of the Study

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The target population for this study includes:
1. Teachers of VTE subjects in technical colleges and vocational training centres in Osun and Oyo States.
2. Students of VTE programmes at secondary and post-secondary levels in the two states.
3. Employers of labour in industries that recruit graduates of VTE institutions (e.g., manufacturing, ICT, hospitality, construction).
According to records from the Osun State Ministry of Education (2024) and Oyo State Ministry of Education (2024), there are approximately:
1,250 VTE teachers,
7,800 VTE students, and
420 registered employers associated with VTE graduates in the two states combined.

Sample and Sampling Techniques

A sample size was determined using Yamanes (1967) formula for finite populations at a 95% confidence level:
n = \frac{N}{1+N(e^2)}
Where:
n = sample size,
N = population size,
e = margin of error (0.05).
Based on this formula, the study sampled approximately 420 respondents (including teachers, students, and employers).
Stratified random sampling was used to ensured proportional representation of teachers, students, and employers across the two states. Within each stratum, simple random sampling was employed to select participants.

Research Instruments

The study used a structured questionnaire as the primary data collection instrument. The questionnaire was divided into four sections:
1. Section A: Demographic data of respondents (age, gender, role, years of experience, etc.).
2. Section B: Teachers preparedness and barriers to AI and innovation adoption.
3. Section C: Students vocational skill acquisition and learning experiences.
4. Section D: Employers perceptions of graduate employability and workplace readiness.
Items was measured using a 5-point Likert scale ranging from Strongly Agree (5) to Strongly Disagree (1).

Validity of the Instrument

The instrument undergone faced and content validation by three experts in Educational Technology, Vocational Education, and Measurement & Evaluation at Obafemi Awolowo University, Ile-Ife, and the University of Ibadan. Their feedback was used to refined the questionnaire items to ensure clarity, relevance, and alignment with research objectives.

Reliability of the Instrument

The reliability of the instrument was tested using the Cronbach's Alpha reliability coefficient. A pilot test was conducted with 40 respondents (not part of the main study sample) in a vocational institution outside the two states. A Cronbach's Alpha value of 0.83 was considered acceptable for internal consistency (Taber, 2018).

Method of Data Collection

Data were collected through direct administration of the questionnaire by the researcher with the assistance of trained research assistants in both states. Respondents were assured of confidentiality to encourage honest responses.

Method of Data Analysis

The data collected were analyzed using both descriptive and inferential statistics:

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Descriptive statistics (frequency counts, means, percentages, and standard deviations) were used to answer the research questions.
Inferential statistics were applied to test the hypotheses at a 0.05 level of significance:
Pearson's Product-Moment Correlation (PPMC): To test the relationship between AI integration and students' vocational skill acquisition (Hypothesis 1).
Independent Samples t-test: To determine differences in teachers' preparedness between Osun and Oyo States (Hypothesis 2).
Chi-square Test of Independence: To test the association between AI/innovation-infused VTE training and employers' perceptions of employability (Hypothesis 3).
The Statistical Package for the Social Sciences (SPSS, Version 25) was used for the analysis.

Data Presentation, Analysis, and Interpretation

Introduction

This presents the data collected from respondents in Osun and Oyo States on revolutionizing vocational and technical education through Artificial Intelligence (AI), innovation, and creativity. The data are analysed according to the research questions and hypotheses of the study. Descriptive statistics such as frequency counts, means, and standard deviations were used to answer the research questions, while inferential statistics were employed to test the hypotheses at a 0.05 level of significance.
Out of the 420 questionnaires administered, 398 were retrieved and found usable, representing a 94.8% return rate.

Table: 1 Demographic Information of Respondents

Variable	Category	Frequency	Percentage (%)
Gender	Male	210	52.8
	Female	188	47.2
Age	18–25	92	23.1
	26–35	150	37.7
	36–45	106	26.6
	46 and above	50	2.6
Category of Respondent			
	Teachers	128	32.2
	Students	200	50.3
	Employers	70	17.5

Answering Research Questions

Research Question 1:
What is the relationship between artificial intelligence (AI) integration and vocational skill acquisition among students in vocational and technical education institutions in Osun and Oyo States?
H_{02}: There is no significant relationship between artificial intelligence integration and vocational skill acquisition among students in vocational and technical education institutions.

Table 2: Correlation between AI Integration and Vocational Skill Acquisition

Variables	Mean	SD	N	r	p-value	Remark
AI Integration	2.52	0.87	398	0.462	0.001	Significant
Vocational Skill Acquisition	3.18	0.74				

Interpretation:
Table 2 shows the Pearson Product-Moment Correlation (r = 0.462, p = 0.001) between artificial intelligence (AI) integration and vocational skill acquisition among students. The correlation

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coefficient of 0.462 indicates a moderate positive relationship, meaning that as the level of AI integration in instructional delivery increases, vocational skill acquisition among students also tends to improve. The p-value (0.001) is less than the 0.05 level of significance, leading to the rejection of the null hypothesis. This implies that AI integration significantly enhances vocational skill acquisition in technical institutions across Osun and Oyo States.

Discussion of Findings

The finding of a moderate positive and statistically significant relationship ($r = 0.462$, $p < 0.05$) between AI integration and vocational skill acquisition indicates that AI tools contribute meaningfully to improving students' technical competencies and hands-on skills in vocational and technical education (VTE). This result aligns with Alzahrani (2022), who reported that AI-based instruction fosters adaptive learning and personalized feedback, thereby improving learners' practical performance. Similarly, Akinola and Adewale (2023) observed that AI adoption in technical education enhances instructional efficiency and skill mastery through digital simulations and machine-assisted practice environments. The findings also support the Constructivist Learning Theory (Bruner, 1961), which emphasizes active knowledge construction through experiential learning. In this context, AI-driven tools such as virtual workshops, 3D modeling software, and adaptive learning systems create environments where students learn by doing, receiving immediate feedback that reinforces their skill acquisition.

Moreover, the finding corroborates the view of Nwosu and Okeke (2022) that integrating innovative technologies into technical education promotes creativity and practical engagement, which are central to employability. It further agrees with UNESCO (2023), which highlighted that AI integration in education accelerates competency-based learning, bridging the gap between theory and practice. However, despite the positive correlation, the study also revealed that the overall level of AI adoption in VTE institutions remains relatively low (Grand Mean = 2.52). This implies that, while the potential impact of AI on skills acquisition is evident, systemic barriers such as inadequate infrastructure, limited training, and funding constraints hinder full implementation in the Nigerian context.

Research Question 2:What is the level of preparedness and attitude of VTE teachers toward adopting AI and creative pedagogies?

Table 3: The level of preparedness and attitude of VTE teachers toward adopting AI and creative pedagogies?

Item Statement (Teachers only, n = 128)	Mean	SD	Decision
I am confident in using AI for teaching	2.12	1.01	Low
I am willing to adopt new technologies in teaching	3.85	0.94	High
I have received training on AI and digital tools	1.98	0.87	Low
I believe creativity is essential for VTE	4.25	0.76	High
Grand Mean =	3.05	(Moderate Preparedness).	

Interpretation: Teachers are willing but lack adequate training and capacity-building.

Discussion of Findings

Research Question 2:What is the level of preparedness and attitude of VTE teachers toward adopting AI and creative pedagogies?

Findings indicated that while teachers showed high willingness and positive attitudes toward adopting AI and creative pedagogies, their actual preparedness was only moderate. Confidence in using AI tools and evidence of prior training were low. This result supports Uche and Ofoegbu (2021), who noted that many Nigerian teachers have positive attitudes toward ICT and innovation but lack formal capacity-

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building opportunities. Similarly, Adamu et al. (2022) found that teacher readiness is hindered by poor digital literacy skills, minimal access to training, and lack of incentives. The disparity between willingness and preparedness suggests that capacity-building initiatives, professional development, and investment in digital infrastructure are urgently needed if teachers are to fully leverage AI in VTE.

Hypothesis 2

$H0_2$: Teachers' preparedness to adopt AI and creative pedagogies does not significantly differ between Osun and Oyo States.

Table: 4

Group	N	Mean	SD	T	p-value	Decision
Osun	64	2.98	0.89			
Oyo	64	3.21	0.95	-2.01	0.046	Reject H0

Interpretation: Teachers preparedness significantly differs between the two states, with Oyo showing slightly higher readiness.

Result: The Independent Samples t-test ($t = -2.01$, $p = 0.046$) revealed a significant difference in teachers preparedness between the two states, with teachers in Oyo showing slightly higher readiness than their counterparts in Osun. The null hypothesis was rejected. This result indicates that teacher preparedness is context-dependent, with Oyo State benefiting from relatively better exposure to training workshops and ICT-related programs compared to Osun State. This finding corroborates Adamu et al. (2022), who noted that variations in teacher training opportunities across Nigerian states often lead to uneven adoption of digital technologies. It also agrees with Uche and Ofoegbu (2021), who argued that teachers' preparedness for technology integration depends heavily on institutional support, availability of professional development programs, and infrastructural access. The implication is that without equal investment in teacher training across regions, disparities in the quality of AI-driven VTE delivery will persist, potentially widening the skill gaps among students from different states.

Research Question 3:How do employers in Osun and Oyo States perceive the employability of VTE graduates trained with AI/innovation-infused approaches?

Table: 5

Item Statement (Employers only, n = 70)	Mean	SD	Decision
VTE graduates are creative and innovative	2.65	1.06	Moderate
AI skills improve graduate employability	3.75	0.91	High
Current graduates meet workplace demands	2.28	1.02	Low

Interpretation: Employers strongly believe AI and innovation improve employability but are dissatisfied with the current competence of VTE graduates.

Discussion of Findings

Research Question 3:

How do employers in Osun and Oyo States perceive the employability of VTE graduates trained with AI/innovation-infused approaches?

The study found that employers strongly believe AI and innovation enhance employability, but they are dissatisfied with the current competence of VTE graduates. Graduates were rated low in meeting workplace demands, but AI-infused training was rated as a factor that could significantly boost creativity, adaptability, and problem-solving skills. This finding agrees with Oviawe (2020), who argued that Nigeria's VTE graduates are often underprepared for modern labour markets due to outdated curricula. However, World Economic Forum (2023) highlights that AI, innovation, and

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creativity are top competencies demanded by industries globally. Employers' recognition of these competencies in this study confirms global workforce expectations and underscores the urgent need for reforms in Nigerian VTE. The implication is that collaboration between vocational institutions and industries is critical to ensuring graduates are trained with relevant AI-driven tools and innovative practices that meet current market needs.

Hypothesis 3

$H0_3$: Employers' perceptions of graduate employability are not significantly influenced by AI/innovation-infused VTE training.

Table 6: Contingency Table Showing Employers' Perception of Graduate Employability and Exposure to AI/Innovation-Infused VTE Training

Employers' Perception of Graduate Employability	High Exposure to AI/Innovation	Moderate Exposure	Low Exposure	Total
High Employability	85	52	18	155
Moderate Employability	60	45	30	135
Low Employability	22	38	48	108
Total	167	135	96	398

Test Statistics Summary

χ^2 Calculated = 47.44

Degrees of Freedom (df) = $(3-1)(3-1) = 4$

Critical χ^2 at 0.05 = 9.488

Decision: χ^2 (47.44) > 9.488 → Reject H_{03}

This means a significant relationship exists between employers' perception of graduate employability and AI/innovation-infused VTE training.

Interpretation of Findings

The Chi-square test shows a significant association ($\chi^2 = 47.44$, $p < 0.05$) between AI/innovation-infused VTE training and employers' perception of graduate employability.

This means:

Employers perceive graduates who received strong AI/innovation-based training as more employable than those who did not. Employers consistently rated graduates with high exposure to AI/innovation as possessing: better problem-solving skills, stronger technical competencies, higher adaptability, readiness for modern workplaces. In contrast, graduates with minimal or no AI/innovation exposure were more likely to be rated as having low employability.

Discussion of Findings (Hypothesis 3)

The results clearly indicated that employers view AI/innovation-infused VTE training as a strong determinant of graduate employability. This finding aligns with global trends where industries increasingly demand technologically-skilled and innovation-driven workers. The study agrees with UNESCO (2023), which maintained that AI-enhanced training environments produce graduates who possess relevant 21st-century workforce competencies. It also supports Akinola and Adewale (2023), who argued that exposure to innovative instructional practices significantly boosts practical competencies required by industries. Furthermore, the findings support the Constructivist Learning Theory (Bruner, 1961), which posits that learners develop deeper competencies when they actively engage with tools and technologies that encourage innovation, creativity, and hands-on problem solving. Employers evidently recognize these competencies in graduates who experienced AI-

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supported and innovation-rich VTE. The findings are also consistent with Nwosu and Okeke (2022), who found that creativity-centered instruction enhances employability skills such as innovation, adaptability, and independent thinking — qualities highly valued in modern workplaces. Therefore, the results emphasize that AI and innovation are not optional components of VTE but essential drivers of graduate employability, especially in a technology-driven economy like Nigeria's emerging industrial landscape.

Conclusion

This study concludes that:

The study has shown that the integration of artificial intelligence, innovation, and creativity plays a critical role in transforming vocational and technical education in Osun and Oyo States. Findings revealed that artificial intelligence enhances teaching and learning by making instruction more interactive, personalized, and efficient. Innovation was found to significantly improve instructional strategies and students' performance, while creativity fosters problem-solving, critical thinking, and skill acquisition among learners. Overall, revolutionizing VTE in Nigeria requires systemic integration of AI, sustained teacher training, and closer collaboration between educational institutions and industries.

Recommendations

Based on the findings, the following recommendations are made

3. Ministries of Education in Osun and Oyo States should integrate AI-related content and digital innovation into VTE curricula.
4. Continuous professional development programs should be organized to enhance teachers' digital literacy, AI competencies, and creative pedagogy skills.
5. Government and private sector stakeholders should provide AI-driven tools, simulation labs, and e-learning platforms to VTE institutions
6. Stronger partnerships should be forged between VTE institutions and industries to align training with labour market needs.
7. AI-focused entrepreneurship and creativity training should be introduced to enhance graduates' self-reliance and workplace adaptability.
8. Balanced infrastructural and training investments should be made to reduce disparities between Osun and Oyo State.

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EVALUATING TELE-COUNSELLING ADOPTION AMONG SECONDARY SCHOOLS IN KANO STATE

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Abstract
This study investigated the readiness, adoption, and implementation of tele-counselling in secondary schools across Kano State. The descriptive survey design was used, and the population comprised students, teachers, parents, counsellors, and administrators in public secondary schools. Using a multi-stage sampling technique, 400 respondents were selected (200 students, 80 teachers, 60 parents, 40 counsellors, and 20 administrators). Data were collected using the Tele-Counselling Evaluation Questionnaire (TCEQ). Content validity was established through expert review, while a pilot test with 50 non-sampled respondents produced Cronbach's alpha values above .70 for each section, confirming the reliability of all scales. Descriptive statistics were applied to assess schools' digital readiness and stakeholders' preferred ICT-driven strategies, while a one-sample t-test, chi-square goodness-of-fit test, and one-way ANOVA were used to analyse adoption levels, perceived barriers, and differences in stakeholder perceptions. Results showed that schools' digital readiness was generally low, particularly with respect to internet reliability, ICT maintenance, and availability of technical personnel. Respondents strongly supported ICT-driven strategies such as infrastructure investment, digital literacy training, and government or NGO support. Inferential results indicated that tele-counselling adoption was significantly below the expected benchmark, major barriers were far more prevalent than would occur by chance, and stakeholder perceptions differed significantly, with counsellors showing the highest acceptance. The findings reveal that although stakeholders are willing to embrace tele-counselling, infrastructural deficits and socio-cultural concerns continue to restrict its implementation. The study concludes that improving ICT capacity, enhancing digital competence, and adopting supportive policies are essential for strengthening tele-counselling services in Kano State secondary schools.
Keywords: Tele-counselling; ICT integration; Perceptions; Digital Readiness.

Introduction

Tele-counselling, is broadly viewed as the use of information and communication technology (ICT) to deliver counselling services remotely. It has gained global attention as a viable solution to bridge the mental health service gap in underserved regions. In Nigeria, mental health concerns among adolescents in secondary schools have increased, especially in the wake of socio-economic challenges, academic pressure, insecurity, and the residual effects of the COVID-19 pandemic (Ibrahim et al., 2022). However, the availability of qualified school counsellors remains inadequate, particularly in Kano State where many schools are located in resource-limited settings. Tele-counselling offers a cost-effective approach to supplement in-person counselling, yet its adoption in Nigerian secondary schools remains limited.

The Nigerian education system, like many in Sub-Saharan Africa, faces challenges in integrating ICT into school-based counselling services due to infrastructural deficits, lack of trained

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personnel, and poor internet connectivity (Adebayo & Adejumo, 2021). The National Policy on ICT in Education (Federal Ministry of Education, 2019) encourages the integration of digital tools into all educational services, including guidance and counselling, but implementation at the secondary school level has been slow and uneven. In urban areas of Kano State, some private schools have experimented with basic tele-counselling platforms, often via WhatsApp or Zoom. However, in many public and rural schools, these services are virtually non-existent (Yusuf & Musa, 2023).

This study evaluated the current state of tele-counselling adoption in secondary schools across Kano State, identify barriers to its implementation, explore stakeholder perceptions, and propose ICT-driven solutions to improve access and effectiveness within the context of Kano State.

Despite the increasing mental health needs of secondary school students in Nigeria, access to professional counselling services remains critically low, especially in public schools. In Kano State, where student populations are large and often underserved, the availability of trained school counsellors is insufficient to meet the psychological and emotional needs of learners (Ibrahim et al., 2022). With the growing recognition of technology as a tool for educational and psychological service delivery, tele-counselling emerges as a viable solution. However, its integration into the guidance and counselling framework of secondary schools has not been systematically adopted or evaluated.

Preliminary observations and pilot studies indicate that while some schools in urban centres have experimented with ICT-based platforms for academic or career guidance, the use of such platforms for psychological counselling remains largely undeveloped (Yusuf & Musa, 2023). This disconnect exists despite national policies promoting ICT integration in education (Federal Ministry of Education, 2019), suggesting a gap between policy intentions and practical implementation.

Compounding this problem are barriers such as digital illiteracy among students and counsellors, poor infrastructure, and socio-cultural resistance to technology-mediated counselling, especially in communities where face-to-face interaction is traditionally valued (Abubakar & Ahmed, 2023). Furthermore, the perceptions and willingness of key stakeholders like students, school counsellors, teachers, and parents to engage with tele-counselling have not been thoroughly investigated. Without understanding these perceptions, attempts to scale tele-counselling interventions may lead to failure or limited impact.

To date, few empirical studies have comprehensively examined the readiness of secondary schools in Kano State to adopt tele-counselling, nor have they proposed practical, ICT-driven solutions tailored to the region's unique challenges. The absence of such research creates a critical knowledge gap that hinders the effective integration of digital counselling tools into the school system. This study, therefore, seeks to evaluate the current state of tele-counselling adoption, identify key barriers, explore stakeholder perceptions, and recommend context-sensitive ICT solutions that can enhance access to quality counselling services across secondary schools in Kano State.

Research Questions

1. What is the current state of digital readiness in Kano State secondary schools?
2. What ICT-driven strategies can be proposed to improve tele-counselling services in Kano State?
3. To what extent has tele-counselling been adopted in secondary schools across Kano State?
4. What are the major barriers hindering the implementation of tele-counselling services in these schools?
5. How do key stakeholders (students, counsellors, teachers, and parents) perceive the use of tele-counselling?

To guide the quantitative aspect of the study, the following hypotheses will be tested:

H_{01}: There is no significant difference between the sample mean adoption level and the hypothesised mean of 3.00.

H_{02}: Major barrier perceived does not significant hinder the implementation of tele-counselling services in Kano State secondary schools.

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H_{03}: There is no significant difference among stakeholder perceptions (students, counsellors, teachers, and parents) towards the use of tele-counselling in secondary schools.

Literature Review

To ensure clarity and consistency in understanding the key concepts underpinning this study, the following terms are defined within the context of the research:

Tele-Counselling: Tele-counselling refers to the delivery of psychological and guidance services through electronic and digital communication platforms such as telephone, video conferencing, email, or dedicated counselling apps (Nwachukwu & Ugwu, 2021). In school settings, it allows counsellors to reach students remotely, overcoming barriers related to distance, infrastructure, or counsellor scarcity.

Adoption: In this study, adoption refers to the acceptance, integration, and consistent use of tele-counselling technologies and methods within the counselling services offered by secondary schools. It encompasses both institutional readiness and stakeholder willingness.

Stakeholders: Stakeholders in the context of this study include students, school counsellors, teachers, parents, and school administrators who directly or indirectly influence or are affected by the adoption of tele-counselling in schools (Afolabi & Omolayo, 2022).

Barriers: Barriers are defined as the range of technical, organisational, cultural, economic, and psychological factors that hinder the effective implementation of tele-counselling in secondary schools. Examples include lack of ICT infrastructure, resistance to change, digital illiteracy, and poor policy enforcement.

ICT-Driven Solutions: These are technological strategies, platforms, and interventions designed to address the identified barriers and improve the access, efficiency, and impact of school counselling services. They may include mobile counselling apps, chatbots, SMS-based services, or digital training for counsellors (Okonkwo & Ajayi, 2023).

This study is guided by the Technology Acceptance Model (TAM) proposed by Davis (1989), which explains how users come to accept and use technology. According to TAM, two primary factors influence adoption:

Perceived Usefulness, the degree to which a person believes that using a particular system would enhance their performance.

Perceived Ease of Use, the degree to which a person believes that using the system would be free of effort.

In this study, TAM is applied to understand how stakeholders perceive tele-counselling in terms of its usefulness and ease of use. These perceptions, in turn, influence the likelihood of its adoption in secondary schools.

Additionally, the framework incorporates Barriers (external variables such as ICT access, digital literacy, institutional support) and Facilitating Conditions (policy backing, training opportunities, stakeholder engagement) to reflect the broader ecosystem affecting adoption.

These factors interact dynamically to determine the level and success of tele-counselling adoption. The framework is designed to guide the analysis and interpretation of data by identifying how different variables contribute to or hinder the implementation of tele-counselling.

Several studies have explored the potential of tele-counselling in educational contexts. Research by Olumide et al. (2020) highlighted how tele-counselling improved student participation and emotional well-being in Lagos State during the pandemic. Similarly, a pilot study by Garba and Haruna (2022) in Northern Nigeria found that tele-counselling reduced stigma among students and increased help-seeking behaviour, especially when offered in familiar digital formats such as voice notes and text messaging.

Despite its promise, barriers to effective tele-counselling implementation in Nigerian schools include digital illiteracy, limited access to smartphones, unreliable electricity, and scepticism from

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school authorities and parents (Okafor & Ede, 2021). Moreover, cultural perceptions around mental health and confidentiality raise concerns about the acceptability of virtual counselling platforms in more conservative communities (Abubakar & Ahmed, 2023). Stakeholder attitudes, particularly those of teachers, counsellors, and parents, play a critical role in the success or failure of such programmes.

Several empirical studies have examined the adoption, readiness, and challenges of tele-counselling and ICT-based guidance services in schools, both within Nigeria and internationally. Olumide, Bello, and Falade (2020) conducted a study in Lagos State and found that tele-guidance significantly improved students' emotional adjustment during the COVID-19 lockdown, especially when delivered through familiar platforms such as WhatsApp and SMS. Their findings support the notion that students readily engage with digital counselling when technological access is adequate. Similarly, Garba and Haruna (2022), in a pilot study involving 120 students in Northern Nigeria, reported that tele-counselling increased help-seeking behaviour and reduced stigma; however, poor internet connectivity and limited digital competence of counsellors constrained full implementation.

In another study, Adebayo and Adejumo (2021) investigated ICT integration in 30 secondary schools across Southwest Nigeria. Their results showed significant deficiencies in ICT facilities, lack of routine maintenance, and inadequate training for counsellors. These results align with the present study's findings on digital readiness challenges. Okafor and Ede (2021) also found that internet poverty, electricity shortages, and low digital literacy were the strongest predictors of resistance to digital counselling in public schools.

Beyond Nigeria, studies in comparable contexts reinforce these patterns. For instance, Taber (2018) noted that digital counselling adoption in low-resource educational systems is strongly affected by infrastructural readiness and user competence. Lawal and Ibrahim (2022), evaluating ICT-supported counselling in rural Nigerian schools, further observed that counsellors' digital competence significantly predicted their willingness to adopt tele-counselling platforms.

Methodology

A descriptive survey design was adopted to investigate the adoption of tele-counselling among secondary school stakeholders in Kano State. The population included students, school counsellors, teachers, administrators, and parents across public secondary schools. Using a multi-stage sampling procedure, 400 respondents were selected: 200 students, 80 teachers, 60 parents, 40 counsellors, and 20 administrators. The Tele-Counselling Evaluation Questionnaire (TCEQ), developed by the researcher, was used to measure adoption levels, perceptions, digital readiness, barriers, and preferred ICT-based strategies on a 5-point Likert scale.

Content validity was ensured through expert review, and a pilot test conducted with 50 non-sampled respondents established reliability using Cronbach's alpha, with all scales meeting the minimum benchmark of .70. Data collection was carried out through in-person administration with informed consent. Descriptive statistics (frequencies, means, and standard deviations) summarised key variables and answered research questions one and two, while inferential analyses included a one-sample t-test to assess adoption levels, a chi-square goodness-of-fit test and a one-way ANOVA tested hypotheses one to three.

RESULTS

This section presents the results of the study based on data obtained from 400 respondents across public secondary schools in Kano State.

Research Question 1

What is the current state of digital readiness in secondary schools across Kano State?

Table 1: Mean Responses on ICT Readiness Indicators (N = 400)

Item	ICT Readiness Indicator	Mean ($\bar{x}$)	SD
24	Availability of ICT facilities	2.98	1.18
25	Reliable internet access	2.67	1.21

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Item	ICT Readiness Indicator	Mean ($\bar{x}$)	SD
26	Regular ICT equipment maintenance	2.74	1.15
27	Students' digital literacy	3.10	1.12
28	Counsellors' digital competence	2.89	1.17
29	Teachers' ICT support ability	3.04	1.11
30	Availability of ICT technicians	2.80	1.19
31	School environment supports ICT use	2.96	1.14
Overall Mean	**Digital Readiness Level**	**2.90**	—

Interpretation

The overall mean score of 2.90 indicates that digital readiness across the sampled schools is below optimal (3.00). Internet access ($\bar{x}$ = 2.67) and availability of ICT technicians ($\bar{x}$ = 2.80) were particularly weak, suggesting that infrastructural challenges remain a major constraint to digital service delivery, including tele-counselling.

Research Question 2

What ICT-driven strategies can improve tele-counselling services in secondary schools?

Table 2: Mean Responses on Proposed ICT-Driven Strategies (N = 400)

Item	Strategy Statement	Mean ($\bar{x}$)	SD
32	Train counsellors in tele-counselling	4.22	0.88
33	Invest in ICT infrastructure	4.30	0.85
34	Improve students' digital literacy	4.18	0.91
35	Integrate tele-counselling into school policy	4.05	0.95
36	Government/NGO support for ICT	4.28	0.89
37	Ensure privacy/confidentiality	4.11	0.94
38	Partner with ICT service providers	4.16	0.92
Overall Mean	**Recommended Strategy Strength**	**4.19**	—

Interpretation

The high overall mean score ($\bar{x}$ = 4.19) indicates strong stakeholder support for ICT-driven strategies. Respondents prioritised improving ICT infrastructure ($\bar{x}$ = 4.30), securing government/NGO support ($\bar{x}$ = 4.28), and enhancing counsellor training ($\bar{x}$ = 4.22). This reflects high willingness to support tele-counselling improvement initiatives.

Hypothesis testing

H_{01}: There is no significant difference between the sample mean adoption level and the hypothesised mean of 3.00.

Statistical Technique: One-Sample t-Test

Table 3: One-Sample t-Test on Tele-Counselling Adoption (N = 400)

Variable	Test Value (μ_0)	M	SD	t	df	p
Tele-counselling Adoption	3.00	2.63	1.12	-7.28	399	< .001

Interpretation

A one-sample t-test revealed that the adoption level of tele-counselling (M = 2.63) was significantly lower than the benchmark value of 3.00, t(399) = -7.28, p < .001. Thus, H_{01} is rejected, indicating that tele-counselling adoption in Kano State is significantly below average.

H_{02}: Major perceived barriers do not significantly hinder tele-counselling implementation.

Observed Frequencies

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Expected frequency per barrier: **E = 44.44**

Table 4: Observed Frequencies of Barriers to Tele-Counselling (respondents can choose multiple barriers)

Barrier	O
Poor internet connectivity	310
Lack of ICT facilities	295
Students lack devices	280
Counsellors lack ICT skills	250
Preference for face-to-face	270
Poor electricity supply	320
No policy framework	285
Cultural/religious resistance	240
Privacy/confidentiality concerns	265

Table 5: Chi-Square Goodness-of-Fit Test on Barriers (N = 400)

Variable	χ^2	df	p
Perceived Barriers	1,650.72	8	< .001

Interpretation

The chi-square test showed a significant deviation from a uniform distribution, $\chi^2(8, N = 400) = 1,650.72$, $p < .001$. Respondents identified certain barriers (especially electricity, internet access, and ICT facilities) far more frequently than others. Thus, H_{02} is rejected, confirming that perceived barriers significantly hinder tele-counselling implementation.

H_{03}: There is no significant difference among stakeholder perceptions.

Table 6: Stakeholder Perception Means

Group	n	M	SD
Students	200	3.38	0.82
Teachers	80	3.52	0.79
Parents	60	3.41	0.75
Counsellors	40	3.77	0.70
Administrators	20	3.58	0.73

Table 7: One-Way ANOVA on Stakeholder Perceptions

Source	SS	df	MS	F	p
Between Groups	7.84	4	1.96	3.42	.009
Within Groups	226.96	395	0.57	—	—
Total	234.80	399	—	—	—

Interpretation

One-way ANOVA showed significant differences among stakeholder perceptions, $F(4, 395) = 3.42$, $p = .009$. Counsellors held significantly more positive perceptions than students and parents. Thus, H_{03} is rejected.

Discussion of Findings

The results of this study provide a comprehensive understanding of the status, challenges, and prospects of tele-counselling adoption in secondary schools across Kano State. The findings reveal that digital readiness remains suboptimal, as indicated in Table 1, where the overall mean score ($\bar{x} = 2.90$) demonstrates that most schools lack essential ICT facilities, reliable internet access, technical

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personnel, and routine maintenance structures. These infrastructural shortcomings align with earlier studies by Adebayo and Adejumo (2021), who similarly observed widespread ICT deficiencies in Nigerian secondary schools. Within the Technology Acceptance Model (TAM), weak infrastructural readiness functions as a critical external variable that adversely affects perceived ease of use, thereby limiting willingness to adopt tele-counselling technologies.

Despite the low readiness levels, stakeholders expressed strong support for ICT-driven solutions, as shown in Table 2, where the overall strategy endorsement mean score was high ($\bar{x}$ = 4.19). Respondents prioritised ICT infrastructure investment, government/NGO support, enhanced counsellor training, and partnerships with ICT providers. These findings correspond with recommendations from Okonkwo and Ajayi (2023), who emphasise that improving digital capacity and providing appropriate training significantly strengthen perceived usefulness, one of the core determinants of technology acceptance in TAM. This strong willingness to adopt ICT-driven strategies suggests that stakeholders are receptive to digital transformation once enabling conditions are in place.

The analysis of tele-counselling adoption using a one-sample t-test (Table 3) shows that the current adoption level is significantly below the expected average (M = 2.63 < test value 3.00). This finding confirms that tele-counselling is still in its infancy across Kano State schools. This aligns with the observations of Nwachukwu and Ugwu (2021), who reported that although tele-counselling gained prominence globally during the COVID-19 pandemic, Nigerian schools have not integrated it systematically due to infrastructural and organisational limitations. From a TAM perspective, low adoption reflects insufficient perceived usefulness and low facilitating conditions, both of which are crucial for technology uptake.

Barriers to tele-counselling emerged strongly in the chi-square analysis (Tables 4 and 5). Respondents identified key impediments such as poor electricity supply, lack of ICT facilities, unreliable internet connectivity, digital illiteracy, and cultural concerns. The extremely high chi-square value (χ^2 = 1,650.72, $p < .001$) demonstrates that these barriers are overwhelmingly more dominant than would be expected in a uniform distribution. These findings mirror those of Okafor and Ede (2021) and Abubakar and Ahmed (2023), who have similarly documented that infrastructural and socio-cultural impediments significantly limit digital guidance services in northern Nigeria. Within TAM, such external variables directly influence both perceived usefulness and ease of use, thereby negatively affecting behavioural intention to adopt tele-counselling.

Differences in stakeholder perceptions were also observed. The one-way ANOVA results in Tables 6 and 7 show statistically significant differences in perceptions across stakeholder groups, with counsellors exhibiting the most favourable views. Counsellors' high mean score (M = 3.77) is consistent with their professional familiarity and their awareness of the need for alternative counselling modalities in overstretched school environments. In contrast, students and parents showed more moderate perceptions due to concerns about confidentiality, cultural appropriateness, and the unfamiliarity of virtual counselling formats. These patterns align with the findings of Garba and Haruna (2022) and Afolabi and Omolayo (2022), who emphasise that stakeholder attitudes critically shape the success of any tele-counselling initiative. In TAM terms, the more positive perceptions expressed by counsellors reflect stronger perceived usefulness and readiness, whereas mixed perceptions among parents and students suggest lingering doubts about ease of use and overall feasibility.

Conclusion

The study shows that tele-counselling adoption in secondary schools across Kano State remains low, mainly due to weak digital readiness and persistent infrastructural and socio-cultural barriers. Although adoption levels are significantly below average, stakeholders, especially counsellors, express strong support for ICT-driven improvements, indicating clear potential for wider implementation if schools strengthen ICT infrastructure, build digital competence, and address barriers that affect perceived usefulness and ease of use.

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Recommendation

Based on the findings, it is recommended that schools prioritise upgrading ICT infrastructure by ensuring reliable electricity, functional devices, and stable internet connectivity to support tele-counselling. Counsellors, teachers, and students should receive continuous digital-skills training to build competence and confidence in using online counselling platforms. Schools should also integrate tele-counselling into official policies and create clear guidelines that address privacy, confidentiality, and culturally sensitive concerns raised by parents and community members. Strengthened partnerships with government agencies, NGOs, and ICT service providers will further enhance technical support and promote sustainable implementation of tele-counselling services across Kano State secondary schools.

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Assessment of Heavy Metals, Antibiotic Residues, and Antimicrobial-Resistant Bacteria in Irrigation Wastewater from an Abattoir in Fagge Local Government Area, Kano State, Nigeria

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Abstract
This study investigated the quality and safety of irrigation wastewater from the abattoir channel in Fagge LGA, Kano State, focusing on physicochemical properties, heavy metals, antibiotic residues, and antimicrobial-resistant bacteria. Wastewater samples collected from upstream, midstream, and downstream sites were compared with borehole water as a control. While parameters such as pH, temperature, colour, and total hardness met WHO irrigation standards, turbidity, electrical conductivity, total dissolved solids, and total suspended solids exceeded permissible limits. Lead concentrations were above WHO limits at all wastewater points. Two resistant bacteria Providencia stuartii *and* Stenotrophomonas maltophilia *were present in all wastewater samples but absent from the control, with total aerobic counts ranging from 46±1.2 to 77±1.7 cfu/ml. Amoxicillin–clavulanic acid was detected in 8% of samples, while ceftriaxone was absent. Overall, the findings indicate contamination of abattoir wastewater with heavy metals, antibiotic residues, and resistant bacteria, posing risks to environmental quality, food safety, and public health.*
Keywords: Abattoir wastewater, Heavy metals, Antibiotic residues, Providencia stuartii, Stenotrophomonas maltophilia, irrigation water quality, Antimicrobial resistance.

Introduction

Abattoir wastewater has increasingly been recognized as a significant environmental and public health concern, especially in low- and middle-income countries where waste treatment infrastructure is often inadequate. Typically, such effluent contains high concentrations of organic matter, blood, fats, animal excreta, detergents, veterinary pharmaceuticals, and heavy metals released during slaughter and processing activities (Lata *et al.*, 2018). When these effluents are discharged into the environment without adequate treatment, soils, surface water, and groundwater become contaminated due to these pollutants, leading to ecological disturbances and human health risks. In Nigeria, for example, abattoir wastewater is the most common kind of effluent used to irrigate vegetables because of its water shortage and the economic importance of urban farming, which exposes humans to contaminants directly (Nafarnda *et al.*, 2012; Yusuf *et al.*, 2021).

Heavy metals such as Pb, Cr, Cd, and Zn are among the most persistent contaminants in abattoir wastewater. They are not biodegradable and have the potential to accumulate in soils and irrigated crops, creating chronic risks including neurotoxicity, renal impairment, reproductive toxicity, and carcinogenic effects (Tchounwou *et al.*, 2012; Jaishankar *et al.*, 2014). In parallel, the increasing use of antibiotics within intensive livestock production means that residues of veterinary drugs will continue to be released into wastewater streams. Residues of drugs place selective pressure on environmental microorganisms, which accelerates the emergence and spread of antimicrobial-resistant

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bacteria (Kümmerer, 2009; Bengtsson-Palme & Larsson, 2016). Increasing concerns regarding the global crisis of AMR have thus subjected abattoir waste streams to increased scrutiny.

The resistant bacteria usually associated with abattoir wastewater include *Escherichia coli, Staphylococcus aureus, Klebsiella* spp., *Pseudomonas* spp., and other clinically relevant pathogens shed in animal feces and slaughterhouse operations (Adekanmbi & Falodun, 2014; Eze *et al.*, 2018). When these organisms get into irrigation channels, the vegetables, farm surfaces, and the hands of agricultural workers get contaminated to facilitate transmission to the wider community. Thus, irrigation wastewater has been an environmental hotspot for the amplification and dissemination of AMR within the One Health spectrum linking humans, animals, and the environment (Robinson *et al.*, 2016; WHO, 2020). Despite the obvious risks, systematic monitoring of heavy metals, antibiotic residues, and resistant bacteria in irrigation wastewater has remained limited across most Nigerian cities.

One of the largest abattoirs in northern Nigeria is located in Fagge Local Government Area of Kano State; the wastewater from this abattoir is widely used for irrigating vegetables all over the year. However, empirical data on chemical and microbiological safety are lacking. It is important to undertake a comprehensive assessment to ascertain the pollutant levels, establish possible health risks, and consequently inform local policies on wastewater management and mitigation of AMR. This study determines the levels of heavy metals, antibiotic residues, and antimicrobial-resistant bacteria in the wastewater of abattoir irrigation from Fagge LGA, Kano State, and presents evidence relevant to environmental protection, food safety, and public health surveillance.

MATERIALS AND METHODS

Study Area

Wastewater samples were collected from the Abattoir located in Nomansland along Zungero Road, Sabon Gari in Fagge Local Government Area of Kano State, Nigeria. The site is located at a latitude of 12.1120° North and a longitude of 8.3130° East. Surrounding activities include small-scale food processing, livestock slaughtering, and irrigation farming that may render the abattoir location a potential hotbed for environmental contamination.

Control water samples were collected from the Centre for Dryland Agriculture, Bayero University Kano, which was established to foster sustainable crop and livestock technologies for semi-arid regions of Nigeria and the West/Central African sub-regions. CDA is located around latitude 11.5850° N and longitude 8.2520° E.

Kano State is the leading commercial and industrial heart in Northern Nigeria with a population of approximately 13,076,892 according to the National Bureau of Statistics, 2017. Kano hosts a significant number of industries such as plastics, textiles, tanning, footwear, and cosmetics among others that are major contributors to wastewater generation (Dawaki *et al.*, 2016). Wastewater used for irrigation in the study area comprises effluents from these industries, households, and the abattoir.

Sample Collection

A total of 36 wastewater samples collected bi-weekly over two months from upstream, midstream, and downstream sections of the abattoir drainage channel. Distances between the sampling points were measured using a 30-m measuring tape, being 300 m between upstream and midstream, and 222 m between midstream and downstream.

The control samples (n = 4) were taken from a borehole at CDA, BUK. The APHA, 2005 standard procedures for collection were followed. All bottles were sterilized with 70% ethanol and air-dried aseptically. At each site, three 250-ml sterile screw-capped glass bottles were submerged for collection. Borehole water was allowed to run for two minutes before collection.

Sampling was done systematically at regular periods and stations to capture changes in both space and time. Sample size was determined to have an adequate statistical representation of water quality during

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the study period. All samples were transported to the laboratory in iceboxes at 4°C and processed according to APHA (2005).

Determination of Physicochemical Parameters

pH and Temperature

pH was determined in situ by use of a factory-calibrated portable pH meter according to manufacturer instructions. The probe was submerged in 10 ml of each sample in a beaker until a stable reading was attained. Temperature was measured in the field with a mercury-in-glass thermometer (APHA, 2012).

Electrical Conductivity (EC)

Electrical conductivity was determined using a digital conductivity meter. The procedures described by Tolulope *et al.* (2019) were followed. A probe was immersed in the sample and the readings expressed in µS/cm.

Chemical Oxygen Demand (COD)

COD was determined by closed-reflux titrimetric method (APHA, 2012). Accordingly, 50 ml of water sample was digested at 150°C for 2 hours with potassium dichromate and concentrated sulfuric acid. The cooled mixture was then titrated with 0.025 M ferrous ammonium sulfate using ferroin indicator.

Biochemical Oxygen Demand (BOD_5)

BOD was determined by the 5-day incubation method, according to APHA (2012). Samples were dosed with $MnSO_4$-alkali-iodide-azide and phosphoric acid; afterwards, they were titrated against 0.05 M Na_2SO_4 both before and after incubation at 20°C for 5 days.

BOD_5 was calculated using:

BOD_{5d} as mg of $\frac{O_2}{L}$ = 16 ($V_1 - V_2$)

where:

V_1 = mL of Na_2SO_4 used pre-incubation; V_2 = mL used post-incubation.

Dissolved Oxygen (DO)

DO was determined by the Winkler method (USEPA, 2018). Manganese sulfate and alkali-iodide-azide reagents were added to the sample and then sulfuric acid. The liberated iodine was titrated with sodium thiosulfate using a starch indicator.

Bicarbonate Ion (HCO_3^-)

Bicarbonate was determined by acid titration using phenolphthalein and methyl orange indicators according to APHA, 2005. Results were recorded at appropriate color change endpoints.

Total Hardness (TH)

EDTA complexometric titration with Eriochrome Black T indicator and ammonium buffer was used to determine the total hardness.

Turbidity and Colour

Turbidity was measured with a nephelometric turbidity meter (Olaoluwa *et al.*, 2010). Colour was assessed using a Lovibond comparator following Ogundele (2010).

Total Dissolved Solids (TDS)

The TDS concentration was determined by a gravimetric method of analysis. The samples were filtered and then evaporated at 180°C, after which the residues were weighed.

Value

$$TDS\ (\frac{mg}{L})\quad \frac{(A-B)}{Volume\ x\ 1000}$$

By most accounts and records, throughout this period (1890-1940s), the company was able to fare remarkably well.

Total Suspended Solids (TSS)

TSS was determined by filtration of samples through pre-weighed glass fibre filters dried at 105°C and then cooled in desiccators to constant weight (Tolutope *et al.*, 2019).

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Heavy Metal Analysis

Samples were digested with concentrated HNO_3 on a hot plate and further treated with HCl following the methods of Bala *et al.* (2008) and Srikanth *et al.* (2013). Filtrates were made to 100 ml and analyzed for Pb by AAS. A reagent blank (double-distilled water) was prepared similarly, as described in Titilawo *et al.* (2018).

Microbiological Analysis

Aerobic Mesophilic Bacteria Enumeration

By using serial dilution (10^{-1}–10^{-9}) and pour-plate methods, aliquots were plated on nutrient agar, incubating at 37°C for 24 hours. The colony counts were expressed as CFU/ml (ISO, 2013).

Isolation of Providencia stuartii and Stenotrophomonas maltophilia

The colorless/transparent colonies that were non-lactose fermenting on MacConkey agar were selected. Pure cultures were obtained by repeated streaking. Isolates were preserved in cryovials containing skim milk–glycerol stock at –80°C.

Biochemical Identification

Conventional biochemical tests followed Cheesbrough 2006. Final confirmation utilized the API 20E kit bioMérieux.

Determination of Residual Amoxicillin and Ceftriaxone

Standard and Sample Preparation

Analytical standards provided by Sigma-Aldrich were prepared at 10 mg/ml and then serially diluted at 1–5 mg/ml. The extraction solvents used included ethanol, acetone, n-hexane, and ethyl acetate of analytical grade.

Extraction and Pre-treatment

The filtered samples (40 ml) were acidified, chelated with Na_2EDTA, and extracted with a solvent mixture of 2:1:1 acetone: n -hexane:ethyl acetate. Ultrasonication and centrifugation increased the efficiency of the extraction. The extracts were dried using a stream of nitrogen and reconstituted in methanol.

GC–MS Analysis

GC–MS analysis was performed according to Yun-Feng (2012). It involved a fused silica capillary column with helium carrier gas at 1.2 ml/min flow, injection in splitless mode, and using SIM mode for targeted detection. Identification was confirmed using the NIST 2017 library.

Bacterial-Heavy Metal Resistance Test

Agar-well diffusion was used in testing Providencia staurtii and Stenotrophomonas maltophilia for resistance to lead (Pb) by Kinare & Shigadia, 2014. Stock solutions were made up of 1.36 g/L $PbCl_2$. Bacterial suspensions were inoculated on Mueller-Hinton agar at 0.1 mL per bacterial suspension prepared from the McFarland 0.5 standards. Wells were filled with increasing Pb concentrations in ranges of 10–100 mg/L per 10 mg/L and incubated at 37°C for 48 h. Positive controls were grown without Pb.

Minimum Inhibitory Concentration (MIC)

For isolates growing at 100 mg/L Pb, concentrations were successively increased up to 100–150 mg/L until no growth was recorded to establish the MIC.

Bacterial-Antibiotic Resistance Test

The Kirby-Bauer disc diffusion method was used to test the isolates for susceptibility against amoxicillin-clavulanic acid (25 µg) and ceftriaxone (30 µg) according to CLSI 2010, 2017. Briefly, 0.1 mL of bacterial suspension was spread on Mueller-Hinton agar and incubated at 37°C for 24 h. Isolates were classified as R, I or S based on zone diameters. E. coli ATCC 25922 was used as control.

Plasmid DNA Extraction & PCR Amplification

DNA from the resistant isolates was extracted using QIAamp DNA kits. The genes blaTEM, blaSHV, blaCTX-M, and pbrA were amplified by PCR using specific primers according to previous studies (Monstein *et al.*, 2007; Shin *et al.*, 2012). The conditions for the PCR cycling were as follows:

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• pbrA: 95°C 4 min, 35 cycles of 95°C 30 s, 60°C 90 s, 72°C 2 min, final 72°C 7 min
bla genes: 30 cycles, denaturation 94°C 30 s, annealing 50-58°C (gene-specific), extension 72°C 1 min
The amplified products were separated on 1.5% agarose gel, visualized by ethidium bromide staining, and compared with a 1000-bp ladder.

Gene	Primers	Sequences (5' – 3')	Primer length (bp)	Target Amplicon Size(bp)	Reference
brA	PbrA-F/R	ATGAGCGAATGTGGCTCGAAG TCATCGACGCAACAGCCTCAA	21 21	766	Shin *et al.* (2012)
bla_{TEM}	bla_{TEM}-F/R	TCCGTCATGAGACAATAACC TTGGTCTGACAGTTACCAATGC	20 22	431	Monstein *et al.* (2007)
bla_{SHV}	bla_{SHV}-F/R	TGGTTATGCGTTATATTCGCC GGTTAGCGTTGCCAGTGCT	21 19	868	Monstein *et al.* (2007)
Bla_{CTX-M}	Bla_{CTX-M}-F/R	ATGTGCACCAGTAARGT TGGGTRAARTARGTSACCAGA	17 21	593	Monstein *et al.* (2007)

Data Analysis

Data were entered into Excel and analyzed using SPSS v25. For categorical variables, frequencies and percentage values were used. Continuous variables were summarized using mean and standard deviation. Comparison between two groups was made by using the Student's t-test while ANOVA was used for multiple groups. Significance was considered as $p < 0.05$.

RESULTS

The physico-chemical analysis of water from four locations (W1 = upstream, W2 = midstream, W3 = downstream, and CW = borehole water) is shown in Table 1. There were significant differences in pH, temperature, electrical conductivity, TSS, TH, TDS, turbidity, and colour across the sites studied ($p<0.05$). W1 had the lowest pH value of 6.62 ± 0.47, while CW had the lowest temperature, EC, TSS, TH, TDS, turbidity, and colour of 21.52 ± 0.51 °C, 251 µS/cm, 1.35 mg/ml, 39.31 mg/ml, 25.22 mg/ml, 1.43 NTU, and 2.34 TCU, respectively. No significant differences existed among BOD, COD, DO, and bicarbonate within the sites studied ($p>0.05$), though CW consistently showed lower values for BOD, COD, and DO.

Concentration of lead in water from W1, W2, W3, and CW is presented in Table 2. While W1 presented the highest mean Pb, 0.77 ± 0.06 mg/ml, no significant statistical difference occurred among the sites of $p > 0.05$. The lowest concentration of lead was recorded in CW with a value of 0.005 mg/ml, below the recommended limit by WHO (0.01 mg/ml).

Tables 3 show the frequency and percentage of Providencia stuartii and Stenotrophomonas maltophilia in wastewater and control water. Both organisms were detected in the wastewater samples, which gave 50% occurrence. The highest frequency of the two organisms was detected in W1 and W3. No isolates were recovered from CW.

The result of the total aerobic bacterial count in wastewater and control water is presented in Table 4. All the wastewater samples showed a significantly higher count than CW at $p<0.05$. W1 had the highest mean count of $77\pm1.7 \times 10^8$ cfu/ml while CW had the lowest mean count of $4.25\pm0.13 \times 10^8$ cfu/ml.

Qualitative and quantitative analysis of antibiotics in water samples is depicted in Figures 1 and 2. Thus, ceftriaxone was consistently detected in higher concentrations in the wastewater samples in the range of 2.18–34.66 mg/ml, whereas amoxicillin-clavulanic acid was always detected in lower concentrations in the range of 1.42–3.44 mg/ml. CW showed no detectable residues of any antibiotic.

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Providencia stuartii and Stenotrophomonas maltophilia showed resistance to lead (10–100 mg/ml) present in wastewater. Both the isolates showed 16 mm diameter of growth at 100 mg/ml, which was very high and resistant (Tables 5).

Tables 6 show the antibiotic susceptibility of Providencia stuartii and Stenotrophomonas maltophilia. All the strains were 100% susceptible to ceftriaxone. Providencia stuartii exhibited 100% resistance to amoxicillin-clavulanic acid in W1 and W3 and showed intermediate susceptibility in W2. No CLSI standard exists for AMC in S. maltophilia.

Table 7. The MIC of Providencia stuartii and Stenotrophomonas maltophilia to lead. Maximum tolerance occurred at 110–120 mg/ml, complete inhibition at 130 mg/ml in W1 and 120 mg/ml at W2 and W3. The PCR analysis confirmed the presence of resistance genes in both isolates figure 3, 4, and 5.

Table 1: Mean Physicochemical Parameters of Water Obtained from Study Sites

Parameter	**W1**	**W2**	**W3**	**CW**	**P-value**	**WHO (2017)**
pH	6.62±0.47	7.59±0.30	8.09±0.30	7.09±0.22	0.000*	6.5–8.5
Temp (°C)	26.12±0.61	26.56±0.44	26.76±0.43	21.52±0.51	0.000*	22–30
EC (µS/cm)	1337±1.0	1318±1.0	1784.6±4.6	251±1.1	0.001*	300
BOD (mg/ml)	3.40±0.22	3.72±1.77	3.76±1.44	1.56±0.85	0.050	5
COD (mg/ml)	6.28±0.85	6.32±0.81	6.07±0.68	3.03±0.72	0.248	10
DO (mg/ml)	9.76±0.10	6.23±0.10	6.14±0.10	4.30±0.10	0.104	4–6
TSS (mg/ml)	111.73±0.66	104.00±1.53	116.00±1.0	1.35±0.62	0.011*	250
TH (mg/ml)	180.67±5.81	134.00±1.0	105.03±1.0	39.31±0.76	0.000*	500
TDS (mg/ml)	233±5.0	300±1.0	197±2.0	25.22±1.43	0.000*	0.5
Turbidity (VTU)	18.27±0.80	21.52±1.0	23.51±1.0	1.43±0.07	0.000*	0.5–5
HCO3 (mg/ml)	9.77±0.86	10.26±0.90	14.46±1.46	32.00±1.56	0.226	12.5
Colour (TCU)	4.65±0.20	5.16±0.40	4.40±0.70	2.34±0.10	0.019*	-

Key: ANOVA test, *p≤0.05 significant; Mean ± SD.*

Table 2: Mean Lead (Pb) Concentration in Water Samples

Water	**Pb (mg/ml)**	**P-value**	**WHO (2017)**
W1	0.77±0.06	0.999	0.01
W2	0.37±0.09	0.382	0.01
W3	0.28±0.08	0.546	0.01
CW	0.005±0.06	-	0.01

Table 3: Occurrence in Wastewater Samples

Isolate	W1 n(%)	W2 n(%)	W3 n(%)	CW n(%)	Total n(%)
P. stuartii	1 (12.5)	1 (12.5)	2 (25.0)	0 (0.0)	4 (50)
S. maltophilia	2 (25.0)	1 (12.5)	1 (12.5)	0 (0.0)	4 (50)

Table 4: Total Mean Aerobic Bacterial Count

Sample	Bacterial Count (x10^8 cfu/ml)	P-value	WHO (2017)
W1	77 ± 1.7	0.000*	100
W2	66 ± 0.6	0.001*	100
W3	46 ± 1.2	0.000*	100
CW	4.25 ± 0.13	-	100

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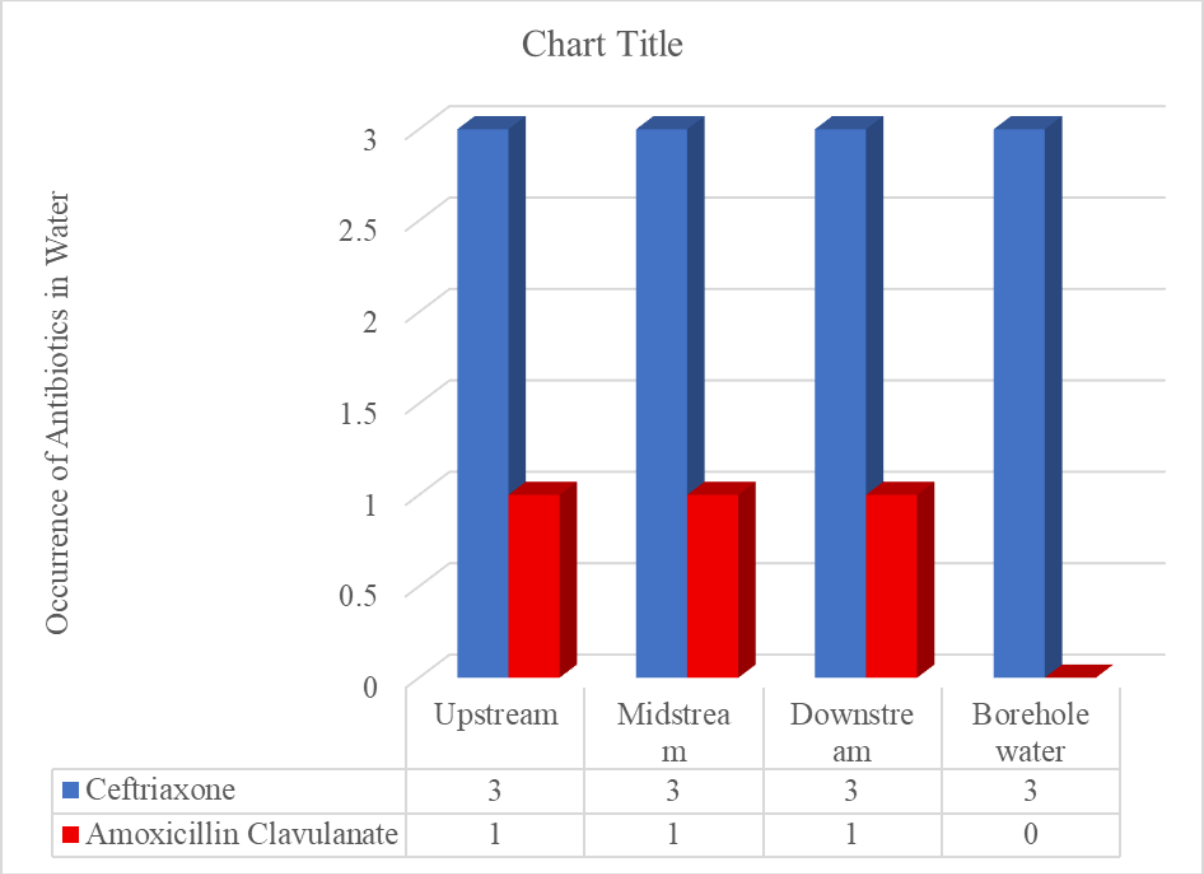


Figure 1: Qualitative Residual Analysis of Antibiotics in Water Obtained from Abattoir, Fagge LGA and Center for Dryland Agriculture Bayero University, Kano during the Study.

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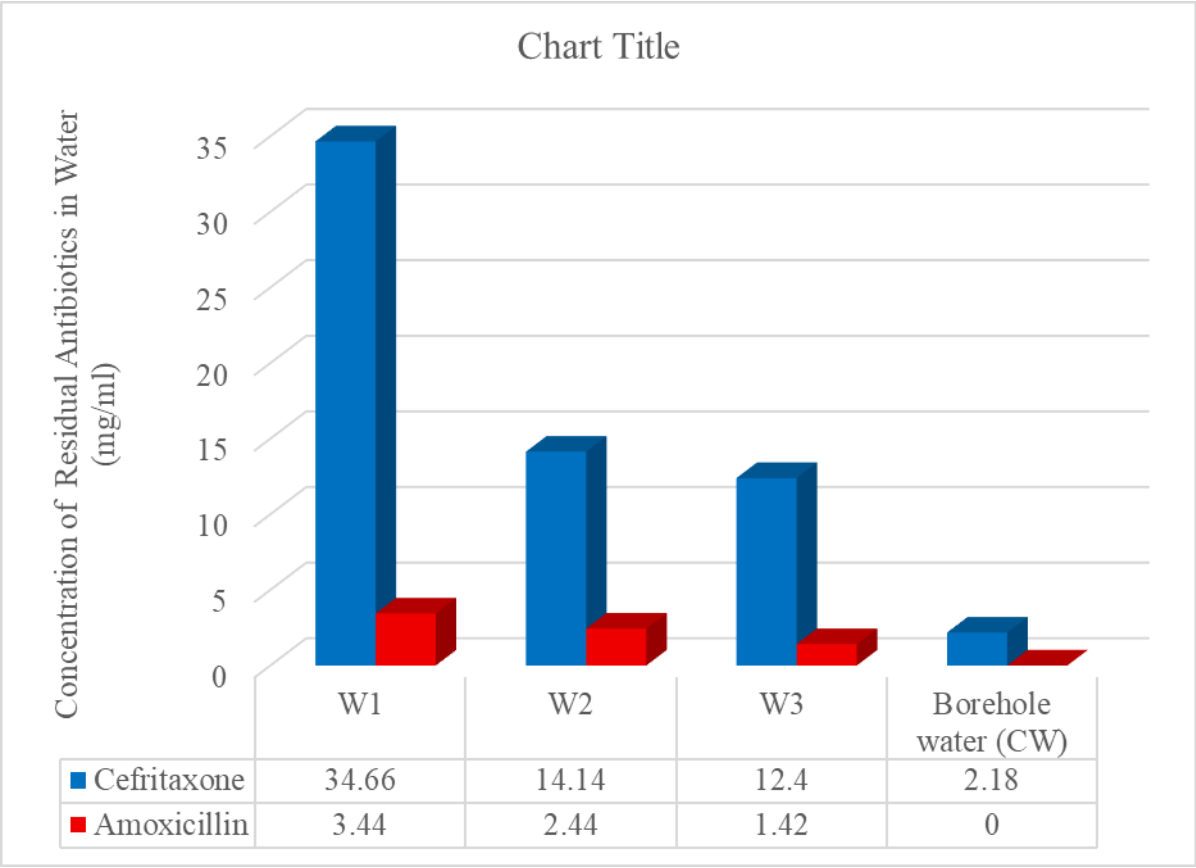


Figure 2: Quantitative Analysis of Antibiotics in Water Obtained from Abattoir, Fagge LGA and Center for Dryland Agriculture Bayero University, Kano during the Study.

Table 5: Lead Tolerance Tests

Isolate	Max Growth at Pb (mg/ml)	W1 (upstream)	W2 (midstream)	W3 (downstream)
P. stuartii	16 mm	100	100	100
S. maltophilia	16 mm	100	100	100

Table 6: Antibiotic Susceptibility Profile of *Providencia stuartii* and *Stenotrophomonas maltophilia* in Wastewater Obtained from Abattoir, Fagge LGA during the Study

	Antibiotics					
	AMC			CRO		
	S	I	R	S	I	R
P. stuartii	0	0	1(100)	1(100)	0	0
S. maltophilia	NC	NC	NC	2(100)	0	0

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Table 7: Minimum Inhibitory Concentration of *Providencia stuartii* and *Stenotrophomonas maltophilia* to Lead Concentration in Wastewater Obtained from Abattoir, Fagge LGA during the Study

SITE	ISOLATE	MIC				
		110	120	130	140	150
W1	*Providencia stuartii*	12.0	6.00	0.00	0.00	0.00
	Stenotrophomonas maltophilia	10.0	5.00	0.00	0.00	0.00
W2	*Providencia stuartii*	6.00	0.00	0.00	0.00	0.00
	Stenotrophomonas maltophilia	6.00	0.00	0.00	0.00	0.00
W3	*Providencia stuartii*	6.00	0.00	0.00	0.00	0.00
	Stenotrophomonas maltophilia	6.00	0.00	0.00	0.00	0.00

Key: no official standard zone diameter chart to interpret MIC for heavy metals, 0.00 = no growth, MIC = Minimum Inhibitory Concentration, Pb = Lead and W1 = Upstream, W2= Midstream and W3= Downstream

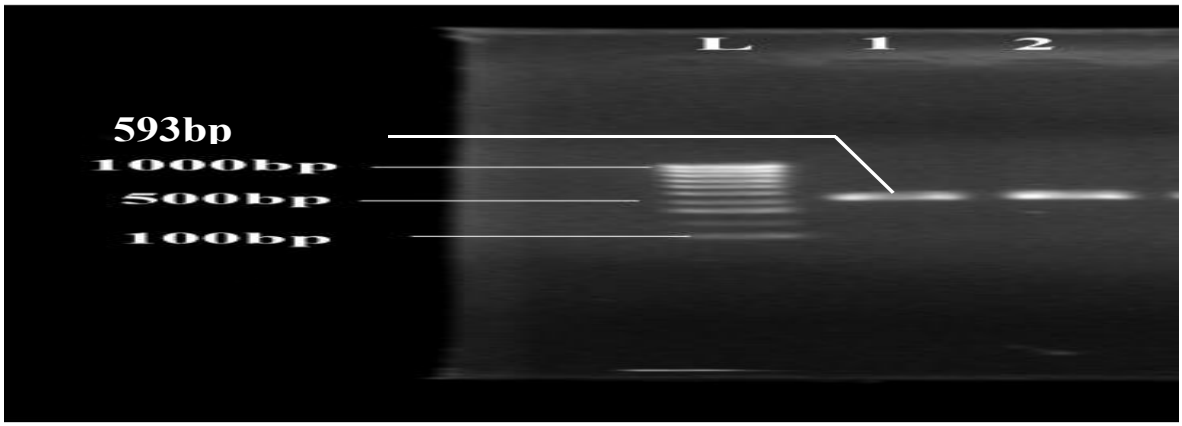


Figure 3: Detection of bla_{CTX-M} Gene by Agarose Gel Electrophoresis in *Providencia stuartii* and *Stenotrophomonas maltophilia* isolated from Wastewater from Abattoir, Fagge LGA during the Study

Key: Lane L = DNA Ladder (1kb) Lane 1=*Providencia stuartii*, and Lane 2 = *Stenotrophomas maltophilia*, Expected amplicon gene size = 593bp

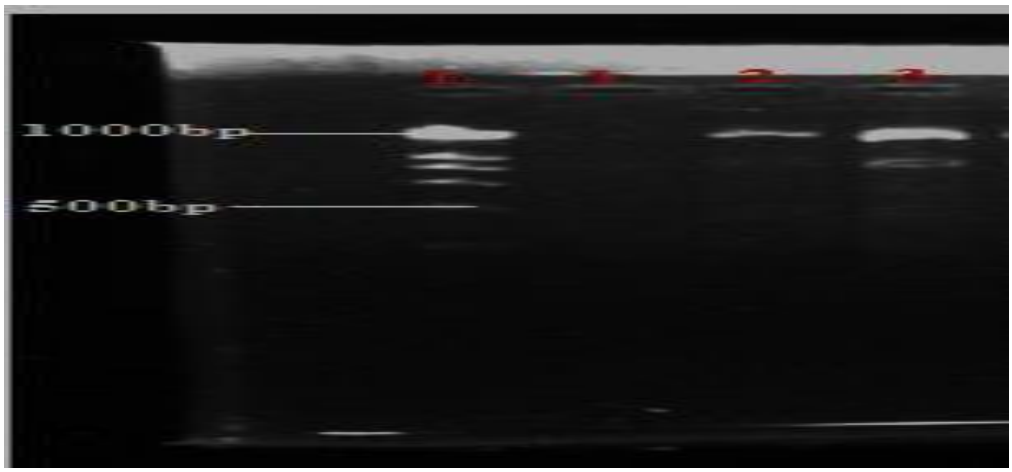


Figure 4: Detection of bla_{SHV} Gene by Agarose Gel Electrophoresis in *Providencia stuartii* and *Stenotrophomonas maltophilia* isolated from Wastewater from Abattoir, Fagge LGA during the Study

Key: Lane L = DNA Ladder (1kb), Lane 1= Negative Control, Lane 2=*Providencia stuartii*, and Lane 3 = *Stenotrophomas maltophilia*, Expected amplicon gene size = 868bp

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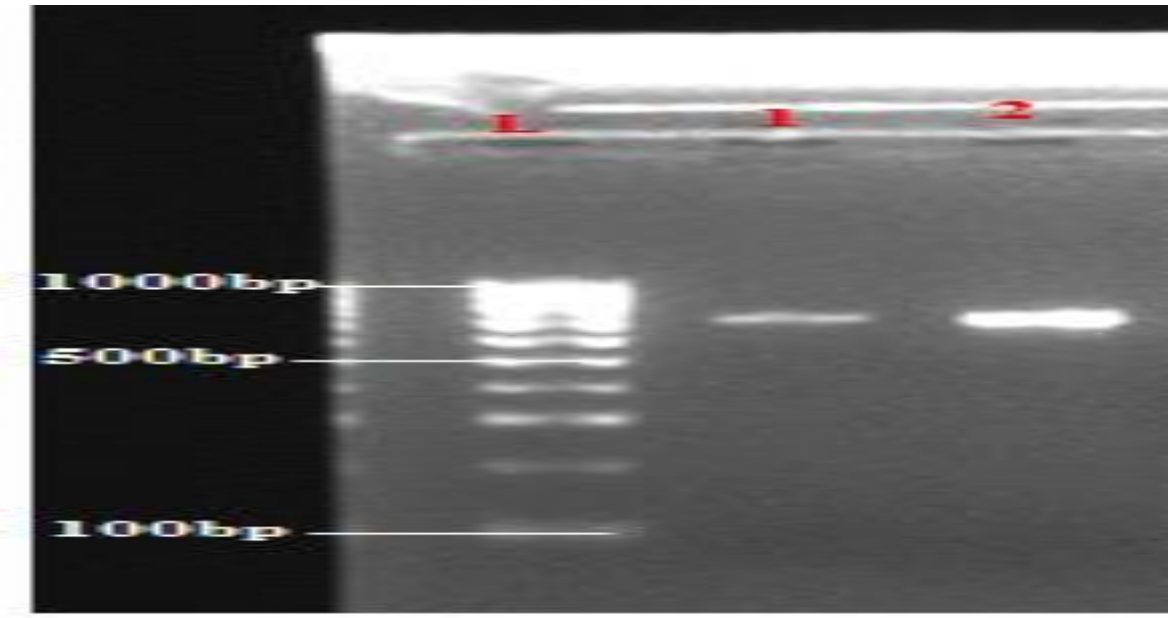


Figure 5: Detection of pbrA Gene by Agarose Gel Electrophoresis in *Providencia stuartii* and *Stenotrophomonas maltophilia* isolated from Wastewater from Abattoir, Fagge LGA during the Study

Key: Lane L = DNA Ladder (1kb), Lane 1= Negative Control, Lane 2=*Providencia stuartii*, and Lane 3 = *Stenotrophomas maltophilia*, Expected amplicon gene size = 868bp

DISCUSSION

Physicochemical, heavy metal, and bacteriological analyses were carried out on the generated wastewater from the Abattoir study area (Fagge LGA). This was done to detect Providencia stuartii and Stenotrophomonas maltophilia. Molecular analysis of the target genes was done in addition to the assessment of antibiotic residues, that is, Ceftriaxone and Amoxicillin-clavulanate. The results are discussed below.

The average pH of the irrigation water ranged from 6.62 ± 0.47 to 8.09 ± 0.30 for W1, W2, W3, and CW, respectively, within the WHO permissible range of 6.5–8.5 (WHO, 2017). A significantly higher pH in the downstream effluent (W3) could be linked to increased organic matter decomposition. This observation is consistent with the work of Tunc & Sahin, 2015; Lu *et al.*, 2016. Similarly, Suleiman *et al.* 2024, recorded similar pH ranges from irrigated farms in Kano State.

Values of turbidity were above the WHO permissible limit of 5 NTU in wastewater and the highest values downstream (23.51 ± 1.0 NTU). This can be ascribed to silt, clay, organic debris, and microbial proliferation caused by human and animal activities. In addition, there was a low turbidity in the borehole water (CW), averaging 1.43 ± 0.07 NTU, and was consistent with values earlier reported in some studies.

Electrical conductivity exceeded the WHO limit of 300 µS/cm at all wastewater sites, peaking downstream due to likely dissolved salts contributed by both agricultural and industrial runoff. Low Electrical Conductivity at the Control site reflects very minimal dissolved salts in this Borehole water. The trend of DO was highest at W1 (upstream) and decreased down to W2 and W3, consistent with many previous studies. The BOD was moderately clean (3.40 ± 0.21 – 3.76 ± 1.54 mg/l), with

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concentration building up downstream because of microbial decomposition of organic matter. On the other hand, COD was highest at midstream, reflecting the collection of household and industrial wastes on its banks. TSS and TDS also surpassed WHO limits, with maximum concentrations downstream and midstream, due to agricultural runoff and domestic waste, respectively. In general, TH is within safe limits; however, the midstream river had the highest value in relation to industrial and domestic effluents.

Heavy metals analysis showed that lead (Pb) exceeded the acceptable limit of WHO at 0.01 mg/l, with the highest concentration upstream at 0.77 ± 0.06 mg/l, likely due to runoff from agricultural activities, sewage, and industrial waste (Suleiman, 2018). Chronic Pb exposure can cause health problems such as neurotoxicity and renal dysfunction.

In fact, bacteriological analysis revealed high contamination with Providencia stuartii (12.5-25%) and Stenotrophomonas maltophilia (12.5-25%), present in the wastewater but completely absent in the borehole water. Total aerobic bacterial counts showed a range from 46 ± 1.2 to 77 ± 1.7 cfu/ml, with a high level recorded upstream due to surface runoff, domestic sewage, and high temperatures. These findings are in agreement with the reports of Suleiman *et al.*, 2024; Fatusin *et al.*, 2020; Aijuka *et al.*, 2015.

The profile of antibiotic residues detected showed low frequencies for amoxicillin-clavulanate in 8% of samples, between 1.42 and 3.44 mg/ml, and ceftriaxone in 25% of wastewater samples between 3 and 34.66 mg/ml; this reflects the widely spread environmental contamination by both human and livestock sources.

Providencia stuartii and Stenotrophomonas maltophilia isolates were tolerant to PbCl2 with a MIC value of 120–130 mg/ml, which may be due to the outer membrane structure, lipopolysaccharides, biofilm formation, and genetic determinants for metal resistance. Chen *et al.* (2016), Gupta & Diwan (2017), and Yakoubi *et al.* (2018) reported that both species were resistant to amoxicillin-clavulanate and susceptible to ceftriaxone, as obtained from this study; Avatsingh *et al.* (2023); Moyen *et al.* (2021), and Suleiman (2025).

The molecular analysis demonstrated that blaCTX-M, blaSHV, and pbrA genes were present in all the isolates. These could indicate co-selection of antibiotic and heavy metal resistance, likely driven by horizontal gene transfer. Lima *et al.* 2020; Gumede *et al.*, 2021; Kimera *et al.*, 2021. This would point to an environmental reservoir for such bacteria and a public health problem.

5.2 Conclusion

This study gives a holistic assessment of the contamination in wastewater from Abattoir, Fagge LGA, Kano State. The following are some of the key findings:

Wastewater had high bacterial counts, 46 ± 1.2 – 77 ± 1.7 cfu/ml, with pathogenic Providencia stuartii and Stenotrophomonas maltophilia that have been associated with foodborne illness, urinary tract infections, sepsis, and other health complications.

2. Some physicochemical parameters of water, including turbidity and electrical conductivity, exceeded the acceptable limits as prescribed by WHO, which may pose water quality and crop safety issues.

3. The lead levels were higher than the permissible limit, thus, were within the range of 0.28 ± 0.08 – 0.77 ± 0.06 mg/l and hence presented potential health risks to humans, animals, and crops.

The antibiotic residues were detected, although at low frequencies: Ceftriaxone and Amoxicillin-clavulanate.

5. All the isolates carried genes for blaCTX-M, blaSHV, and pbrA, indicating that antibiotic and heavy metal resistances co-occur with implications for environmental and public health.

Overall, the study shows how wastewater contaminated with heavy metals negatively affects crop production, food security, and ultimately human health and requires adequate mitigation strategies.

5.3 Recommendations

Based on the findings, the following recommendations are proposed:

1. Advanced wastewater treatment techniques should be employed along with the institution of regular water quality monitoring to ensure safety.
2. Encourage organic fertilizers and natural methods of pest control, which are alternatives to the use of antibiotics and heavy metals.
3. Enforcement of legislation that prevents overuse of antibiotics and heavy metals.
4. Educating farmers and communities about health risks related to the irrigation water that has been contaminated.
5. Support research in non-chemical methods of crop and soil management, such as biological pest control.
6. Formulate ways of good irrigation practice that do not spread bacteria resistant to antibiotics and metals.
7. Monitor and surveil resistant bacterial strains in farm-adjacent communities, such as Providencia stuartii and Stenotrophomonas maltophilia, and improve sanitation practices that reduce public health risks.

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Antimicrobial Potency of *Eucalyptus globulus* Ethanol Leaf Extract Against Selected Bacteria Isolates

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Abstract
The increasing prevalence of antimicrobial resistance has intensified the search for alternative antibacterial agents derived from medicinal plants. Eucalyptus globulus is widely recognized for its rich phytochemical composition and traditional medicinal use, particularly for the management of infectious diseases. This study evaluated the antibacterial activity of ethanolic leaf extract of Eucalyptus globulus against selected bacteria strains. Fresh leaves of E. globulus were extracted using 70% ethanol. Antibacterial activity was assessed using the agar well diffusion method at concentrations of 25, 50, 100, 200, and 400 mg/mL. Streptomycin served as the positive control, while dimethyl sulfoxide was used as the negative control. Zones of inhibition were measured in millimeters. MIC values were determined using the broth dilution technique. Data were analyzed using analysis of variance at $p < 0.05$. The extract exhibited concentration-dependent antibacterial activity against all tested organisms. At 400 mg/mL, inhibition zones of 19.00 mm for S. aureus, 7.50 mm for B. subtilis, 19.00 mm for P. aeruginosa, and 21.50 mm for E. coli were observed. More so, E. coli showed the highest mean susceptibility (17.57 ± 2.05 mm), while B. subtilis had the lowest (11.21 ± 2.46 mm). Minimum inhibition concentration values were lowest for E. coli (62.5 mg/mL), followed by S. aureus (125 mg/mL), and highest for B. subtilis and P. aeruginosa (250 mg/mL). Ethanolic leaf extract of Eucalyptus globulus demonstrates broad-spectrum antibacterial activity and represents a promising natural source of antimicrobial agents for potential therapeutic applications.
Keywords: *Antimicrobial activity; Alternative medicine; Medicinal plants; Phytomedicine*

Introduction

Medicinal plants have played a fundamental role in human health since antiquity, owing to their rich diversity of bioactive compounds. These secondary metabolites, produced primarily for ecological functions such as defense against herbivores, fungi, and insects, number more than 12,000 identified to date; though this represents less than 10% of the total believed to exist (Saxena et al., 2006). Because many of these phytochemicals act through mechanisms similar to those of conventional pharmaceuticals, herbal medicines can exert beneficial therapeutic effects while also posing the potential for adverse reactions (Mishra, 1983). Despite this, they remain the most widely utilized form of traditional medicine globally and continue to serve as essential sources of nutrition, healing agents, and drug leads. It is estimated that between 3,500 and 10,000 plant species are used medicinally, with research efforts frequently directed toward validating their efficacy in areas such as anticancer, antihypertensive, antiviral, antisickling, and cardioprotective applications (Emmanuel, 2015). Worldwide, an estimated 3.5 – 4 million people rely on herbal remedies for the management of various ailments, with Africa recognized as one of the leading consumers of plant-based therapeutics.

Eucalyptus globulus, commonly known as the Tasmanian Blue Gum or Southern Blue Gum, is a significant medicinal plant belonging to the Myrtaceae family. This evergreen species is widely recognized for its ecological adaptability and diverse practical applications. Native to southeastern Australia, particularly Tasmania and parts of Victoria, it has been cultivated in regions such as the Mediterranean, South America, India, and California due to its rapid growth and ability to thrive in temperate to subtropical climates (Akolade et al., 2012; The Green Institute, 2023). It can grow up to

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70 meters tall and features a smooth bark that sheds in strips, revealing a mottled bluish-gray surface as it ages (Akolade et al., 2012). Its aromatic, lanceolate leaves are a source of essential oils, and the tree produces creamy white flowers followed by woody, hemispherical fruit capsules (The Green Institute, 2023).

The phytochemical profile of *Eucalyptus globulus*, especially in its ethanol leaf extract, has been extensively studied. The extract contains a diverse range of bioactive compounds, contributing to its broad-spectrum antimicrobial properties. Among these are phenolic compounds, flavonoids, tannins, alkaloids, terpenoids, saponins, and essential oils, all playing central roles in its therapeutic potential (Abirami et al., 2017; Ewansiha et al., 2024). The dominant phenolic constituents, including quercetin, catechin, gallic acid, and chlorogenic acid, are known for their antioxidant and antibacterial activities (Hamad et al., 2024). Furthermore, eucalyptol (1,8-cineole), a major monoterpene, is another key component that enhances the antimicrobial potency of the extract (Bachir & Benali, 2012; Dixit et al., 2014; Iseppi et al., 2023).

Additional phytochemicals such as α-pinene, limonene, and p-cymene have also been identified, adding to the extract's antibacterial effects (Maczka et al., 2021). The presence of tannins and saponins further amplifies the antimicrobial potential, with studies by Syukri et al. (2019), Gyawali et al. (2022), and Ewansiha et al. (2024) confirming their significant roles. Although alkaloids and glycosides are present in smaller quantities, they contribute to the extract's overall biological activity (Sasikala & Kalaimathi, 2014). These findings underscore the versatility of Eucalyptus globulus ethanol leaf extract as a promising source of natural antimicrobial agents. Therefore, the aim of this study is to evaluate the antimicrobial potency of *Eucalyptus globulus* ethanol leaf extract growing around College of Education Technical, Bichi.

Materials and Methods

Collection of Plants Material and Samples

Fresh leaves of Eucalyptus globulus were collected with the environment of Federal College of Education Technical, Bichi, The test organisms include (*Staphylococcus aureus*, *Bacillus subtilis*, *Pseudomonas aeruginosa*, and *Escherichia coli*) were obtained from Biology Laboratory (Microbiology unit), College of Education Technical, Bichi.

Preparation of Plants Extract

This was carried out by a modified method according to Oko et al. (2017). The samples were washed in running tap water and were chopped into small pieces (where necessary), and dehydrated using a commercial dehydrator (ST-32, China) at 45 ℃ until constant weight was achieved. The dried samples were ground with a blender (Kenwood 6000 BT, China) and stored separately in air-tight containers for further studies. Hundred (100) grams of the plant material powder was weighed using Electronic weighing balance (Ohaus Corp., USA) and put into Erlenmeyer flask containing 200 ml of 70% ethanol (analytical grade) and macerated for 72 hours with stirring at intervals to obtain the plants extract. This was first filtered with cheese cloth then with whatman no 1 filter paper to obtain the extract. Afterwards, the solvent was evaporated to dryness in a water bath at 70 ± 2 ºC for 48 h, and the dried extract was used for the study.

Antimicrobial assay

The media - Mueller Hinton Agar (MHA) (Oxoid, USA) was prepared and treated according to the manufacturer's specification. A sterile cork borer of 8 mm in diameter was used to make six wells on each of the MHA plate. A stock concentration of 400 mg / ml of each of the extracts where prepared by weighing 800 mg of the plant extract and reconstituting in 2 ml of Dimethylsulfoxide (DMSO). Then two fold-serial dilutions were made to get graded concentration. Then, aliquots of 80

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µl of each extract dilutions, reconstituted in DMSO at concentrations of 200, 100, 50, and 25 mg / ml while Streptomycin (40 µg) and untreated wells were used as the positive and negative controls. This was then applied in each of the wells in the culture plates previously seeded with the test organisms. The cultures were incubated at 37°C for 18 – 24 h to observe the zones of inhibition. The antimicrobial potential for the plant extract was determined by measuring the zone of inhibition around each well (excluding the diameter of the well). For each organism, three replicates were conducted.

Minimum Inhibitory Concentration

The minimum inhibitory concentration (MIC) of the extract was assessed using the doubling dilution technique. Initially, 1 g of the extract was dissolved in 1 mL of sterile water to obtain a stock solution of 1000 mg/mL. This stock was subsequently serially diluted with sterile distilled water to produce concentrations of 1000 mg/mL, 500 mg/mL, 250 mg/mL, 125 mg/mL, 62.5 mg/mL, 31.25 mg/mL, 15.625 mg/mL, and 7.813 mg/ mL. Each dilution tube was then inoculated with 1 mL of a standardized 0.5 McFarland bacterial suspension and incubated at 37°C overnight. After incubation, the tubes were examined for the presence or absence of turbidity.

Data analysis

All data were subjected to Univariate analysis of variance while significant means were separated using least significant difference test at $p < 0.05$. the analysis was done using IBM statistical product and service solution (SPSS).

Results

Plate 1-4 shows the culture plates of both gram positive and negative bacteria isolates indicating clear inhibition zones.

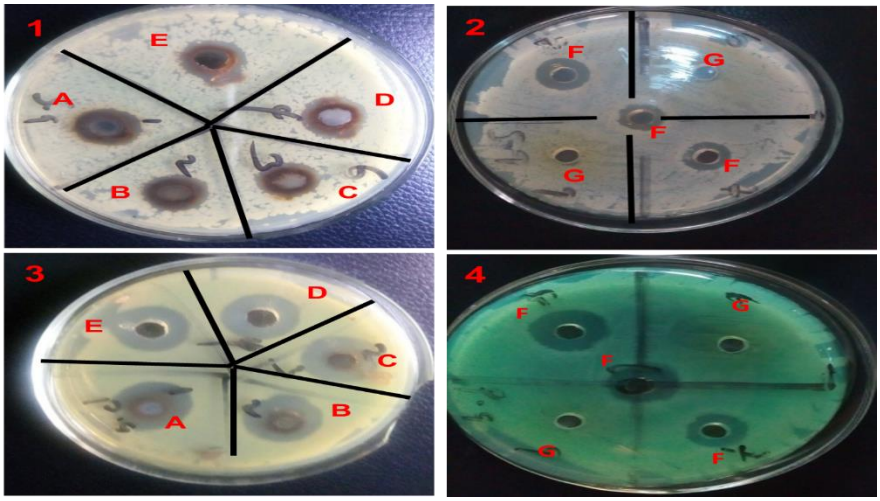


Plate 1&2: Gram positive antibacterial assay (*S. aureus*) 2&3: Gram negative antibacterial assay (*P. aeruginosa*); A (400 mg / ml); B (200 mg / ml); C (100 mg / ml); D (50 mg / ml); E (25 mg / ml); F1 (Positive control- Streptomycin); G (Negative control – DMSO).

Table 1 presents the ANOVA results assessing the effects of organism type, extract concentration, and their interaction on the zone of inhibition. The corrected model was highly significant ($F = 17.597$, $p < 0.001$), indicating that the combined effects of the tested factors adequately explain variations in antibacterial activity. The model exhibited a very high coefficient of determination ($R^2 = 0.944$), with an adjusted R^2 of 0.891, confirming that over 89% of the observed variability in inhibition zones was explained by the experimental factors. Individually, the effect of organism was statistically significant ($F = 14.117$, $p < 0.001$), demonstrating that bacterial species responded

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differently to the extract. Concentration exerted the strongest influence, as shown by the highest F-value ($F = 64.720$, $p < 0.001$), indicating a pronounced dose-dependent antibacterial response. The interaction between organism and concentration was also significant ($F = 2.469$, $p = 0.015$), suggesting that changes in concentration affected each bacterial species differently.

Table 1: Analysis of variance on the zone of inhibition results

Source	Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	3877.339[a]	27	143.605	17.597	.000
Intercept	13361.161	1	13361.161	1637.254	.000
Organism	345.625	3	115.208	14.117	.000
Concentration	3168.964	6	528.161	64.720	.000
Organism × Concentration	362.750	18	20.153	2.469	.015
Error	228.500	28	8.161		
Total	17467.000	56			
Corrected Total	4105.839	55			

a. R Squared = .944 (Adjusted R Squared = .891)

Table 2 shows that the ethanolic leaf extract exhibited measurable antibacterial activity against both Gram-positive and Gram-negative bacteria across all tested concentrations. In general, higher concentrations produced larger inhibition zones, confirming a concentration-dependent effect. The highest extract concentration (400 mg/ml) yielded substantial inhibition against *S. aureus* (19.00 mm), *P. aeruginosa* (19.00 mm), and *E. coli* (21.50 mm), while *B. subtilis* showed comparatively lower sensitivity (7.50 mm). Across concentrations, *E. coli* consistently recorded the highest inhibition zones, with an average organism response of 17.57 ± 2.05 mm, indicating greater susceptibility. *B. subtilis* had the lowest mean response (11.21 ± 2.46 mm), suggesting relative resistance to the extract. The positive control recorded the highest inhibition values across all organisms, while the negative control showed no inhibition.

Table 2: Effect of *E. globulus* ethanolic leaf extract on the inhibition zone of some selected bacteria species

Concentrations	IZDs of AgNPs from Test Plants (mm)				
	Gram positive		Gram negative		**Average Concentration effect**
	S. aureus	***B. subtilis***	***P. aeruginosa***	***E. coli***	
400 mg/ml	$19.00 \pm 0.00^{b,2}$	$7.50 \pm 7.50^{d,3}$	$19.00 \pm 1.00^{b,2}$	$21.50 \pm 0.50^{b,1}$	**16.75 ± 2.51^{bc}**
200 mg/ml	$17.50 \pm 0.50^{c,2}$	$13.50 \pm 0.50^{b,3}$	$18.50 \pm 1.50^{bc,2}$	$20.50 \pm 0.50^{b,1}$	**17.50 ± 1.02^{b}**
100 mg/ml	$16.50 \pm 0.50^{cd,2}$	$12.00 \pm 1.00^{bc,3}$	$18.00 \pm 1.00^{bc,12}$	$19.50 \pm 0.50^{bc,1}$	**16.50 ± 1.10^{bc}**
50 mg/ml	$15.50 \pm 1.50^{de,2}$	$11.50 \pm 1.50^{c,3}$	$17.00 \pm 1.00^{c,2}$	$19.00 \pm 0.00^{bc,1}$	**15.75 ± 1.13^{c}**
25 mg/ml	$14.50 \pm 2.50^{e,3}$	$6.00 \pm 6.00^{d,4}$	$17.00 \pm 1.00^{c,2}$	$18.50 \pm 0.50^{c,1}$	**14.00 ± 2.21^{d}**
Negative control	$33.50 \pm 0.50^{a,1}$	$28.00 \pm 0.00^{a,2}$	$25.00 \pm 1.00^{a,3}$	$24.00 \pm 1.00^{a,4}$	**27.63 ± 1.43^{a}**
Positive control	0.00 ± 0.00^{f}	0.00 ± 0.00	0.00 ± 0.00^{d}	0.00 ± 0.00^{d}	**0.00 ± 0.00^{e}**
Average organism response	**16.64 ± 2.53^{b}**	**11.21 ± 2.46^{c}**	**16.36 ± 2.00^{b}**	**17.57 ± 2.05^{a}**	

*means with different superscripts alphabets along each column shows significant difference across the extract concentrations while different superscript numbers across each row shows significant differences across organisms

Figure 1 summarizes the MIC values of the extract against the tested bacteria. *E. coli* exhibited the lowest MIC (62.5 mg/ml), indicating the highest sensitivity to the extract. *S. aureus* followed with an

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MIC of 125 mg/ml. In contrast, *B. subtilis* and *P. aeruginosa* both recorded higher MIC values of 250 mg/ml, reflecting lower susceptibility.

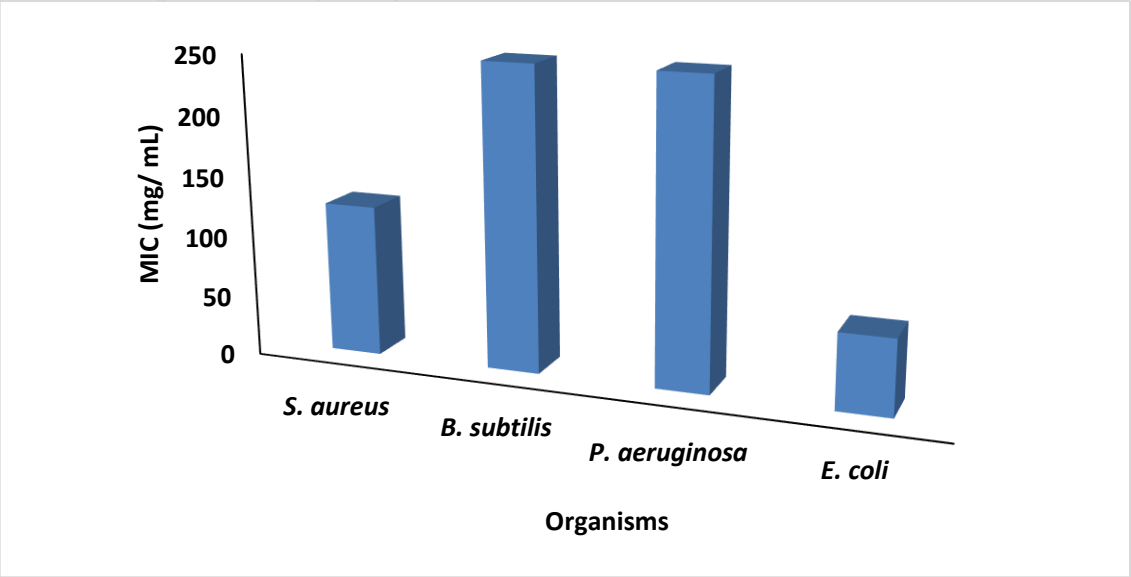


Fig.1.Results of minimum inhibitory (MIC) concentration of *E. globulus* ethanolic leaf extract

Discussion

The antibacterial activity exhibited by *Eucalyptus globulus* ethanol leaf extracts in this study aligns with substantial evidence in the scientific literature demonstrating the antimicrobial potential of *E. globulus*. This consistency underscores the broader relevance of *E. globulus* as a natural source of antimicrobial compounds with implications for alternative therapeutic use. Multiple studies have reported that *E. globulus* extracts and essential oils possess broad-spectrum antibacterial properties against both Gram-positive and Gram-negative bacteria (Fit et al., 2009; Ait-Ouazzou et al., 2011; Abirami et al., 2017; Jammoul and Nawas, 2019). More so, essential oil from the leaves of *E. globulus* demonstrated inhibitory effects against Escherichia coli and Staphylococcus aureus, supporting the general antimicrobial utility of *E. globulus* against major human pathogens. These findings have led researchers to propose the potential exploitation of *E. globulus* essential oils as natural antibiotics for infectious diseases where these bacteria are implicated (Bachir and Benali, 2012).

The presence of various phytochemicals such as phenols, tannins, flavonoids, and terpenoids in *E. globulus* extracts is frequently cited as a key factor contributing to their antimicrobial efficacy. Abirami et al. (2017) and Ewansiha et al. (2024) reported the presence of abundant phenols and flavonoids, noting that ethanol effectively extracts these compounds due to its polarity and strong solubilizing capacity. Phenolic compounds and tannins can disrupt bacterial cell walls and membranes, impairing cell integrity and leading to growth inhibition. These mechanisms are recognized in the broader plant pharmacology literature as primary modes by which plant-derived extracts inhibit microbial growth (Ewansiha et al., 2024). Several studies also suggest that the structural differences in bacterial cell walls influence susceptibility to plant extracts. Gram-negative bacteria possess an outer membrane containing lipopolysaccharides that can impede the entry of lipophilic compounds, often resulting in reduced susceptibility compared to Gram-positive organisms with more accessible peptidoglycan layers. This structural distinction may explain variations in sensitivity observed across bacterial species (Canales et al., 2025)

The bioactive compounds in *E. globulus* extracts particularly oxygenated monoterpenes like 1,8-cineole (eucalyptol), α-pinene, and others have been implicated in antibacterial activity through

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disruption of membrane integrity, inhibition of essential enzymes, and interference with cellular respiration. Moreover, synergistic interactions among these compounds may enhance overall antibacterial effects beyond what single constituents achieve alone (Ait Benlabchir et al., 2024). From an applied perspective, the efficacy of E. globulus leaf extracts suggests potential integration into complementary antimicrobial strategies, such as topical formulations for skin infections, incorporation into antiseptic washes, or inclusion in coatings for antimicrobial textiles. These applications benefit from plant extracts' natural origin, reduced risk of severe side effects, and cultural acceptance in traditional medicine, particularly in regions with limited access to conventional antibiotics.

Conclusion

The antibacterial activity of E. globulus demonstrated in this study is supported by a robust body of literature. The implications of these findings reinforce the value of *E. globulus* as a promising source of natural antibacterial agents, particularly in the ongoing search for effective strategies to address antimicrobial resistance and expand the arsenal of therapeutic options.

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FAMILY STRUCTURE AND CHILD DISCIPLINE IN IBESIKPO ASUTAN LOCAL GOVERNMENT AREA OF AKWA IBOM STATE

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Abstract
The main purpose of this study was to determine the influence of family structure on child discipline in Ibesikpo-Asutan Local Government Area of Akwa Ibom State. Two specific objectives, two research questions, and two null hypotheses guided the study. A descriptive survey research design was adopted. The population comprised approximately 7,406 heads of households from the 2 clans and 43 villages in Ibesikpo-Asutan. A sample size of 380 heads of households was determined using the Taro Yamane formula and selected through simple random sampling technique. One instrument titled Family Structure and Child Discipline Questionnaire (FSCDQ) was used for data collection. The instrument was validated by three experts; one from the Department of Home Economics, Faculty of Agriculture, one from the Department of Sociology, Faculty of Social Science and a statistician from Department of Industrial Technology, Faculty of Vocational Education, Library and Information Science, all from University of Uyo, Uyo. The reliability of the instrument was established using Cronbach Alpha, yielding a coefficient of 0.88. Out of the 380 copies of the questionnaire administered, 377 were properly completed and retrieved with the assistance of three research assistants, yielding a retrieval rate of 99.2%. Data collected were analyzed using frequency counts, mean, and independent t-test statistical tools. Findings revealed that single-parent and blended family structures highly influence child discipline in Ibesikpo-Asutan Local Government Area. The results also showed no significant difference in the mean responses of male and female heads of households regarding the influence of single-parent and blended family structures on child discipline. The study concluded that family structure plays a vital role in shaping the disciplinary approaches used by parents and caregivers, with each family type presenting its own challenges and strengths. It was recommended, among others, that Local Government Authorities should develop comprehensive parent education and family support programs targeted at equipping parents and guardians within single-parent and blended family structures.

***Keywords**: Family Structure, Single-Parent Family, Blended Family, Child Discipline.*

Introduction

Discipline is regarded as a critical aspect of child development and is often defined as a set of rules or guidelines set by parents or caregivers to teach children self-control, responsibility, and acceptable behavior. Effective discipline techniques have been associated with positive outcomes in children, such as improved social skills, academic performance, and emotional well-being. On the other hand, inadequate or inappropriate discipline strategies can lead to negative consequences, such as aggression, defiance, and low self-esteem (Sanders *et al.*, 2024). Shaw *et al.* (2018) found that authoritative discipline, characterized by warmth and support along with clear boundaries, was associated with better behavioral outcomes in children compared to authoritarian or permissive approaches. Effective discipline strategies often involve consistent enforcement of rules, redirection of negative behaviors, and positive reinforcement of desirable behaviors (Graziano *et al.*, 2017). Family structure plays a significant role in shaping a child's discipline and behavior. The interplay between family dynamics and disciplinary practices within the home environment can greatly influence a child's development and subsequent conduct (Brown and Manning, 2019). Research has indicated that children raised in different family structures exhibit varying levels of disciplinary outcomes, with factors such as parental involvement, supervision, communication, and support playing crucial roles.

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A single-parent family is a family structure in which only one parent is present to care for the children. This can occur due to various reasons, such as divorce, separation, death of a spouse, or choice to adopt or have children on their own. According to a study by McLanahan and Sandefur (2024), single-parent families are more common in the United States, with around 29% of households being headed by a single parent. The study also found that single-parent families may face economic hardships and have lower levels of parental involvement compared to two-parent households. Single-parent families play an essential role in society, and it is important to understand and support the unique needs and experiences of these families.

Another family structure is blended family, also known as a stepfamily. This is a family unit in which one or both parents have remarried or formed a new partnership, bringing children from previous relationships together under one household. This family structure can be complex as it involves the integration of individuals from different family backgrounds. Hetherington and Stanley-Hagan (2022) noted that, blending families can pose challenges such as adjusting to new family roles, managing relationships with step-siblings, and dealing with loyalty conflicts between biological and stepfamily members. However, with effective communication and support, blended families can successfully navigate these challenges and build strong, cohesive relationships. Blended families bring together individuals with diverse experiences and backgrounds, offering opportunities for growth, learning, and building new connections within the family unit.

Understanding the impact of family structure on child discipline is essential for developing effective strategies to promote positive behaviors and address disciplinary challenges. Amato and Keith (2021) explored the influence of family structure on child discipline, noting that the quality of the parent-child relationship and the level of parental involvement were crucial factors in determining disciplinary practices. The study highlighted that children from intact families tended to receive more consistent discipline and guidance compared to those from non-intact families. Bramlett and Blumberg (2017) investigated on family structure and children's physical and mental health. Using the 2003 National Survey of Children's Health, this paper examines the physical and mental health of children by family structure. Children in step, single-mother, or grandparent-only families had poorer health than children living with two biological parents. Adjusting for demographic differences reduced observed disparities, although children living in single-mother or grandparent-only families still had poorer health than children living with two biological parents. Adjusted estimates showed that children in single-father families generally did as well as (for mental health) or better than (for physical health) children living with two biological parents.

Furthermore, Wen (2018) investigated on family structure and children's health and behavior: Data from the 1999 National Survey of America's Families. Using data from the 1999 National Survey of America's Families, this research investigates the association and pathways between family structure and child well-being among children age 6 to 17. Three indicators of child well-being are examined: parent-rated health, limiting health conditions, and child behavior. Results show that both stepfamilies and intact families are advantageous relative to single-parent families. Family socioeconomic status (SES) and social capital are important factors of child well-being and help explain family structure effects. Family SES seems to have a stronger mediating effect than social capital. However, after simultaneously modeling these hypothesized mediators, significant differences in aspects of child well-being across family types persist in most cases. Findings support the idea that differences in child well-being across family types are considerably but not entirely accounted for by family SES, parental participation in religious services, parent–child relationship, and child engagement in extracurricular activities.

Exploring the influence of family structure on child discipline Ibesikpo Asutan Local Government Area, Akwa Ibom State is essential for promoting positive behavior management and healthy parent-child relationships. Understanding the relationship between family structure and child

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discipline is important for developing interventions and programs to support families in promoting positive parenting practices and healthy child development.

Statement of the problem

There is a significant variation in discipline techniques used by parents within different family structures and communication patterns, which influences child behavior and development. There is a growing body of research indicating that family dynamics, including family structure and communication patterns, play a crucial role in shaping child discipline strategies and outcomes. Personal experiences and anecdotal evidence suggest that the way parents manage discipline within the family unit can have a lasting impact on a child's behavior and emotional well-being. The importance of family dynamics in determining the effectiveness of discipline strategies and the overall well-being of children cannot be overemphasized. However, there is still a gap in understanding how specific aspect of family dynamics particularly family structure impact child discipline outcomes. Therefore, the problem statement for this study aims to investigate the influence of family structure on child discipline practices and outcomes, with the goal of providing a comprehensive understanding of how these factors interact to shape children's behavior and development.

Purpose of the Study

The main purpose of this study was to determine the influence of family structure on child discipline in Ibesikpo Asutan Local Government Area of Akwa Ibom State. Specifically, the study sought to:

i. determine the influence of single parent family on child discipline in Ibesikpo Asutan Local Government Area of Akwa Ibom State.
ii. determine the influence of blended family on child discipline in Ibesikpo Asutan Local Government Area of Akwa Ibom State.

Research Questions

The following research questions guided the study:

i. What is the influence of single parent family on child discipline in Ibesikpo Asutan Local Government Area of Akwa Ibom State?
ii. What is the influence of blended family on child discipline in Ibesikpo Asutan Local Government Area of Akwa Ibom State?

Research Hypotheses

1. There is no significant influence in the mean response of respondents on the influence of the single parent family on child discipline in Ibesikpo Asutan Local Government Area of Akwa Ibom State.

2.There is no significant influence in the mean response of respondents on the influence of blended family on child discipline in Ibesikpo Asutan Local Government Area of Akwa Ibom State.

Research Method

The study area is Ibesikpo-Asutan is a Local Government Area of Akwa Ibom State, Nigeria. Descriptive survey design was adopted for the study. Survey design is a systematic method for gathering information from a sample of entities for the purpose of constructing quantitative descriptors of the attributes of the larger population of which the entities are members (Siedlecki, 2020). The design was appropriate in this study because it sought the opinion of sampled respondents using questionnaire. The target population of the study is 7,406 heads of households from the 2 clans and 43 villages in Ibesikpo Asutan Local Government Area, Akwa Ibom State (National Population Commission, 2022). The sample size of the study is 380 heads of households. The sample was determined using Taro Yamen Formula. Multistage procedure was used to select samples for the study. Stage one involved selection of five villages from each of the two clans in the study area using stratified random sampling technique.

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Stage two involves the selection of the 38 households in each of the selected villages using simple random sampling technique. Stage three involved the use of purposive also known as judgmental, selective or subjective and snow ball also known as chain or network sampling in selecting the heads of households. This is because only household were selected as the respondents for the study and it then continued on the basis of referrals from one respondent to another (Levine, 2020).

One instrument was used for data collection for the study. The instrument was titled "Family Dynamics and Child's Discipline Questionnaire" (FDCDQ). The instrument was divided into section A and B with items in each section. Section A, contained elicited information on the demographics of the respondents while Section B contained 10 items that elicited on influence of single-parent family structure and blended family structure on child discipline. Items in section B were rated using: Strongly Agree (SA) = 4, Agree (A) = 3, Strongly Disagree (SD) = 2, Disagree (D) = 1 respectively.

Face validation of the instrument was ascertained by three experts; Two from the Department of Business Education and one from the Department of Educational Management, University of Uyo, Uyo. The experts were given the purpose, research questions, research hypotheses and instruments for the study to validate independently.

To determine the internal consistency of the instrument, the questionnaire was administered to 10 respondents from the same population of the study who were not part of the main study. A reliability of the instrument was obtained using Cronbach alpha, and it yielded the reliability coefficient of 0.88 which implies that the instrument was reliable for data collection.

Data were collected from the respondents with the help of three research assistants. The research assistants were drawn from each of the clans in the study area. A letter of introduction was obtained from the Head of Department Home Economics Education and presented to the Clan Head. The researcher and the trained research assistants distributed the questionnaire to the selected respondents in their homes in each of the clans in the local government. The purpose and objectives of the study were explained to the participants, and they were also provided instructions on how to complete the questionnaire. Out of the 380 copies of the questionnaires administered, all were retrieved but 377 copies were properly completed and used for the study giving retrieval rate of 99.2%.

Method of Data Analysis

The research questions were analyzed using frequency, Percentage, mean and standard deviation while independent t-test was used to test the research hypotheses at 0.05 level of significance.

Results

Research Question 1

What is the influence of single parent family on child discipline in Ibesikpo Asutan Local Government Area of Akwa Ibom State?

Table 1: Mean and standard deviation analysis of influence of single parent family on child discipline in Ibesikpo Asutan Local Government Area of Akwa Ibom State

SN	Items	Mean	SD	Remarks
1	Children with single parents usually lack manners	2.90	0.67	High Influence
2	Single parent fine it difficult setting rule for the child	2.81	0.66	High Influence
3	Single parent do not enforce morale rules on the child	3.04	0.68	High Influence
4	Children living with single parent exhibit deviant behaviour	2.96	0.65	High Influence
5	Children model discipline from their from single parents	2.70	0.48	High Influence
	Grand Mean	**2.88**	**0.63**	**High Influence**

N = 377

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Table 1 shows the influence of single parent family on child discipline in Ibesikpo Asutan Local Government Area of Akwa Ibom State. The result shows that all the items had the mean responses above 2.50 indicating high influence. The grand mean of 2.88 shows high influence of single parent family on child discipline in Ibesikpo Asutan Local Government Area of Akwa Ibom State.

Research Question 2

What is the influence of blended family on child discipline in Ibesikpo Asutan Local Government Area of Akwa Ibom State?

Table 2: Mean and standard deviation analysis of influence of blended family on child discipline in Ibesikpo Asutan Local Government Area of Akwa Ibom State

SN	Items	Mean	SD	Remarks
1	Children in blended homes discipline to exhibit good morale	2.71	0.46	High Influence
2	Children in blended family follows set rules	2.83	0.68	High Influence
3	Effective communication of acceptable family norms to children exist in blended homes	3.58	0.76	High Influence
4	Children are coerce to change an unacceptable behaviour in blended homes	2.70	0.49	Very High Influence
5	Children lack who to model disciple from in blended homes	2.70	0.46	High Influence
	Grand Mean	**2.90**	**0.57**	**High Influence**

N = 377

Table 2 shows the influence of blended family on child discipline in Ibesikpo Asutan Local Government Area of Akwa Ibom State. The result shows that all the items had the mean responses are above the cut-off point of 2.50 indicating high influence. The grand mean of 2.90 shows high influence of blended family on child discipline in Ibesikpo Asutan Local Government Area of Akwa Ibom State.

Research Hypothesis 1: There is no significant difference in the mean response of male and female head of households on the influence of single parent family on child discipline in Ibesikpo Asutan Local Government Area of Akwa Ibom State.

Table 3: t-test analysis for mean difference of male and female head of households on the influence of single parent family on child discipline in Ibesikpo Asutan Local Government Area

Variable	N	Mean	Std.	Df	t-cal value	P-Value	Decision
Male Head of Household	214	2.88	0.29				
				375	0.33	0.732	NS
Female Head of Household	163	2.87	0.28				

NS = Significant at .005

Table 3 indicates that the calculated t-value is 0.33 and the P-value is 0.732 at 375 degree of freedom and 0.05 level of significance. Comparison of the P-value and 0.05 level of significance shows that the p-value is less than the 0.05. Thus, the null hypothesis is retained. This implies that, there is no significant difference in the mean response of male and female head of households on the influence of

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single parent family on child discipline in Ibesikpo Asutan Local Government Area of Akwa Ibom State.

Research Hypothesis 2

There is no significant difference in the mean response of male and female head of households on the influence of blended family on child discipline in Ibesikpo Asutan Local Government Area of Akwa Ibom State.

Table 4: Independent t-test analysis showing difference in the mean response of male and female head of households on the influence of blended family on child discipline in Ibesikpo Asutan Local Government Area

Variable	N	Mean	Std.	Df	t-cal value	P-Value	Decision
Male Head of Household	214	2.90	.25				
				375	0.082	0.827	NS
Female Head of Household	163	2.90	.26				

S = Significant at .005

Table 4 indicates that the calculated t-value is 0.082 and the P-value is 0.827 at 69 degree of freedom and 0.05 level of significance. Comparison of the P-value and 0.05 level of significance shows that the p-value is greater than the 0.05. Thus, the null hypothesis is retained. This implies that, there is no significant difference in the mean response of male and female head of households on the influence of blended family on child discipline in Ibesikpo Asutan Local Government Area of Akwa Ibom State.

Discussion of Findings

Finding of the study indicates that single-parent family highly influences child discipline in Ibesikpo Asutan Local Government Area of Akwa Ibom State. Result also showed that there was no significant difference in the mean response of male and female head of households on the influence of single-parent family on child discipline in Ibesikpo Asutan Local Government Area of Akwa Ibom State. This implies that single parents often face increased responsibilities, limited resources, and higher levels of stress, which can impact their ability to consistently implement and enforce disciplinary measures. The lack of a second parental figure to share the responsibilities and provide support can lead to inconsistent or overly permissive disciplinary approaches, which can have adverse effects on child behavior and development. The ability of single parents to navigate these challenges and access the necessary support can be crucial in ensuring positive outcomes for their children.

The finding is in agreement with the findings of Amato and Anthony, (2024) investigated on estimating the effects of parental divorce and death with fixed effects models and revealed a substantial degree of variability in children's outcomes following parental divorce, with some children declining, others improving, and most not changing at all.

Findings showed that blended family type family highly influence child discipline in Ibesikpo Asutan Local Government Area of Akwa Ibom State. It is also observed that there was no significant difference in the mean response of male and female head of households on the influence of blended family on child discipline in Ibesikpo Asutan Local Government Area of Akwa Ibom State. The findings points to the fact that the presence of stepparents, the ambiguity of roles and relationships, and the lack of established emotional bonds can contribute to inconsistent or harsh disciplinary approaches, which can have adverse effects on child behavior and development. The ability of blended families to

navigate these challenges and develop collaborative disciplinary strategies is crucial for ensuring positive outcomes for children.

The finding is in-line with the findings of Wen (2018) who investigated on family structure and children's health and behavior and found that both stepfamilies and intact families are advantageous relative to single-parent families. Family socioeconomic status (SES) and social capital are important factors of child well-being and help explain family structure effects. Family SES seems to have a stronger mediating effect than social capital. The finding is in-line with Albertini and Garriga (2021) who investigated the effect of divorce on parent–child contacts it has been argued that the negative effects of divorce may possibly decrease as children's age at time of divorce increases; secondly, it has been suggested that the consequences of divorce might be less severe the more frequent marriage dissolution is in a society.

Conclusion

This study provided valuable insights into the influence of family structure on child discipline within the Ibesikpo Asutan Local Government Area of Akwa Ibom state, Nigeria. Based on the outcome of the study, households with single-parent, blended families and frequent transitions often experience harsher and more inconsistent disciplinary measures, which can have detrimental effects on their social-emotional development and behavior. Thus, these varying family configurations shape the disciplinary approaches employed by parents and caregivers, with unique challenges and strengths associated with each family structure.

Recommendations

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

1. Ministry of Education should implement teacher training and professional development programs that enhance and support children from singled parent homes. This can include modules on cultural sensitivity, collaborative problem-solving with families, and the adoption of evidenced-based, culturally-responsive classroom management techniques.
2. Counselling services should be made accessible to parents of single family type, blended and extended family type to guide them curb the challenges against effective child discipline.
3. Parents should collaborate with community organizations, religious institutions, and local leaders to develop holistic, multi-stakeholder interventions that address the root causes of disciplinary challenges and promote positive child development within the Ibesikpo Asutan Local Government Area.

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CONSTRUCTION PROCUREMENT PRACTICES AND CLIENT SATISFACTION IN AKWA IBOM STATE

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Abstract
This study determined the procurement practices of construction companies in Akwa Ibom State and how it influences client satisfaction. The Ex post facto research design was employed for the study. The population is 171, comprising 93 building executives and operational staff in building construction and management of companies operating in Akwa Ibom State and 78 corporate clients whose projects are ongoing or completed within the last 18 months. The sample size is 90 respondents. Accidental sampling was used to sample ongoing projects in the study area for inclusion. The researchers' developed instrument titled "Construction Procurement Practices and Client Satisfaction Questionnaire (CPPCSQ)" was used to gather data for the study. The instrument was subjected to face validation by three experts in the Department of Building, University of Uyo, Akwa Ibom State. The scores obtained from testing on 30 respondents was subjected to a Cronbach alpha test. This gave values of 0.85. The data generated were analyzed using mean and simple linear regression to answer the research questions and to test the null hypotheses at .05 level of significance. Findings of the study revealed a significant influence of procurement process on client satisfaction. The study recommended that regular monitoring and adjustment of procurement strategies helps maintain project alignment and ensures optimal outcomes.
***Keywords**: Procurement practice, construction projects, client satisfaction, project quality*

Introduction

In today's interconnected business environment, managing procurement and vendor relations has become imperative for the success of projects. Client satisfaction is traditionally considered to be a function of the product's performance in relation to expectations or to another standard of comparison. In the construction industry, It is a measure of how products and services supplied by a contractor meet or exceed customer expectation. Enhancing customer satisfaction and fostering customer loyalty are pivotal for businesses, given the significant importance of improving the balance between customer attitudes before and after the consumption process(Godovykh & Tasci, 2020).

Client satisfaction in projects is crucial for success, focusing on meeting or exceeding client expectations and ensuring the project delivers the *perceived* value, not just the technical output, boosting loyalty and repeat business. Project success and client satisfaction measures are anchored in the iron triangle: time, quality, and cost.

Lead time is one of the determinants of customer satisfaction in construction projects. Forcada et al. (2017) stated that since customers perceive on-time lead as an indicator of quality and efficiency, it can be stated that projects that manage to prevent schedule time overruns tend to increase customer satisfaction. Cost efficiency also plays an important role in shaping customer satisfaction. Research by Ashill et al. (2022) suggests that cost management is an integral part of project success as it affects customers' perceived value and satisfaction. Bilicia (2025) suggest that clients evaluate contractor

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performance based on the quality of the final product and adherence to budget constraints. Quality perception is another factor affecting customer satisfaction in construction projects. In their proposed construction customer satisfaction model, Durdyev et al. (2018) define service quality as a multidimensional construct that significantly affects customer satisfaction. This is also supported by the study by Hussain et al. (2019), which reveals that many quality factors, such as workmanship and material quality, directly affect customer satisfaction. However, time, quality and cost are heavily influenced by procurement practices for large projects. Thus, client satisfaction is inexplicably linked to the procurement practices of the construction company.

Procurement is a process by which companies source for and acquire goods, services, or works from an external source. Procurement processes vary according to industry, regulations, company size, and budget, but they generally include similar steps (Samson, 2025). Procurement processes can become increasingly complex depending on the size of the organization, the industry, the volume of orders, and the number of suppliers. Procurement is a vital business function, responsible for securing all the goods and services needed by an organisation. Procurement is operational in focus and ensures that the right materials and supplies are on hand when needed. Thus, it is responsible for keeping a company's wheels moving. According to System Analysis Program, SAP (2024), procurement is essential for companies as it helps in managing costs, ensuring quality, goal alignment, risk mitigation, sustainability and ethics. Procurement is the first line of defense for reducing cost and stabilizing cash flow in a business, affecting profit margins and the bottom line. This is achieved through competitive product sourcing and contract negotiations which can deliver significant cost savings. On quality, procuring the right raw materials at the right time is crucial for ensuring high-quality products. Quality encompasses every aspect of the procurement process, as the choice of materials and suppliers directly impacts product and service quality. Moreover, prioritizing quality is key to mitigating risks related to reputation, production, and legal concerns. Procurement also advances goal alignment. This is achieved through the application of strategic sourcing that aligns procurement purchases with a company's goals. Procurement also helps in managing risks. Risk can occur at every step of the procurement process – from inaccurate needs analysis to supplier delivery issues. Additional risk comes from ineffective responses to compliance obligations, unclear ethical standards, weather-related incidents, global disruptions, and similar challenges. Today's technology-powered procurement processes can provide the visibility needed to proactively identify, evaluate, and mitigate risks(SAP, 2024).

In the context of construction, procurement refers to the process of acquiring all the necessary goods, services, and resources required for a construction project to come to fruition. It encompasses a wide spectrum of activities, from sourcing raw materials, hiring contractors, and securing specialized equipment to obtaining permits, licenses, and even skilled labour (kolosky, 2024). According to Godian (2024), construction procurement is the multi-step process of acquiring goods and services for construction projects, including new builds, renovations, and repairs. It goes beyond simple purchasing by encompassing planning, bidding, contracting, and delivery. Unlike "purchasing," which refers only to the act of buying, procurement involves strategic decision-making to ensure quality, cost-efficiency, and timely delivery. According to Davidson (2023), procurement in construction refers to the crucial process of acquiring the necessary goods and services to successfully accomplish a construction project. It involves meticulously selecting the most suitable contractual arrangement, inviting tenders, and finalising the essential contracts needed to initiate the project. Additionally, procurement in

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construction often encompasses securing the required funding facilities to ensure smooth project execution.

Procurement significantly influences project cost, quality, and timeline. The choices made during procurement impact the budget by determining the costs of materials, labor, and services. The quality of materials and the competence of contractors secured through procurement directly affect the project's outcome and durability. Additionally, procurement timelines determine the project schedule, as delays in the process can lead to setbacks and disruptions(Kolosky, 2024).

Statement of the problem

In recent years, quality perception has shifted from a merely product-centric to client-centric quality, which is also referred to as a client satisfaction. Clients are demanding more from contractors beyond the final product. They want projects delivered on time, within budget and high quality. For large construction projects, maintaining client satisfaction will mean managing procurement processes effectively. Poorly managed procurement is a major source of project failure. Delays in supplier delivery, contract disputes, budget overruns, or inconsistent vendor performance can derail timelines and inflate costs. As projects become more complex, span geographies, involve multiple vendors, and face tight deadlines, the need for a structured procurement process becomes non-negotiable.

Most project failures are directly linked to inadequate procurement planning which can damage client relations and in the long run, impact negatively on the company. Unsatisfied clients not only withdraw their support and jobs, may also become public relations disaster for the company.

Purpose of the study

The purpose of this study is to determine the influence of construction procurement practices on client satisfaction in Akwa Ibom State. The specific objectives were

i. Examine the prevalent procurement practice among local contractors in Akwa Ibom State
ii. Assess the influence of construction procurement practices on client satisfaction in Akwa Ibom State

Research Questions

With the objectives of this study, the following research questions are therefore, raised to guide the study.

i. What is the prevalent procurement practice among local contractors in Akwa Ibom State?
ii. What is the influence of construction procurement practices on client satisfaction in Akwa Ibom State?

Research Hypotheses

Ho_1: There is no significant influence of construction procurement practices on client satisfaction in Akwa Ibom State.

Literature Review

Transaction Cost Theory by Ronald Coase (1937)

The Transaction cost theory, was postulated by Ronald Coase in 1937. It focusses on the concept that market economies entail costs beyond mere production—specifically, transaction costs. These encompass information search, negotiation, contracting, and enforcement costs. Williamson later expanded on the theory, identifying three primary drivers of transaction costs: asset specificity,

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uncertainty, and transaction frequency. In supply chain management, transaction cost theory offers a foundation for key decisions, including supplier selection, outsourcing choices, and governance of inter-firm relationships. Transaction cost theory is widely applicable in supply chain management, most notably in: supplier selection and evaluation frameworks, where enterprises assess potential transaction costs across suppliers to identify optimal partners; outsourcing decisions, guided by cost comparisons between in-house production and procurement from external vendors (factoring in both production and transaction costs) and the design of governance structures, where transaction characteristics (such as asset specificity) inform choices between market transactions, long-term contracts, or vertical integration.

Procurement Strategies

Procurement project management refers to the structured planning, execution, and oversight of purchasing activities within a project's lifecycle. In project-based environments, procurement is embedded into the project lifecycle, from initiation to closure, and directly influences delivery timelines, cost control, and quality assurance. Project procurement management is distinct from day-to-day ***procurement operations***. While general procurement supports ongoing business needs, procurement project management focuses on acquiring goods and services required to meet specific project objectives, within defined timelines and budgets.

All projects require an effective procurement strategy to improve efficiency, reduce costs, and gain a competitive advantage. With the wide variation in project size and type, several different construction procurement strategies have emerged, each with inherent benefits and drawbacks. Construction projects are typically handled though one of five procurement methods. Traditional, Design-bid-build, Design-build, Construction Management and Management contract:

In the traditional model, the client selects a general contractor who agrees to the financial terms laid out in the construction contract. Once work begins, the contractor takes responsibility for sourcing and material handling tasks. This method works well for small projects with minimal complexity. **Design-bid-build is** for larger projects with longer timelines, a bidding stage is added to the contractor selection process. The selected contractor will then pursue a procurement strategy that aligns with the elements laid out in their construction proposal and detailed bid.

In Design-build, this strategy involves selecting a single firm or contractor to perform both design and construction work. Since all project tasks are under the control of a single entity, this model can streamline procurement strategies that leverage existing supplier relationships and pricing agreements, especially for large and complex projects. In management contract, some clients choose to hire a management contractor to assume responsibility for all aspects of construction work, including supplier and subcontractor management. This method is selected by clients seeking to outsource day-to-day decision-making and management to another responsible and trustworthy partner. Construction management involves hiring professional construction managers to oversee the project on behalf of the owner. The managing consultant oversees individual trade contracts between sub-contractors and the owner for specified work. The construction manager acts as the owner's representative on the project, planning, scheduling, procuring materials, and coordinating work without assuming financial liability for cost overruns. This method allows owners to use their preferred contractors and maintain cost control while gaining professional management expertise and logistics support throughout construction(Schwartz, 2025).

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The choice of construction procurement methods and strategies impacts roles and responsibilities, collaboration methods, and project risks. The strategy selected must also provide adequate oversight to ensure procurement issues do not lead to delays or shortages.

Chinedum, et al, (2019) examined the performance of two project procurement methods commonly used in project construction, the direct labour and contracting system. Using cost, time and quality as assessment criteria, the work seek to determine possible advantage of one method over the other. Quasi-experimental design and questionnaire were combined to carry this study. Sample size was 30 experts. Respondents were mainly officers and building contractors, key players in project procurement. Frequencies, percentages and mean were used for the analysis. Results obtained showed that there was no significant difference between the two methods in terms of cost overrun, though overall cost was higher for the direct labour method. It also revealed a significant difference between time overrun for the two methods as direct method took longer time.

Client Satisfaction in project delivery and construction procurement

Customer satisfaction in construction is a multifaceted concept that revolves around the overall experience clients have throughout the lifecycle of a project. The growth and development of the construction industry is dependent on customer satisfaction. According to Omonori and Lawal (2015), customer dissatisfaction poses the greatest threat to the future of the construction industry. Construction industry growth and prosperity can only be achieved if prospective customers or clients are attracted by investment opportunities in the industry.

In the construction industry, there are two classes of clients- private and public clients. The private client often include individual developers as well as corporate organizations, while the public client are mostly governments as well as their agencies and parastatals. Shruthi. et al (2017) stated that satisfying clients is key in projects and can be seen as either a goal or a measurement tool in the development of construction quality. Karna et al (2004) in Oluwaseun and Abiodun (2021) commenting further, stated that in construction, the relationship between the client and contractor constitutes a multilevel complex in which parties operate and collaborate with in-groups networks. Thus, client satisfaction in construction should be understood as a relationship specific rather than a transaction specific construct. In contrast to other areas of production where there is long term relationship between the client and supplier. The relationship in construction is periodic and dependent on the duration of the project. Barret (2008) highlighted that clients satisfaction is the ultimate measure of construction quality and will be achieved if construction companies (firms) addresses full range of quality dimensions that impact on the client (customer). The client satisfaction experienced with constructed facility and the contracting service defines project-level quality in construction. It is a desire or want of what client (customer) feel that a service provider (contractor) should offer rather than would offer(Oluwaseun & Abiodun, 2021).

There are several stakeholders involved in the procurement process. Nonetheless, in construction industry, researchers submitted that there are no common methods of measuring clients/customer satisfaction. Generally, in construction, expectations and perceived service quality are the functions of customers/clients satisfaction. These expectations, subsequently, forms a frame of reference by which one makes a comparative judgment and gains satisfaction. Karna et al (2004) in Oluwaseun and Abiodun (2021) stated that clients compare the perceived performance of a service with some performance standard and the dissatisfaction is perceived when the performance falls short of the

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standard (negatively disconfirmed). Consequently, when quality is ambiguous or difficult to evaluate as a result of changes in plan and execution, client expectations play a greater role in determining satisfaction. Thus, the client also plays an vital role in appraising the performance of contractor. Subsequently, client satisfaction in the construction industry can be premised on how well a contractor meets the clients' expectations.

Clients are the major initiators of projects. Expectedly, project initiators is have their personal goals for such construction project that will bring them satisfaction and success. According to Oluwaseun and Abiodun (2021), most often, success factors, and by extension client satisfaction criteria, are established at the beginning of a project and tend to remain fixed, whereas some of may evolve over time. The satisfaction level are the measures of differences between expectation and level of performances.

Clients' satisfaction can be measured through direct inquiry and indirectly as well by repeat business (re-use) and use referrals from a clients. Referrals and re-use of contractors are especially more applicable to private sector procurements as most public sector procedures tend to follow strict competitive rules that may not allow these practices. With respect to procurement and client satisfaction, Rashvand and Majid (2014) stated that clients satisfaction in construction industry can be achieved by adopting flexible procurement approach. An effective procurement management helps manage project time, reduce the rapidly spiraling cost of construction, minimize the high interest rate period, meeting clients' demands of better value for money and an earlier return on investment. The flexibility procurement approach also helps in utilizing the vast amount of knowledge and practical experience of contractors at early stages of the project life cycle which makes a valuable contribution to a successful outcome.

Oluwaseun and Abiodun(2021) investigated the attributable factors that influences client satisfaction in building construction projects. The respondent were purposively selected and 120 questionnaires were administered but 90 responses were found useful. The data used in this research were sourced from both primary and secondary sources. Indicative findings from the questionnaire survey established the variance degree of the attributable factors as it contributes to clients satisfaction in building construction projects. The study therefore establishes the type of factors that significantly influences clients satisfaction and recommended that project participants should endeavor to promote its success in their project execution.

Ayegun, et al (2018) assessed clients' perception and satisfaction with project quality delivery in Nigeria. The aim of the study is to evaluate and compare the current and desired level of the satisfaction of clients with the quality of projects delivered. 115 responses were received from construction professionals working in clients' organizations, and the data were collated and analyzed. The findings revealed that clients relate quality to compliance with specification and design standards. The results also showed that factors influencing project quality in the Nigerian construction industry are management commitment, regular inspections, and audits, skilled workforce.

Methodology

This study adopted the Ex post facto research design. The study area is Akwa Ibom State, Nigeria. The population is 171, comprising 93 building executives and operational staff in building construction and management of companies operating in Akwa Ibom State and 78 staff members of the Akwa Ibom State ministry of works and housing. The sample size is 90 respondents. This comprised 50 building

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executives and operational staff from building, architectural, engineering and construction companies in Akwa Ibom State and 40 corporate client representatives. Accidental sampling was used to sample respondents based on availability at site or office. The researcher developed instrument titled "Construction Procurement Practices and Client Satisfaction Questionnaire (CPPCSQ)" was used to gather data for the study. The instrument developed by the researchers was face validated by three experts in the Department of Building, University of Uyo, Akwa Ibom State. The experts assessed the instrument in terms of appropriateness of material to the constructs under study. The instrument was subjected to a pilot test to determine the reliability. The instrument was trial tested on 30 respondents who are not part of the sample but part of the study area. The scores obtained was subjected to a Cronbach alpha test. This gave a value of 0.85. Based on the high reliability index, the instruments were deemed fit for use for the study. The data generated were analyzed using mean and simple linear regression to answer the research questions and to test the null hypotheses at .05 level of significance. In testing the null hypotheses, when $P \leq .05$, the null hypothesis will be rejected. On the other hand, when $P \geq .05$, the null hypotheses will be upheld.

The Model Specification

The data was analyzed using the regression analysis, with the dependent variable as project cost, time, client satisfaction and project quality.

In order to ascertain the impact of procurement practices on project deliverables**,** the following econometric models were specified:

$Y = f(X) + \mu$. The above model could be re-constructed as thus;

$YPP_{it} = \beta 0 + \beta 1 Cli_Sat.it + \mu it$ ……. (1)

Where: $\beta 0$ = Intercept of the regression $\beta 1$ = Coefficients of client satisfaction, μit = error term capturing other explanatory variables not explicitly included in the model of firm í in period t Y = Independent variable (procurement processes, PP) t = time period.

Presentation of Findings

Research Question 1: What is the prevalent procurement practice among local contractors in Akwa Ibom State?

Table 1: Summary of Procurement Strategies applied by local contractors in Akwa Ibom State

Construction Procurement Strategies	VGE	GE	ME	LE	VLE	Mean	Ranking
Traditional Method	53	65	24	8	9	3.91	1st
Management contract	28	26	13	34	58	2.57	5th
Design and construct (Build)	42	65	35	12	5	3.80	2nd
Public private partnership (PPP)	21	26	13	41	58	2.44	6th
Direct Labor	42	68	32	8	9	3.79	3rd
Construction Management	38	45	35	29	12	3.43	4th

Table 1 presents the frequency and mean values of respondents on the different procurement practices of construction companies operating in Akwa Ibom State. The result shows that the traditional method of design-bid -and build (DBB) is 3.91, ranking 1st as the most practiced procurement strategy. This

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was closely followed by design and build (DB) ranking second with a mean value of 3.80. direct labour was ranked third with a mean value of 3.79, construction management have a mean value of 3.43, ranking fourth, while management contract has a mean value of 2.57 and was ranked 5th and public private partnership (PPP) has a mean value of 2.44 and ranked 6th.

Research Question 2: What is the influence of construction procurement practices on client satisfaction in Akwa Ibom State?

Ho_1: There is no significant influence of construction procurement practices on client satisfaction in Akwa Ibom State.

Table 2: Summary of regression test for influence of construction procurement practices on client satisfaction

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	8.340	17.154		.486	.630
	Procurement_process	.704	.296	.360	2.376	.023

a. Dependent Variable: Client_satisfaction

Fcal=5.644, Fstat=.023

Table 2 gives the summary of the linear regression analysis. The result shows a coefficient value of .704, indicating a positive and linear effect of procurement processes on client satisfaction. As the procurement process gets better, client satisfaction increases. The fcal is 5.644, while the probability value (Fstat) is .023. since the probability value is less than the alpha level of .05 ($p<.05$), the result is statistically significant. Thus, there is a positive significant influence of construction procurement practices on client satisfaction in Akwa Ibom State.

Discussion of Results

The result of analysis ranks the procurement strategies based on frequency of utilization by construction companies in Akwa Ibom State. The findings showed that the traditional method of design-bid-build is the most utilized procurement strategy for public contracts. This was followed by design and build and direct labour procurement. Construction management and management contract were ranked 4th and 5th, while public private partnership was the least applied procurement strategy. Most corporate jobs are often presented using the DBB and DB, while contractors often utilize construction management and direct labour in managing procurement. Public private partnerships is starting to gain momentum among governments and companies. Nonetheless, the drawback is the challenge of tying down investments for longer periods. Contractors still prefer contracts where they bid and are paid for jobs when completed, not having to wait for returns over time. Furthermore, most construction companies are project companies, which focus on the completion of projects and moving on to another project.

This finding is corroborated by Chinedum, et al, (2019) who investigated the performance of two project procurement methods commonly used in project construction, the direct labour and contracting system. The study found that there was no difference in the utilization of direct labour and contracting, signifying that both methods are utilized by construction companies.

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Findings from analysis shows a high positive influence of procurement processes on client satisfaction. The hypothesis test confirms a significant positive influence of procurement processes on project client satisfaction in Akwa Ibom State. The clients expressed satisfaction on the project delivery based on procurement processes as very good. This shows a great impact of procurement processes on satisfaction. This finding is in tandem with Oluwaseun and Abiodun(2021) who investigated the attributable factors that influences client satisfaction in building construction projects. The study found that effective procurement management final project outcome greatly influenced client satisfaction. The finding is also in agreement with Ayegun, et al (2018) who assessed clients' perception and satisfaction with project quality delivery in Nigeria. The results also showed that factors influencing project quality in the Nigerian construction industry are management commitment, regular inspections, and audits, skilled workforce.

Conclusion

In the construction industry, the intricacies of procurement have emerged as a pivotal factor in determining the success of projects, both large and small. Based on the findings of the study, it is concluded that clients' satisfaction is impacted by the procurement process and where project procurement are well managed, the client satisfaction is also positive.

Recommendations

Based on the findings of the study, the following recommendations are therefore made;

1. Regular meetings between construction companies and client representatives should be held to review project milestones and work done.
2. Adopt Integrated Quality Management Systems that encompass planning, assurance, and control processes from project inception to completion. This ensures consistency and alignment with project objectives.
3. Incorporate lean construction principles to minimize waste, optimize workflows, and foster collaborative teamwork among project stakeholders.
4. Regular monitoring and adjustment of procurement strategies helps maintain project alignment and ensures optimal outcomes.

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FROM LINEAR TO CIRCULAR: A SURVEY OF PRE-SERVICE TVET TEACHERS' READINESS FOR CIRCULAR ENTREPRENEURSHIP IN NIGERIAN COLLEGES OF EDUCATION

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Abstract
The global shift towards a circular economy (CE) is essential for sustainable development, demanding a workforce equipped with relevant skills. In Nigeria, Technical and Vocational Education and Training (TVET) is strategically positioned to foster such green skills and entrepreneurial mindsets. However, it remains unclear whether future TVET educators possess the necessary awareness and readiness to drive this transition. This study, therefore, assessed the level of awareness of circular economy concepts and evaluated the entrepreneurial readiness for circular entrepreneurship among final-year TVET students in Nigerian Colleges of Education. A descriptive survey research design was adopted, and data were collected via a structured questionnaire from a census of 511 final-year TVET students across two government-owned Colleges of Education in Southwest, Nigeria. Data were analyzed using descriptive statistics of mean and standard deviation. Findings revealed that the pre-service TVET educators demonstrated a low level of CE awareness (Cumulative Mean=2.08), with a majority only familiar with basic environmental principles like "reduce, reuse, recycle" but not the broader CE framework. Furthermore, while they showed a positive disposition and willingness to engage in circular entrepreneurship, their overall entrepreneurial readiness was low (Cumulative Mean=2.35), marked by a critical lack of confidence in concrete skills such as identifying business opportunities, developing business plans, and starting recycling ventures. The study concludes that a significant gap exists between students' intentions and their perceived capabilities, underscoring an urgent need for curriculum reform. It is recommended that TVET curricula be revised to integrate CE principles and practical, experiential entrepreneurship education to equip graduates as catalysts for Nigeria's transition to a circular economy.
Keywords: Circular Economy, Entrepreneurship, Readiness, TVET, Sustainability.

Introduction

The traditional economy operates on a "take-make-dispose" model, in which finite resources are extracted, manufactured into products, and then discarded as waste after use (Ellen Macarthur foundation, 2023). This one-directional process typically underutilizes materials, drives climate change and biodiversity loss amongst other sustainability crises. By contrast, a circular economy is built on design principles that eliminate waste and pollution, circulate products and materials at their highest value, and regenerate natural systems. In a circular model, goods are designed for reuse, repair, and recycling, keeping resources in use and ecosystems intact.

Globally, this transition is seen as essential to sustainable development and Nigeria is not left out. In committing to this new paradigm, the Nigerian government has even gone ahead to launch a national Circular Economy Programme (NCEP) with a roadmap to shift from a traditional linear economy to a sustainable circular one by 2050 (AGDF, 2024). This signals that Nigeria recognizes the need to redefine its development model in the face of resource scarcity and environmental pressures.Nigeria has a country faces the challenges of rapid urbanization, growing populations, and mounting waste which makes adoption of circular strategies especially urgent (Nkanta. 2024). For example, Nigeria's climate commitments now explicitly aim to integrate waste reduction, indicating an

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intention to apply circular approaches to lower emissions. Yet, as noted by Adesua-Lincoln (2025), the country still has no explicit circular economy legislation, only a patchwork of environmental laws such as the National Plastic Waste Policy that touch on circular concepts. In practice, therefore, circular practices have been driven largely by entrepreneurs and informal actors as local innovators have begun converting waste streams into opportunities. Startups like WeCyclers and RecyclePoints in Lagos, for instance, incentivize residents to collect recyclables, turning discarded plastics into marketable goods (Nkanta. 2024). These examples illustrate the kinds of grassroots circular initiatives emerging in Nigeria even as national policy catches up.

At its core, a circular economy depends on new business models and entrepreneurial innovation. Products and services must be conceived so their materials retain value through reuse, repair, or remanufacturing (Ellen Macarthur Foundation, 2023). Okoye (2023) defines the circular economy as an economic system that replaces the "end-of-life" mindset with loops of reduce, reuse, and recycle, thereby achieving environmental quality, economic prosperity, and social equity for current and future generations. In this framework, entrepreneurs are important agents as they develop and commercialize the innovations needed to transform waste into inputs for new products, generating markets and jobs in the process. In Nigeria's case, circular entrepreneurs might tackle local challenges by building ventures around plastic recycling, electronic waste refurbishment, or bioenergy from farm residues, turning liabilities into value. Indeed, by creating green jobs and resilient supply chains, circular entrepreneurship aligns closely with global sustainability.

Technical and Vocational Education and Training (TVET) is seen worldwide as a key vehicle for entrepreneurship education. Researchers observe that TVET's purpose is not only to train skilled workers but also to instill business and innovation skills for self-reliance (Oshotoye & Adewale (2024); Akpan et. al (2022). As Akpan et al. (2022) argue, embedding entrepreneurship in TVET helps graduates to organize other factors of production to make a meaningful living, thereby tackling youth unemployment and related social problems. This view has been echoed by the National Board for Technical Education (NBTE) which emphasized that entrepreneurship holds the key to self-reliance and declare that about 90% of Nigerians work in small and medium enterprises, underscoring the need for entrepreneurial skills in vocational training (NBTE, 2024). As a result, the board needs to update the TVET curricula by placing greater emphasis on creativity, innovation, and practical skills so that trainees can become job creators rather than job-seekers

College of Education is one of Nigeria's tertiary education systems, primarily committed to the training of teachers for basic and secondary levels of education in the country. The colleges offer three years teacher education programme and award the Nigerian Certificate of Education (NCE). The system is segmented according to the structure of programmes. One of the segments is the School of Secondary Education (Technical and Vocational Programmes) where Technical and Vocational Education Training (TVET) programmes such as Business Education, Agricultural Science Education, Fine Arts Education, Home Economics Education and hosts of others are hosted. The students offering these programmes are being trained as secondary-level vocational educators and technicians. As future TVET teachers, their attitudes and skills toward entrepreneurship will influence not only their own career paths but also the trainees they eventually teach. It is therefore a fitting context in which to examine awareness of circular concepts of the would-be teacher. If graduates from Colleges of Education understand circular entrepreneurship, they can integrate it into their lesson plans and their own enterprises. Conversely, if they lack this knowledge, circular economy principles may never filter into Nigeria's technical education system. Thus, it is crucial to assess how prepared these future educators are for the shift from linear to circular models.

Ultimately, evaluating Nigeria's Colleges of Education TVET students' readiness for circular entrepreneurship addresses an urgent national need. If future teachers and technicians can embrace sustainable business models, they may catalyze innovation that turns "take-make-waste" industries into circular ones. This research sets the stage for such transformation by identifying gaps in current

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education and attitudes. In doing so, it contributes to a deeper understanding of how Nigeria's educational policies and entrepreneurial ecosystems must evolve to achieve economic resilience and environmental sustainability.

Statement of the Problem

The global shift toward a circular economy (CE) demands a workforce skilled in sustainable enterprise. In Nigeria, there are high-level initiatives such as the Circular Economy Youth Empowerment Initiative which aim to train and equip young Nigerians with the skills to convert waste into eco-friendly products, sustainable businesses, and valuable resources (Federal Ministry of Education, 2025). Technical and Vocational Education and Training (TVET) institutions are seen as crucial for developing such green skills. However, it remains unclear whether Nigerian TVET students currently possess awareness of CE concepts or entrepreneurial readiness to exploit emerging waste-to-wealth opportunities.

It is therefore germane to investigate this knowledge gap because if students lack understanding of the circular economy concepts, national sustainability goals and youth entrepreneurship may suffer. There is currently a paucity of research on whether Nigerian TVET graduates are entrepreneurially ready. This study therefore examines the level of CE awareness and the extent of entrepreneurial preparedness among final-year TVET students at Nigerian Colleges of Education.

Research Objectives

6. To assess the level of awareness and knowledge of circular economy concepts among TVET students in Nigerian Colleges of Education
7. To evaluate the entrepreneurial readiness of TVET students in Nigerian Colleges of Education to engage in circular entrepreneurship.

Research Questions

1. What is the level of awareness and knowledge of circular economy concepts among TVET students in Nigerian Colleges of Education?
2. To what extent are TVET students in Nigerian Colleges of Education prepared entrepreneurially to engage in circular entrepreneurship?

Methodology

The study adopted a descriptive survey research design. This design was appropriate as it allowed for the collection of data from a sample of a population to describe the levels of awareness and entrepreneurial readiness at a specific point in time. The population for the study comprised all final-year (NCE III) Technical and Vocational Education and Training (TVET) students in the two government-owned Colleges of Education in Southwest, Nigeria: Federal College of Education (Special), Oyo, and Oyo State College of Education, Lanlate. A census sampling technique was employed, whereby the entire population of 535 final-year TVET students across both colleges was invited to participate. No sampling was done due to the manageable size of the population. The instrument used for data collection was a researcher-constructed questionnaire titled "Circular Economy Awareness and Entrepreneurial Readiness Questionnaire (CEAERQ)". The questionnaire was structured into three sections (A, B, and C). Section A solicited information on the respondents' demographic characteristics such as age, gender, and specific TVET programme. Section B contained 15 items designed to measure students' awareness and knowledge of circular economy concepts. Section C contained 10 items designed to measure students' entrepreneurial readiness to engage in circular entrepreneurship. All items in Sections B and C were structured on a 4-point Likert scale of measurement with the following options: Strongly Disagree (SD) = 1, Disagree (D) = 2, Agree (A) = 3, Strongly Agree (SA) = 4. The face validity of the questionnaire was established by presenting the instrument to two experts in the fields of Vocational Education and Entrepreneurship Education. Their

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corrections and suggestions were used to refine the instrument for clarity and appropriateness. The reliability of the instrument was established through a pilot study conducted with 20 final-year TVET students from a College of Education not involved in the main study. The data collected were analyzed using Cronbach's Alpha, which yielded a coefficient of 0.79 for the awareness scale and 0.82 for the entrepreneurial readiness scale, indicating that the instrument was reliable for the study. After approval from the relevant authorities in the two colleges, 535 questionnaires were administered directly to the final-year TVET students in their classrooms with the permission of their heads of department. The purpose of the study was explained to the respondents, and they were assured of the confidentiality of their responses. The completed questionnaires were collected immediately upon completion. Out of the 535 questionnaires distributed, 511 were duly completed, retrieved, and found usable for data analysis, giving a response rate of 95.5%. The non-response was due to the absence of some students on the days of administration. The data collected were analyzed using the Statistical Package for the Social Sciences (SPSS) version 27. Descriptive statistics of mean and standard deviation were used to answer the research questions. The mean scores for the items and the entire scale were interpreted based on the following real limits of numbers: Strongly Agree (SA)= 3.50 – 4.00, Agree (A)= 2.50 – 3.49**,** Disagree (D)= 1.50 – 2.49**,** Strongly Disagree (SD)= 1.00 – 1.49

Data Analyses and Results

Demographic Characteristics of Respondents

Table 1: Demographic Profile of Respondents by College and Department (N=511)

College	Department	Frequency	Percentage (%)
FCE (Special), Oyo	Business Education	225	44.0
	Agricultural Education	86	16.8
	Home Economics Education	14	2.7
	Fine Arts Education	18	3.5
	Technical Education	1	0.2
	Total	**344**	**67.3%**
Oyo State CoE, Lanlate	Business Education	110	21.5
	Agricultural Education	20	3.9
	Home Economics Education	24	4.7
	Fine Arts Education	10	2.0
	Technical Education	3	0.6
	Total	**167**	**32.7%**
	Business Education	335	65.5
	Agricultural Education	106	20.7
	Home Economics Education	38	7.4
	Fine Arts Education	28	5.5
	Technical Education	4	0.8
	Total	**511**	**100%**
Gender	Female	367	71.8
	Male	144	28.2
	Total	511	100%

Source: Field Study, 2025

The demographic characteristics of the 511 respondents were examined. Table 1 provides a detailed breakdown of the sample by college and department. The Federal College of Education (Special), Oyo, contributed the majority of respondents (67.3%, n=344), while Oyo State College of

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Education, Lanlate, contributed 32.7% (n=167). In terms of departmental distribution, Business Education was the most represented programme in both colleges, constituting 44.0% (n=225) of the sample from FCE (Special), Oyo and 21.5% (n=110) from Oyo State CoE, Lanlate, for a combined total of 65.5% (n=335). Agricultural Education was the second largest department, with 16.8% (n=86) from FCE Oyo and 3.9% (n=20) from Lanlate. The gender distribution for the entire sample shows a predominance of female respondents (71.8%, n=367).

Research Question One: What is the level of awareness and knowledge of circular economy concepts among TVET students in Nigerian Colleges of Education?

Table 2: Frequency, Percentage, Mean, and Standard Deviation of Respondents on Awareness and Knowledge of Circular Economy Concepts

S/N	Item	SD	D	A	SA	Mean	SD	Decision
1.	I understand what the term. "Circular Economy" means	102 (20%)	255 (50%)	128 (25%)	26 (5%)	2.15	0.82	Disagree
2.	I am aware that a CE aims to eliminate waste and pollution	92 (18%)	240 (47%)	153 (30%)	26 (5%)	2.22	0.81	Disagree
3.	I know that the traditional "take-make-dispose" model is harmful	77 (15%)	230 (45%)	179 (35%)	25 (5%)	2.30	0.79	Disagree
4.	I understand that waste can be a. valuable resource	110 (22%)	270 (53%)	115 (23%)	16 (3%)	2.06	0.75	Disagree
5.	I am aware of the "reduce, reuse, and recycle" principles	41 (8%)	120 (23%)	256 (50%)	94 (18%)	2.79	0.85	Agree
6.	I know that products can be designed for repair and longer use	118 (23%)	281 (55%)	102 (20%)	10 (2%)	2.01	0.71	Disagree
7.	I am aware of the Nigerian government's Circular Economy Programme.	210 (41%)	240 (47%)	51 (10%)	10 (2%)	1.73	0.71	Disagree
8.	I know about local examples of circular businesses (e.g., WeCyclers).	224 (44%)	245 (48%)	36 (7%)	6 (1%)	1.65	0.67	Disagree
9.	I understand how CE can create. new job opportunities	87 (17%)	235 (46%)	168 (33%)	21 (4%)	2.24	0.77	Disagree
10.	I am aware that circular practices can help fight climate change.	95 (19%)	250 (49%)	148 (29%)	18 (4%)	2.17	0.77	Disagree
11.	I know the difference between a linear and a circular economy	125 (24%)	270 (53%)	102 (20%)	14 (3%)	2.02	0.74	Disagree
12.	I understand the concept of turning organic waste into energy.	195 (38%)	250 (49%)	56 (11%)	10 (2%)	1.77	0.71	Disagree

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13. I am aware that electronic waste (e-waste) can be refurbished	112 (22%)	275 (54%)	112 (22%)	12 (2%)	2.04	0.73	Disagree
14. I know that a CE helps in conserving natural resources.	80 (16%)	225 (44%)	184 (36%)	22 (4%)	2.28	0.77	Disagree
15. I feel informed about how CE principles work in practice.	132 (26%)	265 (52%)	102 (20%)	12 (2%)	1.98	0.73	Disagree
Cumulative Mean					**2.08**	**0.75**	**Disagree**

Source: Field Study, 2025

Table 2 presents the data on the awareness and knowledge of circular economy (CE) concepts. The cumulative mean of 2.08 firmly places the overall awareness level in the "Disagree" category. The frequency distributions provide a stark picture: for most items, a overwhelming majority of respondents (ranging from 67% to 92% across different items) selected Strongly Disagree or Disagree. This indicates a widespread lack of familiarity with core CE concepts. The only exception is Item 5, concerning awareness of the "reduce, reuse, and recycle" principles, where 68% of respondents agreed or strongly agreed (Mean=2.79). This suggests that students are familiar with this basic environmental mantra but have not connected it to the broader, systemic framework of a circular economy. Notably, knowledge of national initiatives (Item 7) and local examples (Item 8) was particularly low, with over 85% of respondents disagreeing or strongly disagreeing with these statements.

Research Question Two: To what extent are TVET students in Nigerian Colleges of Education prepared entrepreneurially to engage in circular entrepreneurship?

Table 3: Frequency, Percentage, Mean, and Standard Deviation of Respondents on Entrepreneurial Readiness for Circular Entrepreneurship

S/N Item	SD	D	A	SA	Mean	SD	Decision
16. I have the skills to identify business. opportunities in waste management	105 (21%)	275 (54%)	115 (23%)	16 (3%)	2.07	0.76	Disagree
17. I am confident in my ability to start a business that recycles waste	118 (23%)	281 (55%)	102 (20%)	10 (2%)	2.01	0.72	Disagree
18. I can develop a simple business plan for a circular venture.	128 (25%)	270 (53%)	102 (20%)	11 (2%)	1.99	0.74	Disagree
19. I am willing to take the risk to become a circular entrepreneur.	62 (12%)	160 (31%)	230 (45%)	59 (12%)	2.57	0.86	Agree
20. My TVET education has prepared me to be an entrepreneur	92 (18%)	245 (48%)	153 (30%)	21 (4%)	2.20	0.78	Disagree
21. I see myself starting a business based on circular principles.	100 (20%)	260 (51%)	133 (26%)	18 (4%)	2.13	0.77	Disagree
22. I am motivated to solve environ-mental problems through business.	56 (11%)	150 (29%)	240 (47%)	65 (13%)	2.62	0.84	Agree

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23. I believe there is a profitable market for recycled products	72 (14%)	180 (35%)	214 (42%)	45 (9%)	2.46	0.83	Disagree
24. I have the perseverance to overcome challenges in starting a business	59 (12%)	155 (30%)	240 (47%)	57 (11%)	2.57	0.83	Agree
25. I am ready to learn new skills to succeed as a circular entrepreneur.	31 (6%)	120 (23%)	260 (51%)	100 (20%)	2.85	0.82	Agree
Cumulative Mean					**2.35**	**0.79**	**Disagree**

Source: Field Study, 2025

Table 3 presents the analysed data on entrepreneurial readiness. The cumulative mean of 2.35 falls within the "Disagree" category, indicating an overall low level of preparedness. The frequency data reveals a critical divergence between students' intentions and their perceived capabilities. On one hand, a significant portion of students showed a positive disposition towards entrepreneurship. Notably, 57% were willing to take the risk (Item 19), 60% were motivated by environmental problem-solving (Item 22), 58% believed in their perseverance (Item 24), and a strong majority of 71% expressed readiness to learn new skills (Item 25). On the other hand, students overwhelmingly lacked confidence in their concrete entrepreneurial abilities. Between 74% and 78% of respondents felt they did not possess the skills to identify opportunities (Item 16), start a recycling business (Item 17), or develop a business plan (Item 18). Furthermore, 66% felt their TVET education had not prepared them for entrepreneurship (Item 20). This clear gap highlights that while students have the will and motivation, they do not believe they currently have the requisite skills or training to act on it.

Discussion of findings

This study set out to understand how well final-year TVET students in Nigerian Colleges of Education know about circular economy concepts and how ready they are to embrace circular entrepreneurship. The findings reveal a complex reality: while many students show enthusiasm and intention toward circular entrepreneurship, their knowledge and practical skills remain insufficient. Most students displayed limited familiarity with circular economy principles, often reducing these to the basic "reduce, reuse, recycle" mantra without grasping the broader economic and systemic dimensions. This echoes research by Adesua-Lincoln (2025) and aligns with broader analyses that highlight the nascent stage of circular economy awareness in Nigeria, where policies and curricula have yet to fully integrate these concepts (Okorie & Ekong, 2024). For instance, studies emphasize that national initiatives such as the Nigerian Circular Economy Programme (NCEP) are not widely recognized among educational cohorts, indicating gaps between high-level policy frameworks and grassroots educational experiences (Ifeanyi & Adebayo, 2023).

The study also notably found a clear divergence between students' positive entrepreneurial intentions and their perceived capabilities. While many expressed willingness and motivation to engage in circular entrepreneurship, a large majority felt unequipped with essential skills like opportunity identification and business planning. This reflects findings from Okoye et al. (2023) and Nkanta (2024), who point out that prevailing TVET curricula in Nigeria remain overly theoretical and insufficiently practical, failing to translate motivation into capabilities. The emphasis in TVET on job-seeking over job-creating skills has been frequently critiqued in the literature, underscoring the urgent need to reorient training toward fostering innovation and entrepreneurial self-reliance (Akpan et al., 2022; Oshotoye & Adewale, 2024). This gap between motivation and skill suggests that despite a fertile entrepreneurial mindset among students, the lack of experiential learning opportunities and practical skill development hampers their preparedness to launch circular ventures. Research advocates for embedding hands-on pedagogical strategies such as project-based learning, mentorship programs, and

exposure to local circular enterprises to bridge this divide effectively (Ekwe & Emeche, 2022; Ugochukwu & Nwafor, 2023). Ultimately, the findings highlight an urgent need for Nigerian TVET institutions to update curricula and teaching methods to support the transition toward a circular economy and sustainable entrepreneurial practices.

Conclusion

From the study's findings, it is clear that final-year TVET students in Nigerian Colleges of Education generally have a low level of awareness about circular economy concepts and are not fully prepared to engage in circular entrepreneurship. While they do possess some basic environmental knowledge, they lack a deeper understanding of how to apply those principles within a systemic circular model. This gap means their potential to drive Nigeria's shift from a linear to a circular economy, both through their future teaching and entrepreneurial activities is largely unrealized.

There is also a notable divide between the students' motivation and their perceived capabilities. Many want to become circular entrepreneurs but don't feel equipped with the skills or confidence to do so. This points to shortcomings in the current curriculum and TVET training methods, which need urgent revision to blend circular economy theory with practical entrepreneurial training. Updating TVET education in this way would better prepare graduates to be effective agents of sustainable development.

Recommendations

Based on the findings, several important steps are suggested:

Curriculum and Teaching Practices: TVET lecturers should adopt more hands-on, experiential teaching strategies that build practical skills. The curriculum must explicitly include circular economy concepts through project-based learning, local case studies, and workshops focused on real-world applications like waste upcycling and sustainable design.

Institutional Leadership: Tertiary institution management should prioritize active, skill-building teaching approaches and support students through field visits to circular businesses and partnerships with local entrepreneurs for mentorship and exposure.

Policymakers: Authorities like National Commission for Colleges of Education (NCCE), National board for Technical Education (NBTE), National Universities Commission (NUC) and others need to review and revise the TVET curriculum to integrate circular economy principles and entrepreneurship education more effectively. They should also provide resources and training for lecturers to stay current with these concepts and teaching methods.

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Innovative Pedagogies in English Language Teaching: Integrating Sustainability and Green Innovation into Learning Practices

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Abstract
This paper investigates the role of innovative pedagogies in integrating sustainability and green innovation into English language teaching. It argues that English classrooms extend beyond linguistic training to become platforms for environmental awareness and global citizenship. By embedding sustainability themes into reading, writing, speaking, and listening tasks, learners gain both communicative competence and ecological consciousness. This paper adopts a descriptive qualitative approach based on content analysis of existing literature and classroom-based case examples. Data sources include peer-reviewed articles, policy documents, and teaching models that demonstrate how sustainability and green innovation can be incorporated into English language teaching. Pedagogical strategies such as project-based learning, task-based instruction, and digital innovations provide opportunities for students to design eco-friendly campaigns, debate environmental policies, and produce creative solutions to global challenges. The study underscores the nexus between sustainability, green innovation, and education, emphasising the transformative potential of English pedagogy in shaping environmentally responsible learners. ELT classrooms can serve as effective platforms for sustainability education.
Keywords: English language teaching, Innovative pedagogies, Environmental awareness, Ecological consciousness, Global challenges

Introduction

The 21st century has witnessed a global re-evaluation of educational priorities, as environmental crises, technological disruptions, and socio-economic inequalities increasingly shape how societies learn and communicate. In this context, English Language Teaching (ELT) is being redefined not only as a tool for linguistic proficiency but also as a medium for fostering global citizenship, sustainability awareness, and responsible innovation (Adegbite, 2021). As the lingua franca of international communication, English carries both cultural influence and pedagogical responsibility. Therefore, the integration of sustainability and green innovation into ELT is essential in preparing learners to address the ecological and ethical challenges of the modern world.

In Nigeria, English serves as the official language and a major medium of instruction from upper primary to tertiary education. However, traditional ELT methods have often emphasized grammar, vocabulary, and examination outcomes over critical thinking and social responsibility (Olaofe, 2013). With global educational reforms advocating for education for sustainable development (ESD), Nigerian institutions are now challenged to embed sustainability principles into classroom practices. The National Policy on Education (Federal Republic of Nigeria, 2014) highlights the need for education to promote self-reliance, environmental stewardship, and civic responsibility.

English has become not only a global lingua franca but also a key medium for engaging with contemporary global challenges. As nations grapple with climate change, resource depletion, and the quest for sustainable futures, education is increasingly recognized as a powerful tool for fostering eco-literacy. English Language Teaching (ELT), as part of this broader educational system, cannot remain

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isolated from these global imperatives. Innovative pedagogies that integrate sustainability and green innovation into language classrooms provide an opportunity to cultivate environmentally conscious learners who are also effective communicators across cultures.

Traditionally, ELT has emphasized communicative competence, grammar instruction, reading comprehension, and literary appreciation. While these remain important, the 21st-century learning environment demands a reorientation toward critical, interdisciplinary approaches that prepare learners to respond to complex global realities. For instance, teaching English through texts about Sustainability has emerged as one of the most urgent global concerns of the twenty-first century. With issues such as climate change, biodiversity loss, and resource depletion, education is increasingly seen as a critical space for fostering awareness and inspiring change. Within this broader framework, English language teaching (ELT) offers unique opportunities to engage learners with sustainability-related content while simultaneously developing linguistic competence. As English serves as a global medium for communication, it provides a platform for learners to participate in international discussions on environmental challenges and green innovation. English language classrooms can serve as effective spaces for fostering environmental awareness when students are engaged in project- based tasks. These projects not only support language development but also encourage learners to explore and respond to real –world ecological challenges, promoting both critical thinking and sustainable values.

Traditional English language teaching has often emphasized grammar mastery, vocabulary acquisition, and literary appreciation, with limited connection to real-world issues. However, a shift toward innovative pedagogy reveals the potential of language classrooms to contribute to sustainability education. By incorporating sustainability-related themes into lesson design, English learning becomes more meaningful, contextual, and transformative. Such integration not only enhances communicative ability but also encourages students to think critically about their role in addressing environmental problems.

The purpose of this paper is to examine how innovative pedagogical approaches in English language teaching can align with sustainability goals and promote green innovation. The study argues that English teaching should be reframed as both a linguistic and social practice, enabling learners to apply language in real-world contexts that contribute to ecological responsibility and global citizenship.

Literature Review

Conceptualizing Innovative Pedagogy

Innovation in pedagogy has become a cornerstone of contemporary educational reform. The term innovative pedagogy refers to creative and context-sensitive teaching strategies that transform conventional classroom practices to meet emerging global challenges (Laurillard, 2012). In the context of English Language Teaching (ELT), innovative pedagogy involves a shift from teacher-centred instruction to learner-driven exploration, emphasizing collaboration, creativity, and critical engagement (Richards, 2013). This approach supports students in constructing meaning through real-life communication rather than rote memorisation of linguistic forms.

In Nigeria, innovation in pedagogy is increasingly viewed as a means of revitalizing English teaching in both secondary and tertiary institutions. Scholars such as Adegbite (2021) and Fakeye (2017) have argued that Nigerian English classrooms often remain traditional, dominated by grammar-translation and exam-focused instruction. However, innovations such as blended learning, project-based learning (PBL), and task-based language teaching (TBLT) can stimulate deeper learner engagement. These strategies emphasise active participation, digital collaboration, and contextualized problem-solving, which align closely with sustainability principles.

Education for Sustainable Development (ESD) in Language Teaching

Education for Sustainable Development (ESD) is an educational paradigm promoted by UNESCO (2020) that aims to equip learners with the knowledge, skills, values, and attitudes necessary to shape a sustainable future. ESD encourages interdisciplinary teaching, critical thinking, and social

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responsibility. In language education, ESD can be realized through content that integrates ecological awareness, ethical communication, and intercultural understanding (Sterling, 2014).

For ELT in Nigeria, integrating ESD is particularly relevant because language is both a medium of knowledge transmission and a reflection of culture. Through English lessons, teachers can embed sustainability themes into grammar exercises, reading comprehension, and oral discussions. For instance, a comprehension passage about waste recycling or renewable energy allows students to learn vocabulary while engaging with environmental issues. Similarly, writing assignments on topics such as deforestation or climate change provide learners with linguistic tools to articulate sustainable ideas.

Ogunbiyi (2018) observes that sustainable education in Nigeria remains largely policy-driven rather than practice-based, meaning that teachers often lack the training and resources to operationalize ESD principles in language classrooms. This gap underscores the importance of professional development and curriculum innovation that aligns sustainability with linguistic learning outcomes.

Green Innovation and Eco-Pedagogy

The concept of green innovation in education refers to integrating environmentally friendly practices and technologies into teaching and learning processes (Tilbury, 2011). It extends beyond environmental topics to include the development of learning environments that minimize waste, conserve energy, and promote ecological consciousness. Eco-pedagogy, a related concept, emphasizes the interdependence between education and the natural environment (Gadotti, 2010). It encourages students to view themselves as agents of ecological transformation through reflective and action-oriented learning.

In Nigerian classrooms, green innovation can take simple but meaningful forms. Teachers can reduce paper consumption by adopting digital platforms such as Google Classroom or WhatsApp for assignments and communication. They can also promote environmental literacy through classroom projects that involve students in community clean-ups, tree planting, or awareness campaigns conducted in English. Such activities combine linguistic development with civic engagement, reinforcing the idea that language is a tool for positive change.

Internationally, studies by Cates (2019) and Haapala et al. (2020) demonstrate that integrating sustainability in language education enhances learners' global awareness and sense of responsibility. These findings suggest that when students use language to discuss environmental issues, they develop both communicative competence and ecological consciousness. Applying these insights to Nigeria, ELT can become a platform for promoting national and global environmental awareness through English language use.

Technological Pedagogical Innovation in ELT

Technological integration is a critical component of innovative pedagogy. In the 21st-century classroom, digital tools—such as interactive learning platforms, virtual classrooms, and mobile applications—enable teachers to deliver engaging and eco-friendly instruction (Rahman, 2018). Digital learning supports sustainability by reducing paper waste, facilitating remote learning, and encouraging collaborative problem-solving.In Nigeria, the use of technology in ELT has grown, particularly after the COVID-19 pandemic, which accelerated the adoption of online and blended learning (Adebayo & Oseni, 2020). Teachers increasingly use platforms such as Zoom, Google Meet, and Telegram for virtual lessons. However, infrastructural challenges, such as unreliable electricity and limited internet access, continue to restrict full implementation. Nevertheless, integrating low-cost technologies—like audio lessons, WhatsApp discussion groups, and digital storytelling—can promote sustainable and inclusive English instruction even in resource-limited contexts.

Furthermore, the digital classroom aligns with sustainability principles by fostering virtual collaboration across regions. Nigerian students can engage in cross-border language exchange projects, discussing global issues like pollution, food security, or sustainable tourism. Such projects reinforce both linguistic proficiency and ecological empathy.

Contextualizing Sustainability in Nigerian ELT

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The integration of sustainability and green innovation into ELT in Nigeria must consider local sociocultural realities. Nigeria faces environmental challenges such as deforestation, urban pollution, and poor waste management (Nwankwo, 2019). These issues provide authentic contexts for language learning. When students discuss real environmental problems affecting their communities, they not only improve their English proficiency but also develop civic consciousness and problem-solving abilities.

Culturally responsive pedagogy is also vital. Nigerian classrooms are linguistically and culturally diverse, and sustainability-oriented teaching must respect local knowledge systems. Teachers can draw on indigenous proverbs, folktales, and oral traditions that convey ecological wisdom. For instance, Ejagham and Yoruba proverbs that warn against the destruction of forests or rivers can be used in reading comprehension and writing tasks. This approach connects traditional environmental ethics with modern sustainability discourse, creating a culturally grounded pedagogy (Okolo, 2021).Additionally, language teachers can collaborate with other disciplines—such as geography, agriculture, or civic education—to design interdisciplinary projects that highlight sustainable living. Such cross-curricular integration reinforces the idea that language learning is not isolated but embedded within broader social and environmental contexts.

Teacher Professional Development and Policy Frameworks

Teacher preparation is a crucial factor in achieving sustainable innovation in ELT. According to Eze (2022), many Nigerian English teachers have limited exposure to sustainability education during their training. Teacher education programs often emphasize methodology and grammar teaching but neglect eco-pedagogical skills. Professional development workshops and curriculum reforms are needed to equip teachers with knowledge of sustainability principles and the creativity to integrate them into classroom activities.

The National Policy on Education (Federal Republic of Nigeria, 2014) supports sustainable development goals, but implementation remains weak. Educational authorities must provide incentives for schools that adopt green practices and incorporate sustainability in assessment standards. Moreover, teacher education institutions should introduce modules on environmental literacy and sustainable communication to ensure pre-service teachers graduate with a green pedagogical mindset.

Scholarly interest in sustainability education has expanded significantly over the past two decades. UNESCO (2017) stresses that education for sustainable development (ESD) equips learners with the knowledge, skills, and values needed to create a sustainable future. ESD emphasizes critical thinking, problem-solving, and interdisciplinary approaches—qualities that conform with modern pedagogical practices.

Within language education, several studies highlight the potential of integrating sustainability themes. Cates (1990) was among the first to propose “global education” in English language teaching, suggesting that language learning can serve as a gateway to addressing issues such as peace, human rights, and the environment. According to Cates (1990), English language teaching should be directed towards addressing global issues. English language teaching ought to cultivate critical thinking as a means of enhancing learners’ capacity for problem solving. Cates (1990) urges educators to transform English language learning into arenas for global awareness and civic engagement. In other words, educators should include topics that create environment awareness of problems and the skills that are essential to tackle address global problems. Hence, contributing to the advancement of the world at large. Tilbury (2011), argues pedagogy has a transformative role in shaping learners who can think critically, reflect on values, and act responsibly toward sustainability. Although her focus is on education for sustainable development, these principles resonate strongly with English language teaching. Language classrooms can serve as spaces where learners not only acquire communicative competence but also engage in reflective dialogue, collaborative problem- solving, and global awareness. By integrating topics such as ecological responsibility or social justice into rea ding, writing, and speaking activities. Teachers can also cultivate both linguistic proficiency and ecological literacy.

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In this way, English language teaching moves beyond grammar and vocabulary instruction to become a vehicle for empowering learners to participate meaningfully in shaping sustainable futures. In a similar vein,Godwin-Jones (2018) demonstrates how sustainability themes can be integrated into English language teaching/learning, suggesting that language classrooms can serve as spaces for cultivating both communicative competence and social responsibility. More recent work (Sterling, 2012; Tilbury, 2011) emphasizes the transformative power of pedagogy in fostering ecological literacy.

Innovative pedagogies have also gained attention in English language teaching research. Project-based learning and task-based instruction are widely recognized for encouraging learner autonomy, collaboration, and real-world engagement (Ellis, 2003; Beckett & Slater, 2020). These approaches conform closely with sustainability education, as they encourage learners to tackle authentic problems. Digital tools, such as online collaborative platforms, have further expanded opportunities for integrating sustainability into English learning while reducing ecological footprints by minimizing paper use (Godwin-Jones, 2018).

This body of literature underscores the possibility of merging sustainability education with English pedagogy through innovative teaching practices that promote both language acquisition and

Theoretical Framework

This study draws on two interrelated frameworks:

Ecological Linguistics (Stibbe, 2015): This perspective views language as deeply connected to ecological realities. By examining the stories and discourses embedded in texts, eco-linguistics empowers learners to identify harmful narratives (e.g., consumerism, exploitation of nature) and promote alternative, sustainable ones.

Communicative Language Teaching: (CLT): CLT emphasises meaningful communication and real-life language use. Embedding sustainability-related themes into English language teaching tasks conforms with CLT principles by making communication authentic and socially relevant.

Together, these frameworks position English teaching not only as a tool for communication but also as a transformative practice that engages learners in environmental and social action.

Methodology

Research Design

This study adopted a qualitative research design to explore how innovative pedagogies can be used to integrate sustainability and green innovation into English Language Teaching (ELT) in Nigeria. The qualitative approach was chosen because it allows for an in-depth understanding of teachers' experiences, beliefs, and classroom practices regarding sustainable education. As Creswell and Poth (2018) explain, qualitative research is appropriate for examining complex social phenomena from participants' perspectives within their natural contexts. This approach enabled the researcher to interpret not only what teachers do but also why they make certain pedagogical decisions.

The study used a descriptive case study model, focusing on selected tertiary institutions and secondary schools within Nigeria's northern and southern regions. This design provided a rich, contextualized understanding of how English teachers innovate in response to sustainability challenges in diverse socio-educational environments.

This paper also adopts a descriptive qualitative approach based on content analysis of existing literature and classroom-based case examples. Data sources include peer-reviewed articles, policy documents, and teaching models that demonstrate how sustainability and green innovation can be incorporated into English language teaching. The analysis identifies patterns of pedagogical innovation and highlights best practices for embedding sustainability into language instruction.

Although not based on primary data collection, this study provides a conceptual model that can inform future empirical research on sustainable ELT practices.

Population and Sample

The population of the study comprised English language teachers in Nigerian secondary and tertiary institutions. From this population, a purposive sampling technique was employed to select participants

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who were actively involved in teaching English and who had demonstrated interest in adopting innovative or sustainability-related classroom practices.A total of 20 participants were selected from 10 secondary school English teachers from Jigawa. The selected teachers varied in years of experience, ranging from early-career educators to senior lecturers. Their diversity allowed the study to examine different perspectives on how sustainability concepts can be integrated into English teaching across multiple educational levels.

Semi-Structured Interviews:

Individual interviews were conducted with all 20 participants. The interviews explored teachers' understanding of sustainability, their classroom strategies, and the challenges they faced in applying innovative or eco-friendly practices. The open-ended nature of the questions allowed participants to express their views freely and to share concrete examples of their teaching methods.

Classroom Observations:

Observations were carried out in selected English classes to examine how sustainability-related themes or green pedagogical strategies were incorporated into lessons. The observation schedule focused on aspects such as teaching materials, learner participation, use of technology, and evidence of environmental consciousness in classroom interaction.

Data Collection Procedures

Data collection occurred over a two-month period, between September and October,2025. Prior to data collection, participants were briefed about the study's objectives. Consent was obtained from both the teachers and their institutions.Interviews were conducted both face-to-face and via online platforms (Zoom and WhatsApp calls) depending on the participants' locations and convenience. Each interview lasted approximately 45 minutes and was audio-recorded with participants' permission. Classroom observations took place during regular English lessons, with minimal interference from the researcher to ensure natural behaviour. Field notes were taken to capture classroom dynamics, teacher-student interactions, and non-verbal cues relevant to sustainability themes.Institutional documents were accessed through Principals, who granted permission to review materials such as English language syllabuses and environmental education reports.

Data Analysis

The collected data were analyzed using thematic analysis, following the guidelines proposed by Braun and Clarke (2019). The analysis involved six stages: familiarization with data, generation of initial codes, searching for patterns, reviewing themes, defining themes, and producing the final report.

Transcribed interviews and observation notes were read multiple times to identify recurring ideas related to innovative teaching, sustainability, and green classroom practices. Codes such as technology use, environmental topics in lessons, teacher creativity, institutional support, and barriers to implementation were generated. These codes were then grouped into broader themes that reflected how teachers conceptualized and enacted sustainability in ELT.

To enhance validity, the researcher employed member checking, allowing participants to review summaries of their responses for accuracy. Triangulation of interview, observation, and document data ensured consistency and depth of interpretation.

To guarantee trustworthiness, the study adhered to Lincoln and Guba's (1985) criteria of credibility, transferability, dependability, and confirmability.

Credibility was achieved through prolonged engagement with participants and triangulation of data sources.

Transferability was ensured by providing detailed contextual descriptions of the schools and teaching environments, allowing readers to relate findings to similar contexts.

Dependability was maintained through consistent documentation of research procedures and reflective notes.

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Confirmability was enhanced through audit trails and peer debriefing, ensuring that interpretations were grounded in participants' views rather than researcher bias.

Discussion of Findings

The study examined how innovative pedagogies can integrate sustainability and green innovation into English Language Teaching (ELT) in Nigeria. Analysis of interviews, classroom observations, and documents revealed several key themes: teachers' awareness of sustainability concepts, their use of innovative and eco-pedagogical practices, the influence of institutional support, and the challenges that constrain full implementation. Each of these themes is discussed below in relation to existing literature and theoretical perspectives.

Teachers' Awareness and Conceptual Understanding of Sustainability

Findings indicate that most English teachers in secondary institutions possess a basic understanding of sustainability, though their interpretations vary. Many participants associated sustainability with environmental protection, cleanliness, and waste management, while a smaller number linked it to long-term learning and social responsibility. This partial understanding suggests that sustainability education in Nigeria remains largely superficial and policy-driven rather than deeply embedded in pedagogical philosophy.

Several teachers expressed enthusiasm about linking environmental topics with language lessons. For instance, one teacher from Dutse Local Government Area of Jigawa State, reported integrating reading passages on deforestation and wildlife conservation into comprehension lessons, explaining that it "helps students see English as more than just grammar." Similarly, a teacher in Dutse Model Secondary School in Jigawa described how he used essay writing to engage students in discussions about desertification and renewable energy. These examples demonstrate that Nigerian English teachers are beginning to explore sustainability-related content, aligning with Cates's (2019) argument that language education can be a medium for ecological consciousness.

However, the findings also revealed gaps in teachers' conceptual depth. While they often discussed "keeping the environment clean," few connected sustainability to broader issues like equity, critical thinking, or long-term social development. This reflects Ogunbiyi's (2018) observation that many Nigerian educators view sustainability primarily as environmental hygiene rather than a holistic framework involving ethics, innovation, and systems thinking. Consequently, there is a need to expand teachers' understanding of sustainability beyond environmentalism to encompass economic and cultural dimensions.

Integration of Innovative Pedagogies in ELT

Teachers in the study demonstrated varying degrees of innovation in their classroom practices. The most commonly observed strategies included project-based learning, discussion-oriented lessons, and the use of digital tools to enhance engagement. These methods align with constructivist learning principles, which emphasize learner participation and contextualized meaning-making (Vygotsky, 1978).

Project-based learning emerged as one of the most effective approaches. For example, several teachers asked students to conduct short projects such as writing and presenting environmental awareness campaigns in English. Such projects not only improved communication skills but also encouraged collaboration and civic engagement. This finding supports the claim by Tilbury (2011) that experiential learning deepens sustainability awareness by connecting classroom content to real-world issues.

Technology also played a significant role in promoting sustainable teaching. Many teachers used mobile applications, online discussions, and digital assignments to reduce paper waste and encourage virtual collaboration. One lecturer noted that "using Google Docs and WhatsApp groups allows students to share work without printing," which aligns with the principles of green innovation in education. This finding resonates with Rahman's (2018) observation that digital tools foster both ecological efficiency and interactive learning.

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However, not all teachers had equal access to these technologies. In some public schools, limited internet connectivity and unreliable electricity hindered the consistent use of online learning tools. Despite these challenges, teachers displayed adaptability—often substituting printed materials with oral presentations or community-based projects that required minimal resources. This adaptive creativity reflects what Adebayo and Oseni (2020) describe as the resilience of Nigerian teachers in resource-constrained environments.

Eco-Pedagogical Practices and Cultural Contexts

The study found that several teachers incorporated local cultural materials—such as folktales, proverbs, and community experiences—into their sustainability-themed lessons. This aligns with Okolo's (2021) argument that indigenous narratives can serve as powerful pedagogical tools for environmental education. For instance, teachers from Cross River and Ekiti States reported using traditional proverbs that emphasize harmony with nature, such as "When you cut the tree that shelters you, you stand under the sun." By interpreting such proverbs in English lessons, teachers connected linguistic learning with ecological wisdom embedded in Nigerian oral traditions. This integration of culture and sustainability supports Gadotti's (2010) view that eco-pedagogy must be grounded in local realities rather than imposed global narratives.

Furthermore, observed lessons revealed that students responded positively to culturally rooted discussions. They were more engaged when learning activities reflected their immediate environment—such as the pollution in local markets, waste disposal habits, or farming practices. This engagement underscores the importance of contextual learning in promoting sustainability-oriented thinking. By linking English to everyday environmental issues, teachers helped students perceive the relevance of language learning to their lives and communities.

Nevertheless, eco-pedagogical integration remains sporadic and largely dependent on individual teacher initiative. The absence of structured sustainability content in national English curricula limits widespread adoption. Teachers often expressed the need for government and institutional guidance to standardize sustainability-oriented instruction.

Institutional Support and Curriculum Policy

Institutional support emerged as a significant determinant of whether teachers could effectively implement sustainable and innovative pedagogies. In universities where sustainability initiatives were formally recognized ,such as those participating in green campus projects, teachers reported greater motivation to incorporate environmental topics into their teaching. In institutions where management prioritized examination performance over holistic education, sustainability-related lessons were rarely encouraged.

Document analysis revealed that Nigeria's current English language curricula at both secondary and tertiary levels make limited reference to sustainability or environmental issues. While civic education and social studies incorporate sustainability themes, English teaching guidelines remain focused on literacy, grammar, and communicative competence. This misalignment echoes Eze's (2022) claim that educational policies in Nigeria often promote sustainability in rhetoric but fail to translate it into subject-specific curricula.

Furthermore, teacher participants expressed concerns about workload, inadequate materials, and lack of incentives for innovation. Several noted that without administrative support, implementing creative and environmentally conscious lessons becomes difficult. This situation highlights the need for systemic collaboration among teachers, curriculum planners, and policymakers to institutionalize sustainability education across all subject areas, including English.

Challenges in Implementing Sustainable Innovation in ELT

Despite positive attitudes toward sustainability, the study identified several obstacles to effective integration in ELT. These challenges include:

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Lack of Training and Awareness: Many teachers reported never receiving formal instruction on sustainability education during their pre-service training. This knowledge gap limits their ability to design lessons that align with ESD goals.
Insufficient Resources: Schools often lack digital devices, stable electricity, and access to the internet, restricting the use of technology-driven green practices.
Overcrowded Classrooms and Curriculum Constraints: Teachers described the difficulty of conducting project-based or discussion-oriented lessons in large classes where time is limited and syllabus completion is prioritized.
Institutional Inertia: Resistance to change among school administrators and colleagues discourages innovation. Some teachers reported being criticized for deviating from conventional teaching patterns.
Economic and Social Pressures: The focus on examinations and certificate acquisition often overshadows broader educational goals such as environmental responsibility and ethical awareness.
These findings are consistent with previous studies (Olaofe, 2013; Ogunbiyi, 2018) that have identified structural and attitudinal barriers as major obstacles to pedagogical innovation in Nigeria. Overcoming these barriers requires comprehensive reforms, including professional development, curriculum redesign, and infrastructural investment.

Implications for ELT and Sustainable Development

The results of this study suggest that integrating sustainability and green innovation into ELT can significantly enhance both language learning and environmental literacy. When teachers use English to explore real-world issues such as pollution, conservation, or waste management, learners not only improve their communicative competence but also develop empathy, critical thinking, and civic responsibility.

Furthermore, the study highlights that English classrooms can serve as incubators for sustainable citizenship. Through reflective dialogue, collaborative projects, and creative writing, students can use language as a means of advocating for social and environmental justice. This aligns with UNESCO's (2020) vision of education as a transformative force for sustainable societies. However, achieving this vision in Nigeria requires aligning teacher training, curriculum design, and institutional policy with ESD principles. English language educators should be encouraged to move beyond grammar-based instruction toward participatory and interdisciplinary methods that connect language with sustainability themes. Teacher education programs must incorporate modules on eco-pedagogy and digital green innovation, equipping educators to function as agents of change.

Conclusion

This study examined how innovative pedagogies can support the integration of sustainability and green innovation into English Language Teaching (ELT) in Nigeria. Drawing on interviews, classroom observations, and document analysis, it explored the extent to which English teachers understand and apply sustainability concepts in their instructional practices. The findings revealed that while many Nigerian teachers recognize the importance of environmental and social responsibility, their practical engagement with sustainability-oriented teaching remains limited due to institutional, infrastructural, and curricular constraints. The study established that Innovative pedagogies such as project-based learning, inquiry-based activities, and digital instruction serve as effective frameworks for embedding sustainability into English teaching. These approaches encourage active learner participation, contextual learning, and critical reflection, which align with constructivist and eco-pedagogical principles. When implemented effectively, they transform the classroom into a space for environmental dialogue, creative problem-solving, and social awareness.

Teachers who incorporated cultural elements such as Nigerian proverbs, folktales, and indigenous environmental wisdom into their lessons demonstrated how language learning can reflect both local identity and global consciousness. Such integration not only enhances learners' communicative competence but also cultivates a sense of ecological stewardship. However, the study

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found that these practices are mostly teacher-driven rather than systemically supported, indicating the need for structured institutional frameworks. At the policy level, the research underscores the gap between national educational objectives and actual classroom implementation. Although Nigeria's National Policy on Education (2014) and international frameworks like UNESCO's Education for Sustainable Development (2020) emphasize sustainability, the English curriculum has yet to reflect this orientation. Without explicit policy directives, teacher training programs, and assessment standards, sustainability integration will remain uneven across schools. Overall, the study concludes that integrating sustainability and green innovation into ELT is both necessary and achievable. It requires not only individual teacher initiative but also collective institutional commitment. By aligning teaching strategies with sustainable values, English educators in Nigeria can nurture learners who are linguistically competent, environmentally conscious, and responsible citizens prepared to address the challenges of a changing world.

This study has argued that English Language Teaching must evolve to meet the demands of the 21st century by integrating sustainability and green innovation into its pedagogical practices. Using Communicative Language Teaching: and Eco-linguistic frameworks, the study demonstrated how ELT can simultaneously foster linguistic competence and environmental responsibility. Findings suggest that sustainability-oriented ELT enhances student motivation, critical thinking, and global citizenship. However, successful implementation requires systemic support, including curriculum reform, teacher training, and investment in green technologies.

Embedding sustainability and green innovation into English classrooms is not merely an add-on but a transformative approach that redefines the purpose of language education in our time. By doing so, ELT becomes a powerful platform for cultivating not only competent language users but also responsible citizens of a fragile planet.

English language performs major functions in Nigeria such as accommodation, participation and social mobility. Akindele and Adegbite (2005), say English language performs the function of accommodation because it is recognized as a world language, so it performs informational functions. The doors of modern technology, science, trade, sustainability and green innovation which are all central and cardinal to achieving self –reliance and sustainable economic growth, are achieved through the use of English language. Cognitive English abilities can be enhance to develop learners' competence in problem solving.

The study demonstrates that English language teaching can be re-envisioned through innovative pedagogies that conform with sustainability goals and support green innovation. By embedding ecological themes into classroom practices, English language teaching moves beyond linguistic training to become a transformative educational practice. The nexus of sustainability, education, and innovation underscores the vital role of pedagogy in shaping responsible, critically aware, and globally engaged learners. Future research should focus on empirical classroom-based studies that measure the effectiveness of specific pedagogical interventions in promoting both linguistic competence and sustainability literacy.

Recommendations

Based on the findings and conclusions, the following recommendations are proposed for various stakeholders:

Curriculum Reform

The Federal Ministry of Education and curriculum developers should revise the English language curriculum at all levels to explicitly incorporate sustainability and green innovation. Lessons, reading materials, and writing tasks should address environmental, social, and ethical issues relevant to Nigerian communities. This will ensure that sustainability becomes an integral part of language learning rather than an occasional theme.

Teacher Education and Professional Development- Teacher training institutions should introduce dedicated courses on eco-pedagogy, digital innovation, and sustainability literacy. In-

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service workshops and seminars can further equip practicing teachers with the skills needed to design sustainability-oriented lessons. Teacher education programs should emphasize reflective practice, creativity, and contextual application of global sustainability goals.

Institutional and Governmental Support- Educational institutions should provide the necessary infrastructure such as stable electricity, internet access, and multimedia tools, to facilitate digital and green learning. Government agencies and school administrators should also support teachers' initiatives by recognizing and rewarding innovative classroom practices. Policies that promote paperless communication and eco-friendly school operations will model sustainable behaviour for both teachers and students.

Integration of Indigenous Knowledge-Sustainability education should draw on Nigeria's rich cultural heritage. Incorporating local wisdom, proverbs, and oral traditions that promote harmony with nature can make sustainability education culturally relevant and more impactful. English teachers should collaborate with local communities to document and use indigenous ecological expressions in lessons, bridging traditional knowledge and modern learning.

Collaborative and Interdisciplinary Approaches-To make sustainability education holistic, English language instruction should collaborate with other subjects such as civic education, science, and social studies.

Use of Digital and Green Technologies- Teachers should maximize the use of low-cost digital platforms to minimize paper usage and promote interactive learning. Online collaboration tools, mobile learning apps, and virtual classrooms can enhance both language skills and sustainability awareness. Institutions should invest in renewable energy solutions such as solar power to support these initiatives sustainably.

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EVALUATION OF THE POTENTIALS OF SCHOOL FARM AND INNOVATIVE TECHNOLOGY ADOPTION IN COLLEGES OF EDUCATION IN KANO AND JIGAWA STATES, NIGERIA.

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Abstract

This study focused on the Evaluation of the Potentials of School Farm and Innovative Technology Adoption in Colleges of Education in Kano and Jigawa States, Nigeria. Survey research design was adopted for the study. Four research questions and three hypotheses guided the study. The population for the study comprised of 120 lecturers of Agricultural Education and Agricultural Instructors and support staff in Federal and State Colleges of Education in the study area. Purposive and Convenience sampling technique was used for the study. The instrument for data collection was validated by three experts. Cronbach alpha method was used to determine reliability with a reliability co-efficient of 0.76. Six research assistants administered the instrument and were later retrieved from the respondents with a return rate of 100%. The data generated was analyzed using mean and standard deviation to answer the research questions while the hypotheses were tested using t-test at the probability of 0.05 levels of significance at relevant degree of freedom. The results of the analysis indicated that both lecturers of Agricultural Education and Agricultural Instructors and support staff consensually agreed using improved seed varieties, fertilizers, farm machinery, viable research laboratories, availability of manpower as well as collaborating with industries in some area such as access to manpower and technical support, partnerships with extension officers and agribusinesses, provision of agricultural inputs among others. The study also discovered irregular or non use of advanced technology such as drip/precision irrigation systems, integrated pest management techniques, soil testing and nutrient management tools, on-site weather forecasting tools, and remote sensors for precision agriculture among others. The study also identified strategies such as creating diverse practical projects with agricultural technology inclusion among others to enhance students' competencies. It was also discovered that there was no significant differences in the mean responses of the three hypotheses tested between the responses of lecturers of Agricultural Education and Instructors and support Staff across all the areas of concern. It was recommended that collaboration with industries should be given due attention, especially through Students Industrial Work Experience Scheme, Projects work and Field Trip. It should be properly planned, funded and well monitored for positive outcome.

Keywords: Evaluation, Potentials, School Farm, Innovative Technology Adoption, Agricultural Education, Teaching and Learning.

Introduction

Agricultural Education teaching and learning is done both in the classroom and on the field (farm) for incorporation of the practical components towards enhancing hands-on learning. School farm is the key to achieving this, since it is where practical is done in collaboration with other facilities. Agriculture has an immense impact on humanity in terms of global food supplies, hunger alleviation,

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economic development and provision of employment (Atata, Efobi and Orkoh, 2020)). Therefore, agriculture is considered as a pillar for human survival and hence teaching at all levels of education cannot be overlooked. As a vocational educational programme, agricultural education focuses on three major components: formal classroom instruction, career experience programmes and leadership development. These components are delivered through a competency-based curriculum in the context of agriculture, which provides excellent opportunities for students to specialize and gain knowledge and skills in various aspects of agriculture through the translation of classroom experience to practical activities in the school farm.

School Farm according to Gilbert (2013) is any type of land laboratory and/or feeding facility utilized by the agricultural science programme; the laboratory/facilities could include but not limited to greenhouses, livestock/ small animal housing, crop fields, aquaculture tanks, orchards, soil pits, grass fields, and welding, wood working, and mechanics shops. Tambayo (2018) stated that school farm is an area of land, and the buildings on it used for growing crops or keeping animals managed by students under the supervision of their teachers. According to Blair, e;tal (2023) school farms have been used worldwide as educational facility for teaching students about food systems and engaging them in their communities for sustainable agricultural production. The school farm is designed to support the provision of sound knowledge and skills for both students and teachers as well as ample opportunity to apply this knowledge through classroom activities, laboratory experiments, project participation and supervised agricultural experience. The school farm, which is an area of land within the school premises or a trekking distance from the school, is solely allocated for agricultural activities and usually possesses the potential or characteristics required for agricultural productivity.

Over the years, school farms have been used as laboratory for agricultural practical training and handy when it comes to teaching a variety of topics in agriculture such as crop rotation, mixed cropping, breeding, managing livestock, food and feed processing among others. Ochijenu and Nadi. (2023) stated that agricultural science practical which normally takes place in secondary schools and tertiary institutions laboratories and farm is aimed at imparting relevant and specialized knowledge, skills and attitude to agricultural science students towards enhancing the student's competence in agricultural production for self-reliant.

Tertiary institutions according to Shimave, Benedict and Azuaga (2018) refer to institutions that offer the third level (post-secondary) education. They include universities, colleges of education, polytechnics, and monotechnic including institutions offering correspondence courses. Bogoro in Shimave, Osinem, and Kaka'an, (2020) views tertiary education as the apex of knowledge and skills generation where jobs and wealth are created, poverty mitigated, and global competitiveness enhanced. This is why there is high expectation from graduates of tertiary institutions, especially those of Technical Vocational Education and Training (TVET) where high level relevant manpower training, high quality career counseling and lifelong learning programmes that prepare students with the knowledge and skills for self-reliance are produced.

In Nigeria, due to the vast agricultural potentials, agriculture is included among the courses being thought at all levels of education. One sure way of restoring the sector to its lost position as a dominant export earner of the country is by boosting agricultural productivity in skills, techniques and methods of farming through Agricultural Education. According to Manning, Cosby; Power, Fogarty & Harreveld (2022) Agriculture, food, and natural resources (AFNR) systems are shifting in method and design at an unprecedented rate due to continuous advancement in science and technology through extensive research to address the problem of food security and sustainable practices.

The adoption of agricultural technology into school farm practices can spark growth in productivity, incomes and food security. The National Academies of Sciences, Engineering, and Medicine (2018) stated that agricultural technology is a broad term that is used to describe equipment, genetic materials, farming techniques, and agricultural inputs that have been developed to improve the effectiveness of agriculture. ''Effectiveness" here refers to an equally broad range of productivity,

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health, welfare, and sustainability outcomes that is derivable because of technology adoption in agricultural production. Adopting and practicing new technology on the school farm becomes inevitable as it provides opportunities for students to acquire the knowledge and skills to put such technology into practice for sustainable livelihood. Food and Agricultural Organisation (FAO,2019) stated that, there is a high demand for increase in food production because of continuous growth in population both at the national and sub-national level in developing countries including Nigeria. Also, in the Global Food Security Index – GFSI (GFSI, 2018) revealed that the current statistics on the nutritional outcome in Nigeria are staggering: Nigeria ranks 96/113, disaggregated as 101, 100, and 77 for affordability, availability, quality and safety respectively.

The Federal Government in other to meet up with food requirement as projected by the United Nation, The Nigeria Digital Agriculture Strategy (NDAS) a ten-year (2020-2030) plan to provides purpose and direction for adopting digital technologies in agriculture was initiated. It is inspired by the Economic Recovery and Growth Plan (ERGP) of the Federal Government and the Agriculture Promotion Policy (APP). It is an offshoot of the Nigeria Smart Initiative and the Nigeria Digital Economy Policy and Strategy (NDEPS). The NDAS is aimed at supporting the agricultural sector towards achieving the Federal Government's economic diversification policy for increasing food production and revenue generation for human and infrastructural development.

Higher institutions such as Colleges of Education with reference to agricultural education departments need to key in and provide the needed practical skills for students to enable them to practice well in food production after graduation. This could provide support for attaining the laudable objectives of the Nigeria Digital Agriculture Strategy (NDAS, 2020-2030) for digital technology adoption in agricultural production towards providing employment and enhancing food production as well as addressing food insecurity. Therefore, evaluating and repositioning of school farms across institutions to ascertain their level of readiness and re-strategies at addressing any existing skills gap in the utilization of school farm for agricultural technology adoption and practice among students of agricultural education in Colleges of Education becomes inevitable in Kano and Jigawa State. Hence, this study.

Statement of the Problems

Agricultural technologies have long been promoted by governments and development organizations as effective ways to increase farm productivity and reduce poverty. These agricultural technologies are expected to be adopted by schools or institutions offering agriculture as a programme to enhance its subsequent usage by graduates as a means for increased food production. However, adoption of many seemingly beneficial technologies remains low by schools and institutions that are engaged in the training of youths and food production. A holistic implementation of agricultural education curriculum as stated in the NCCE Minimum Standard (2020) is expected to embrace classroom instruction and practical experiences which the students in agriculture are exposed to both in the classroom and in the school farm. The school farms are expected to have well trained manpower, adequate equipment, farm implements/tools, farm structure and regular supply of inputs in addition to farm space to accommodate crops and livestock managed by students under the supervision of their teachers. However, In the area of the study, despite the vast fertile land, and availability of TVET institutions there is a high rate of graduate unemployment as well as lack lustier attitude of youths in embracing agriculture. This may not be unconnected with their level of preparation while in schools. Most of the graduate's roam about surviving by menial jobs which could easily expose them to committing crime. In most training institutions, school farms, laboratories and workshops are poorly equipped. Where tools, machines and equipment are available, many are either obsolete or not working and not in conformity with what is currently in used in the industries. From the foregoing, there could be deficiencies in the training received by graduates of agricultural education which makes it necessary to evaluate and reposition the agricultural education programme school farm in Colleges of Education especially in Kano and Jigawa State respectively. This could lead to provision of the needed information

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for proper planning of the school farm for use in providing the needed training for students through the adoption of agricultural innovative technologies towards enhancing their skills for increased food production and sustainable livelihood.

Purpose of the Study

The main purpose of the study was to evaluate the potentials of school farm and innovative technology adoption in Colleges of Education in Kano and Jigawa State, Nigeria. Specifically, the study evaluated:

1. The level of utilization of school farm in the adoption of agricultural innovative technology for teaching and learning of agriculture in Colleges of Education in Kano and Jigawa State.
2. The availability of both human and material resources for effective utilization of school farm for teaching and learning agriculture in Colleges of Education in Kano and Jigawa State
3. The level of collaboration with industries in the utilization of school farm for Teaching and learning of Agriculture in Colleges of Education in Kano and Jigawa State.
4. Strategies that could be adopted towards enhancing effective utilization of school farm in the dissemination of innovative technologies in agriculture among students in Colleges of Education in Kano and Jigawa State, Nigeria.

Research Questions

The following research questions guided the study:

1. What is the level of utilization of school farm in the adoption of agricultural innovative technology for teaching and learning agriculture in Colleges of Education in Kano and Jigawa State?
2. What is the level of availability of both human and material resources for effective utilization of school farm for teaching and learning of agriculture in Colleges of Education in Kano and Jigawa State?
3. What is the level of collaboration with industries in the utilization of school farm for teaching and learning agriculture in Colleges of Education in Kano and Jigawa State?
4. What are the strategies that could be adopted towards enhancing effective utilization of school farm in the dissemination of innovative technologies in agriculture among students in Colleges of Education in Kano and Jigawa State, Nigeria?

Hypotheses for the Study

The following hypotheses guided the study and were tested at the probability of 0.05 level of significance at relevant degree of freedom:

HO_1. There is no significant difference in the mean rating of the responses of Lecturers of Agricultural Education and Agricultural Instructors and Support Staff (AIS) on the level of availability of both human and material resources for effective utilization of school farm for teaching and learning of agriculture in Colleges of Education in Kano and Jigawa State?

HO_2. There is no significant difference in the mean rating of the responses of Lecturers of Agricultural Education and Agricultural Instructors and Support Staff (AIS) on the level of collaboration with industries in the utilization of school farm for teaching and learning of agriculture in Colleges of Education in Kano and Jigawa State?

HO_3. There is no significant difference in the mean rating of the responses of Lecturers of Agricultural Education and Agricultural Instructors and Support Staff (AIS) on strategies that could be adopted towards enhancing effective utilization of school farm in the dissemination of innovative technologies in agriculture among students in Colleges of Education in Kano and Jigawa State, Nigeria.

Methodology

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The study was guided by four research questions and three Hypotheses respectively. Descriptive survey research design was used for the study. This design is suitable for the study as it makes use of questionnaires developed from the literature reviewed to collect data from the respondents.

The area of the study: The study was carried out in Colleges of Education in Kano and Jigawa State, Nigeria. They are Federal, State and Private Colleges of Education in Kano and Jigawa State.

The population and Sample for the study: The population for the study comprises of Lecturers of Agricultural Education (LAE) and Agricultural Instructors and Support Staff (AIS) in Colleges of Education in Kano and Jigawa States. A purposive and convenient sampling technique was used in selecting 60 Lecturers of Agricultural Education (LAE) and 60 Agricultural Instructors and Support Staff (AIS) given a total of 120 respondents involved in the study.

Instrument for Data Collection: The instrument for data collection was a structured questionnaire titled: Evaluation of the Potentials of School Farm and Innovative Technology Adoption in Colleges of Education in Kano and Jigawa State, Nigeria (EPSFITACEKJ). The questionnaire was divided into two sections: Section A elicit information on personal data of the respondents and section B elicited information on the level of agricultural innovative technology adoption in the school farm; availability of both human and material resources for effective utilization of school farm for teaching and learning of agriculture; level of collaboration with industries and strategies that could be adopted towards enhancing effective utilization of school farm in the dissemination of innovative technologies in agriculture among students in Colleges of Education in Kano and Jigawa State, Nigeria: Section B has four (4) point response scale options of Strongly Agreed (SA), Agreed (A), Disagreed (D) and Strongly Disagreed (SD) with corresponding value of 4, 3, 2, and 1 respectively.

Validation of the Instrument: The instrument was validated by three experts: one from the Agricultural Extension unit, Kano State Ministry of Agriculture and Natural Resources, one each from Department of Crop and Animal Science, College of Agriculture Danbatta, Kano State respectively. Their corrections and suggestions were utilized to improve the questionnaire before producing the final copies. A pre-test of the questionnaires was done prior to its administration. The results of the pre-test were analyzed using Cronbach alpha reliability method to determine the internal consistency of the questionnaire items which produced a coefficient index of 0.76, meaning that the instrument was reliable and valid for the study.

Methods of Data Collection: The data for the study were collected with the help of six (6) research assistants hired for administration and retrieval of the instrument in Kano and Jigawa States. One hundred and twenty (120) copies of the questionnaire were administered and retrieved by the research assistants after three (3) weeks and handed over to the researcher at an agreed time and location for data analysis.

Method of Data Analysis: The data generated by the study were analyzed using Frequency Distribution Table, Mean and Standard Deviation to answer the research questions, while the t-test statistics were used to test the hypotheses of no significant difference at the probability of 0.05 level of significant at relevant degree of freedom.

Decision Rule: Any mean value equal or above 2.50 was described as agreed or accepted, and mean value less than 2.50 was regarded as disagreed or not accepted. Also, any item whose standard deviation is below1.96 that is 95% confidence limits indicated that the respondents were close to the mean and not too far from one another in their responses, while any item with standard deviation above 1.96 that is 95% confidence limits indicated that the respondents were far from the mean and from one another in their responses.

Also, on the hypotheses tested, the hypotheses of no significant difference were accepted where the P-value is greater than 0.05 levels which indicated that there was no significant difference in the mean ratings of the responses of the two groups of respondents on that item. If the p-value is less than 0.05 levels, this indicated that the hypothesis of no significant difference in the mean ratings of the responses of the two groups of respondents was rejected for that item.

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Results

The analysis and results were presented based on research questions answered and hypothesis tested.

Research Question 1: What is the level of utilization of school farms in the adoption of agricultural innovative technology for teaching and learning of Agricultural Education in Colleges of Education in Kano and Jigawa State?

Table 1: Mean Rating of the Responses of Agricultural Education Lecturers (LAE) and Agricultural Instructors and Support Staff (AIS) on the level of utilization of school farm in the adoption of agricultural innovative technology for teaching and learning of agricultural Education in Colleges of Education in Kano and Jigawa State.

Lecturers of Agricultural Edu. (LAE- 60), Agricultural Instructors and Support Staff (AIS-60) =120

S/NO	ITEMS	$\bar{x}_1$	SD_1	**Remark**
01	Improved seed varieties (e.g. Disease-resistant, high-yielding)	3.28	1.04	Accepted
02	Drip/Precision irrigation systems	1.78	1.11	Rejected
03	Use of organic/inorganic fertilizers	3.75	0.57	Accepted
04	Integrated Pest Management (IPM) techniques	1.58	0.98	Rejected
05	Soil testing and nutrient management tools	2.06	1.29	Rejected
06	Modern farm machinery/equipment (e.g., tractors and coupled implement)	3.63	0.66	Accepted
07	Information and Communication Technology (ICT) (e.g., mobile apps, internet for information)	2.10	1.36	Rejected
08	On-site weather forecasting tools/sensors	1.30	0.71	Rejected
09	viable laboratory for research projects conducted by both students and lecturers	3.63	0,84	Accepted
10	Rearing and crossing of hybrid livestock (ruminant and non-ruminant)	3.29	1.18	Accepted
11	Remote sensor for data generation on soil moisture, soil nutrient content and other related factor	1.58	1.04	Rejected
12	Geographical Position System (GPS)	2.63	1.29	Accepted
13	Record keeping model	3.23	1.17	Accepted
14	Network with local farmers and agricultural businesses through school farm activities.	2.88	1.25	Accepted

Field Survey, 2025

The data in table one above presented the mean ($\bar{x}$) and standard deviation (SD) for 14 items assessing the level of utilization of school farms in adopting innovative agricultural technologies. The mean scores ranged from 1.30 to 3.75, while the standard deviations ranged from 0.57 to 1.36, indicating varying levels of consensus among respondents. Items with mean scores ≥ 2.50 such as the use of improved seed varieties (M = 3.28, SD = 1.04), fertilizers (M = 3.75, SD = 0.57), modern farm machinery (M = 3.63, SD = 0.66), viable research laboratories (M = 3.63, SD = 0.84), rearing hybrid livestock (M = 3.29, SD = 1.18), GPS (M = 2.63, SD = 1.29), record keeping model (M = 3.23, SD = 1.17), and networking with local farmers (M = 2.88, SD = 1.25) were **accepted** by respondents as being effectively utilized. Conversely, items with mean scores below 2.50, including drip/precision irrigation

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systems, integrated pest management techniques, soil testing and nutrient management tools, ICT, on-site weather forecasting tools, and remote sensors, were **rejected**, indicating low utilization. The SD values reveal that some items, such as ICT and soil testing tools, had wider variability in responses, suggesting inconsistency in perception among lecturers and instructors. These findings imply that while certain agricultural technologies are well-utilized for teaching and learning, there is a need to improve the adoption of advanced and modern technologies to enhance the effectiveness of school farms utilization in the teaching and learning of agricultural education.

Research Question 2 What is the level of availability of both human and material resources for effective utilization of school farm for teaching and learning of Agricultural Education in Colleges of Education in Kano and Jigawa State?

Table 2: mean rating of the Responses of Agricultural Education Lecturers (LAE) and Agricultural Instructors and Support Staff (AIS) on the level of availability of both human and material resources for effective utilization of school farms for teaching and learning of agricultural education in Colleges of Education in Kano and Jigawa State

S/NO	ITEMS (Human Resources)	Response of Agric Edu. Lect. (60)			Response of Agric Edu. Instructors and Support Staff. (60)		
		$\bar{x}_1$	SD_1	Remark	$\bar{x}_1$	SD_1	Remark
01	Availability of qualified Agricultural teachers and Instructors.	3.65	0.57	Accepted	3.53	0.67	Accepted
02	Agricultural teachers with specialized skills in innovative farming.	3.53	0.67	Accepted	3.30	0.84	Accepted
03	Qualified technical support staff (e.g., lab assistants, farmhands).	2.57	1.22	Accepted	2.55	1.04	Accepted
04	Support from school administration for farm activities.	2.37	1.02	Rejected	2.55	0.86	Accepted
05	Availability of expert resource persons from the agricultural industry.	2.15	0.91	Rejected	1.95	0.80	Rejected
06	The school effectively involves parents in supporting farm activities.	2.78	1.11	Accepted	2.78	1.14	Accepted
	ITEMS (Material Resources)						
01	The farm has enough suitable and well drained cultivatable land to meet its production needs.	3.73	0.48	Accepted	3.50	0.65	Accepted
02	The farm has a reliable and adequate water source.	2.58	1.23	Accepted	2.33	1.31	Rejected
03	There is an efficient irrigation system for watering crops and livestock	2.27	1.09	Rejected	2.50	1.15	Accepted
04	Storage facilities (e.g., barns, silos) are available and sufficient for produce/feed.	2.55	1.15	Accepted	2.57	1.15	Accepted
05	Housing for livestock is adequate and well-maintained.	2.50	1.13	Accepted	2.73	1.17	Accepted

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06	The farm has access to a complete set of necessary hand tools.	2.27	1.05	Rejected	2.23	1.12	Rejected
07	Appropriate machinery (e.g., tractor and coupled implement) for farm operations.	3.65	0.70	Accepted	3.58	0.74	Accepted
08	A reliable supply of quality seeds and seedlings is consistently available.	2.47	1.12	Rejected	2.53	1.13	Accepted
09	Fertilizers and pesticides are readily accessible.	2.48	1.16	Rejected	2.38	1.17	Rejected
10	Specialized facilities (e.g., greenhouse, fishpond).	1.88	0.93	Rejected	1.98	1.04	Rejected
11	Innovative technology (e.g., sensors, drones, smart irrigation).	1.72	0.71	Rejected	1.90	0.91	Rejected
12	Relevant textbooks and instructional materials.	3.17	1.04	Accepted	2.90	1.01	Accepted

Field Survey, 2025

Table 2 presented the mean ($\bar{x}$) and standard deviation (SD) for 18 items assessing the availability of human and material resources, separately for Agricultural Education Lecturers (LAE) (n = 60) and Agricultural Instructors and Support Staff (AIS) (n = 60). The mean scores ranged from 1.72 to 3.73, while SD values ranged from 0.48 to 1.31, reflecting varying consensus among respondents. For human resources, items such as the availability of qualified lecturers of agricultural education and agricultural instructors and support staff (Lecturers: M = 3.65, SD = 0.57; Instructors: M = 3.53, SD = 0.67) and lecturers with specialized skills in innovative farming (Lecturers: M = 3.53, SD = 0.67; Instructors: M = 3.30, SD = 0.84) were accepted as adequately available. Conversely, expert resource persons from the agricultural industry (Lecturers: M = 2.15, SD = 0.91; Instructors: M = 1.95, SD = 0.80) and limited administrative support (Lecturers: M = 2.37, SD = 1.02) were rejected or inconsistently available. Regarding material resources, highly available items included cultivable land (Lecturers: M = 3.73, SD = 0.48; Instructors: M = 3.50, SD = 0.65), modern machinery (Lecturers: M = 3.65, SD = 0.70; Instructors: M = 3.58, SD = 0.74), and instructional materials (Lecturers: M = 3.17, SD = 1.04; Instructors: M = 2.90, SD = 1.01). Items with low availability, indicated by mean scores below 2.50, included specialized facilities (greenhouses, fishponds) and innovative technologies (sensors, drones, smart irrigation). These findings suggest that while some critical human and material resources are adequately available for effective school farm utilization, significant gaps remain in advanced technology, expert personnel, and certain infrastructural support, highlighting areas for strategic improvement to enhance teaching and learning outcomes in agricultural education.

Research Question 3: What is the level of collaboration with industries in the utilization of school farms for teaching and learning of agricultural education in Colleges of Education in Kano and Jigawa State?

Table 3: mean rating of the Responses of Agricultural Education Lecturers (LAE) and Agricultural Instructors and Support Staff (AIS) on the level of collaboration with industries in the utilization of school farm for teaching and learning of agricultural education in Colleges of Education in Kano and Jigawa State.

S/NO	ITEMS	Response of Agric Edu. Lect. (60)			Response of Agric Edu. Instructors and Support Staff (60)		
		$\bar{x}_1$	SD_1	Remark	$\bar{x}_1$	SD_1	Remark

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01	Collaborate with industries for exposure of students to modern farming facilities and techniques.	3.53	0.67	Accepted	3.67	0.47	Accepted
02	Collaborate with industries for students to gain hands-on experience that aligns with current industry practices.	3.20	1.05	Accepted	3.53	0.81	Accepted
03	Partner with industries for students to develop a stronger understanding of the agricultural value chain	2.83	1.00	Accepted	3.55	0.67	Accepted
04	Collaboration with industries assist in the maintenance or improve the quality of school farm facilities.	1.77	0.82	Rejected	2.13	0.78	Rejected
05	Collaboration with industries has helped to organize events on the school farm where students can showcase their technology projects.	2.38	1.00	Accepted	2.17	0.90	Rejected
06	Collaboration with industries afford school farm access to manpower and technical support	3.82	0.39	Accepted	3.53	0.67	Accepted
07	Collaboration with agricultural extension officers and agricultural related small-scale businesses to develop students' interest in self-reliance.	3.70	0.46	Accepted	3.87	0.34	Accepted
08	Collaborate with industries for donation of agricultural inputs (seeds, fertilizers, etc.)	3.60	0.69	Accepted	3.57	0.62	Accepted
09	Collaborate for joint practical projects or research with staff and students	3.80	0.40	Accepted	3.73	0.51	Accepted
10	Collaboration on student internships or farm placement programs	3.78	0.41	Accepted	3.67	0.54	Accepted
11	Collaboration on Technical advice or consultation on farm management	3.50	0.70	Accepted	3.60	0.58	Accepted
12	Collaboration on marketing or selling farm produce	2.98	1.18	Accepted	3.77	0.42	Accepted

Field Survey, 2025

Table 3 presented the mean ($\bar{x}$) and standard deviation (SD) for 12 items assessing the level of collaboration with industries, separately for Agricultural Education Lecturers (n = 60) and Instructors (n = 60). The mean scores ranged from 1.77 to 3.82, while SD values ranged from 0.34 to 1.18, indicating varied responses among respondents. Items such as collaboration for students exposure to modern farming facilities (Lecturers: M = 3.53, SD = 0.67; Instructors: M = 3.67, SD = 0.47), access to manpower and technical support (Lecturers: M = 3.82, SD = 0.39; Instructors: M = 3.53, SD = 0.67), partnerships with extension officers and agribusinesses (Lecturers: M = 3.70, SD = 0.46; Instructors: M = 3.87, SD = 0.34), provision of agricultural inputs (Lecturers: M = 3.60, SD = 0.69; Instructors: M = 3.57, SD = 0.62), joint practical projects/research (Lecturers: M = 3.80, SD = 0.40; Instructors: M = 3.73, SD = 0.51), internship/farm placement programs (Lecturers: M = 3.78, SD = 0.41; Instructors: M = 3.67, SD = 0.54), and technical advisory support (Lecturers: M = 3.50, SD = 0.70; Instructors: M = 3.60, SD = 0.58) were accepted, indicating strong collaboration in these areas. In contrast, collaboration aimed at maintenance or improvement of school farm facilities (Lecturers: M = 1.77, SD = 0.82; Instructors: M = 2.13, SD = 0.78) was rejected, reflecting weak industrial support in this domain. These findings suggest that while collaboration with industries is generally strong in providing technical

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support, experiential learning, and research opportunities, there is a notable gap in collaboration for farm facility maintenance and organization of showcase events, highlighting areas for strategic improvement to maximize the educational impact of school farms.

Research Question 4: What are the strategies that could be adopted towards enhancing effective utilization of school farm in the dissemination of innovative technologies in agricultural education among students in Colleges of Education in Kano and Jigawa State, Nigeria?

Table 4: Mean ratings of the Responses of Agricultural Education Lecturers (LAE) and **Agricultural Instructors and Support Staff (AIS) on the strategies that could be adopted towards enhancing effective utilization of school farm in the dissemination of innovative technologies in agricultural education among students in Colleges of Education in Kano and Jigawa State, Nigeria.**

S/NO	ITEMS	Response of Agric Edu. Lect. (60)		Remark	Response of Agric Edu. Instructors and Support Staff (60)		Remark
		$\bar{x}_1$	SD_1	Accepted	$\bar{x}_1$	SD_1	Accepted
01	Increase school budget for farm activities	3.83	0.37	Accepted	3.67	0.47	Accepted
02	Training and re-training of agricultural Education lecturers, Instructors and technologist	3.57	0.49	Accepted	3.70	0.46	Accepted
03	Improve security measures	2.83	1.00	Accepted	3.65	0.48	Accepted
04	Integrate farm activities more deeply into the curriculum	3.53	0.67	Accepted	3.67	0.47	Accepted
05	Involve parents and the wider community	3.20	1.05	Accepted	3.53	0.81	Accepted
06	Create more diverse projects (e.g., Equipment maintenance, practicing breeding, gardening, livestock management)	3.63	0.48	Accepted	3.73	0.53	Accepted
07	Develop a clear maintenance schedule for facilities and equipment	3.78	0.41	Accepted	3.70	0.46	Accepted
08	Establish a student farm management committee	3.50	0.70	Accepted	3.55	0.67	Accepted
09	Provision of instructional materials for effective teaching of agricultural education	3.80	0.40	Accepted	3.70	0.52	Accepted
10	Encouragement and setting up of agribusiness clubs in schools	3.67	0.47	Accepted	3.57	0.49	Accepted

Field Survey, 2025

Table 4 presented the mean ($\bar{x}$) and standard deviation (SD) for 10 items assessing strategies for enhancing the effective utilization of school farms, separately for Agricultural Education Lecturers (n = 60) and Instructors (n = 60). The mean scores ranged from 2.83 to 3.83, while SD values ranged from 0.37 to 1.05, reflecting varying levels of agreement among respondents. All items were accepted, indicating strong endorsement of the proposed strategies. Highly rated strategies included increasing the school budget for farm activities (Lecturers: M = 3.83, SD = 0.37; Instructors: M = 3.67, SD = 0.47), training and re-training of lecturers, instructors, and technologists (Lecturers: M = 3.57, SD = 0.49; Instructors: M = 3.70, SD = 0.46), creating diverse practical projects (Lecturers: M = 3.63, SD = 0.48; Instructors: M = 3.73, SD = 0.53), developing clear maintenance schedules (Lecturers: M = 3.78, SD = 0.41; Instructors: M = 3.70, SD = 0.46), and provision of instructional materials (Lecturers: M =

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3.80, SD = 0.40; Instructors: M = 3.70, SD = 0.52). The SD values suggest relatively consistent agreement across respondents, especially for core strategies such as budgeting, maintenance planning, and instructional support. These findings imply that strategic investment in funding, staff capacity building, curriculum integration, project diversity, and institutional support mechanisms is critical for maximizing the utilization of school farms and effectively disseminating innovative agricultural technologies among students.

Results of the Hypothesis Tested.

HO_1.There is no significant difference in the mean rating of the responses of Lecturers of Agricultural Education and Agricultural Instructors and Support Staff on the level of availability of both human and material resources for effective utilization of school farm for teaching and learning of agricultural education in Colleges of Education in Kano and Jigawa State?

Table 5: Independent Samples t-Test of Lecturers of Agricultural Education and Agricultural Instructors and support staff Mean Ratings on the Level of Availability of Human and Material Resources for Effective Utilization of School Farms

Group	Mean	SD	t	P	Decision
Lecturers	2.68	0.63	0.15	0.88	Accept H_0
Instructors	2.66	0.61			

Table 5 presented the results of an independent samples t-test comparing the mean ratings of Lecturers and Instructors on the level of availability of human and material resources for effective utilization of school farms. Lecturers had a mean rating of 2.68 (SD = 0.63) while Instructors and support staff had a mean rating of 2.66 (SD = 0.61). The t-test revealed no significant difference between the two groups, **t (unequal variances) = 0.15, p = 0.88**, indicating that both Lecturers and Instructors and support staff perceive the availability of human and material resources similarly. This result supports the null hypothesis (H_0), suggesting a high level of agreement between the two groups regarding the adequacy of resources for teaching and learning in school farms.

HO_2. Is there no significant difference in the mean rating of the responses of Lecturers of Agricultural Education and Agricultural Instructors and Support Staff on the level of collaboration with industries in the utilization of school farm for teaching and learning of agricultural education in Colleges of Education in Kano and Jigawa State?

Table 6: Independent Samples t-Test of Lecturers of Agricultural Education and Agricultural Instructors and support staff Mean Ratings on the Level of Collaboration with Industries in the Utilization of School Farms

Group	Mean	SD	t	P	Decision
Lecturers	3.24	0.64	-0.63	0.54	Accept H_0
Instructors	3.40	0.59			

Table 6 shows the results of an independent samples t-test comparing Lecturers' and Instructors' mean ratings on the level of collaboration with industries in the utilization of school farms. Lecturers' mean rating was 3.24 (SD = 0.64), while Instructors and support staff mean rating was 3.40 (SD = 0.59). The t-test revealed no significant difference, t (unequal variances) = -0.63, p = 0.54, indicating that both groups similarly perceive the level of industrial collaboration in school farm activities. These findings support the null hypothesis (H_0), demonstrating that Lecturers and Instructors and support staff have comparable perceptions of the extent and effectiveness of collaboration with industries in the teaching

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and learning of agricultural education towards enhancing the adoption of agricultural innovative technology by students

HO_3.There is no significant difference in the mean rating of the responses of Lecturers of Agricultural Education and Agricultural Instructors and Support Staff on the strategies that could be adopted towards enhancing effective utilization of school farm in the dissemination of innovative technologies in agricultural education among students in Colleges of Education in Kano and Jigawa State, Nigeria.

Table 7: Independent Samples t-Test of Lecturers' and Agricultural Instructors and Support Staff Mean Ratings on Strategies for Enhancing Effective Utilization of School Farms

Group	Mean	SD	t	P	Decision
Lecturers	3.53	0.31	-1.13	0.29	Accept H_0
Instructors	3.65	0.07			

Table 7 presented the results of an independent samples t-test comparing Lecturers' and Agricultural Instructors and Support Staff mean ratings on strategies for enhancing the effective utilization of school farms in disseminating innovative agricultural technologies. Lecturers had a mean rating of 3.53 (SD = 0.31), while Agricultural Instructors and Support Staff had a mean rating of 3.65 (SD = 0.07). The t-test indicated no significant difference between the groups, t (unequal variances) = -1.13, p = 0.29**,** suggesting that both groups agree on the recommended strategies for improving school farm utilization. This result supports the null hypothesis (H_0) and highlights a consistent perception between Lecturers and Agricultural Instructors and Support Staff regarding effective strategies for promoting innovative agricultural technologies among students.

Discussions of Findings

The findings of this study in relation to the level of utilization of school farms in the adoption of agricultural innovative technology for teaching and learning of agricultural education revealed that both lecturers of agricultural education and instructors and support staff consensually agreed using improved seed varieties, fertilizers, modern farm machinery, viable research laboratories, rearing hybrid livestock among others, while the use of drip/precision irrigation systems, integrated pest management techniques, ICT, on-site weather forecasting tools, and remote sensors still remain at low level or not use at all. The findings of this study is in tandem with the study by Yohanna, Ishaq, Muhammad, & Aledare (2021) on Availability and use of Agricultural Innovations and Adoption of Animal and Crop Technologies among farmers in Sokoto State, Nigeria which showed that higher proportion (33.6%) of the respondents involved in crop farming adopted crop technologies like recommended crop spacing, pesticides application, pest and disease control among others. The findings of this study are in line with the findings of the study carried out by Ikehi, Ejiofor, Ifeanyieze., Nwachukwu and Ali (2022). On the Adoption of agricultural innovations by farmers in Enugu State, Nigeria. It was revealed that more than 60% of the respondents were aware of technology/innovations relating to improving production using genetically modified seeds (such as high yielding and drought tolerant varieties), improved feed and forage, soil and water conservation techniques, nutrition sensitive agriculture among others.

The findings of the study on the level of availability of both human and material resources for effective utilization of school farm for teaching and learning of agricultural education in Colleges of Education in Kano and Jigawa State indicated varying consensus among respondents. For human resources, both respondents established the availability of qualified Agricultural teachers and Instructors, qualified agricultural teachers with specialized skills in innovative farming. However, there is limited access to resources from the agricultural industry, poorly trained workshops and laboratory

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support staff and poor administrative support. Regarding material resources, highly available cultivable land, modern machinery and coupled implement and instructional materials, laboratories among others. However, Items with low availability included specialized facilities such as greenhouses, fishponds and innovative technologies like sensors, drones, smart irrigation among others. The finding of the study is in agreement with the findings of Shimave, Osinem , and Kaka'an, (2020) which conducted a study on the Assessment of Agricultural Education Programme Environment in Tertiary Institutions for Sustainable Industries in Benue State showed that 60.53% of recommended material resources were available, and there were adequate human resources for their utilization in teaching and learning of agricultural education. The finding also agrees with Milo, Garnizova and Shkreli (2014) who found out that there was insufficient training of laboratories staff, and computers to support students and teachers. The findings of the study also on the level of collaboration with industries in the utilization of school farm for teaching and learning agriculture in Colleges of Education in Kano and Jigawa State indicated that both respondents: lecturers of agricultural education and agricultural instructors and support staff established the existence of the collaboration for students exposure to modern farming facilities, access to manpower and technical support, partnerships with extension officers and agribusinesses, provision of agricultural inputs among others, while in contrast, collaboration aimed at maintenance or improvement of school farm facilities is low, reflecting weak industrial support in this domain.. The findings of this study are in tandem with the findings of Theresa, Kimberley, Julie and John (2017) in a study carried out on Collaboration as a Tool to Improve Career and Technical Education: A Qualitative Study of Successful Collaboration Among Extension Agents and Agricultural Science Teachers, it revealed several areas of collaborations including animal transportation, use of livestock equipment, programming efforts, leadership activities, fund raisers, planning, workshops, and livestock projects in general. It revealed further that when both teachers and agents are working on common tasks, there is equal benefit in all areas of collaboration. Also, the findings of the study is in contrary to some extent with the findings of Shimave, Osinem and Kaka'an, (2020) where it was also found out that there was no sustained/regular partnership between tertiary institutions and industry to complement school-based activities with work-based activities. Overall, the findings suggest that while collaboration with industries is generally strong in providing technical support, experiential learning, and research opportunities, there is a notable gap in collaboration for farm facility maintenance and organization of showcase events, highlighting areas for strategic improvement to maximize the educational impact of school farms

Findings of the study on strategies that could be adopted towards enhancing effective utilization of school farm in the dissemination of innovative technologies in agriculture among students in Colleges of Education in Kano and Jigawa State, Nigeria. It reflected varying levels of agreement among respondents on strategies such as increasing school budget for farm activities, training and re-training of lecturers, instructors, and technologists, creating diverse practical projects, developing clear maintenance schedules and provision of instructional materials among others. The findings of this study are in line with the findings of the study carried out by Ramongwane, Moses and Sammy (2023) on Innovative Strategies for Integrating Technology into Agricultural Programmes at Technical and Vocational Colleges Tshwane University of Technology, Pretoria, South Africa. The study revealed that innovative strategies, including but not limited to being proactive, improvising, seeking assistance to effectively use school farms for spreading agricultural technology, adopt strategies like hands-on learning with modern tools such as drones, sensors, digital literacy, creating demonstration plots for precision farming, fostering partnerships with agri-tech companies/researchers, promoting student entrepreneurship and the need to provide TVET lecturers with continuous training in the use of innovative technology. These findings imply that strategic investment in funding, staff capacity building, curriculum integration, project diversity, and institutional support mechanisms is critical for maximizing the utilization of school farms and effectively disseminating innovative agricultural technologies among students.

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Conclusions

The study concludes that the utilization of school farms to enhance the adoption of agricultural innovative technologies through teaching and learning can bring about speedy dissemination and adoption of agricultural technologies. This is achievable when the right competencies about the technologies are passed on to the trainees who in turn practice as farmers at individual level or in collaboration with others. With the support of well-trained agricultural extension agent, gradually, technologies such as precision farming, deployment of drones, integrated pest management as well as collaboration with stakeholders will on the long run advance agricultural production sector and the attainment of food security in the study area and Nigeria at large.

RECOMMENDATIONS

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

1. There should be training and re-training of lecturers, instructors and support staff for effective utilization of school farm towards enhancing agricultural technology adoption through teaching and learning of agriculture in Colleges of Education and other tertiary institutions.
2. The importance of school farms in relation to the teaching and learning of agriculture is strategic and must be given due attention while budgeting for workshops and laboratories. This is to enhance effective and adequate provision of the technologies needed for deployment during teaching and learning.
3. Collaboration with industries should be given due attention, especially through Students Industrial Work Experience Scheme, Projects work and Field Trip. It should be properly planned, funded and well monitored for positive outcome.

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GREEN INNOVATION AND WEALTH CREATION IN HOME ECONOMICS IN AKWA IBOM STATE

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Abstract
The study examined green innovation practices on wealth creation in home economics in Akwa Ibom State. The research employed descriptive survey research design. Interviews, questionnaire were the major instrument for data collection. The population for this study consists of graduates from higher institutions in Akwa Ibom State. The specific institutions to be included UNIUYO, AKSU and College of Education, Afaha Nsit. The population of the study was limited to final year students in 2022-2023 and 2023/2024 academic session graduates as contained in convocation brochure (8,089). Taro Yamane formula was used to obtain 381 sample size. The study employed stratified random sampling. Data collected were systematically analyzed using descriptive statistics and linear regression model. The result revealed that there is a significant effect of green innovation practices on energy efficiency and wealth creation in home economics. there is a significant effect of waste recycling on institutional wealth creation among home-based enterprises in Akwa Ibom State. It was recommended that home economists and home-based enterprise operators should be encouraged to adopt green innovation practices such as energy-efficient appliances, renewable energy sources, and sustainable production processes to enhance energy efficiency and wealth creation.
***Keywords**: Green innovations, wealth creation.*

INTRODUCTION

With the increasing economic development, environmental problems have become more and more prominent. Environmental issues, such as global warming, ozone depletion, pollution etc. have greatly affected the economic development and progress for the coming generations. Increasing world population and consumption of resources by industries, such as coal, natural gas, oil etc. is leading to a gradual decrease and even depletion of these resources. Companies that do not respond to this environmental sensitivity will eventually lose their potential opportunities in the market. Owing to the fact that being environmentally responsible is the need of the hour and thus companies have started to change their attitudes and pay more attention to the consequences of their decision-making and management practices on the environment thereby promoting "eco innovation". Some companies focus son designing green products, some focus on green production processes, some on raw materials and others on clean energy. Noticeably, majority of the firms are still exploring green innovation practices. According to studies, green innovation introduces the idea of ecological importance into the development process so that environment is not harmed. In addition to this, organizations incorporating green innovation have the ability to respond to customer needs promptly and accurately thereby gaining competitive advantage (Huang *et al*., 2017).

In home economics, energy efficiency fosters wealth creation primarily through significant cost savings on utility bills, which in turn allows for greater savings and investment potential. Additionally, it equips individuals with vocational skills that can lead to gainful employment and new business opportunities within the green economy. Home economics focuses on the effective utilization and

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management of human and material resources for the welfare of individuals and families. Energy efficiency is a core component of this, involving using less energy to achieve the same result, thereby minimizing waste. Adopting energy-efficient appliances significantly reduces electricity consumption, leading to direct cost savings. Simple energy-saving practices (turning off lights and appliances when not in use) reduce energy bills and promote sustained financial health. Investing in proper insulation, double-pane windows, and other energy-efficient home features results in long-term energy savings that accumulate wealth over time. The role that energy plays in the development of a country is pivotal. Quality of life is unfavourably affected by insufficient energy supply which hinders economic activities and growth

In Akwa Ibom State, green innovation and wealth creation within Home Economics can be achieved by applying sustainable practices to key sectors like agriculture, textiles, and waste management. The state's investment in agricultural projects like the Ibom Green House, and its strong seafood and oil palm industries, provide a solid foundation for green entrepreneurial activities. Home Economics education provides the skills needed for these value-added, eco-friendly business ventures. Within Akwa Ibom State, recent empirical studies indicate the persistence and importance of home-based enterprises (HBEs) for household livelihoods in urban and peri-urban centres such as Ikot Ekpene, while manufacturing and small firms that adopt green operation practices report improved organizational performance where such practices are implemented (Ezeadichie, 2022; Ekanem *et al*., 2023). These findings suggest a local opportunity space where upgrading home-economics skills with green-innovation techniques could improve enterprise productivity, marketability and environmental outcomes (Ekanem *et al*., 2023; John-Nsa *et al*., 2024).

Home economics in Akwa Ibom State can significantly drive wealth creation through **green innovation** by focusing on sustainable practices in food production, waste management, and fashion/textiles, leveraging the state's natural resources and government initiatives. Home economics in Akwa Ibom State can significantly drive wealth creation through **green innovation** by focusing on sustainable practices in food production, waste management, and fashion/textiles, leveraging the state's natural resources and government initiatives. Home Economics brings the focus of households as building blocks of sustainable societies. Addressing complex interrelated human and environmental problems, it aims at achieving optimal and sustainable living conditions for individuals, families and their communities while acknowledging their global interdependence. Home economics is a field of study and a profession, situated in the human sciences. It is also known as family and consumer sciences or human ecology. It follows an integrated approach and draws from a disciplinary diversity which might include, among others: food, nutrition, health, textiles and clothing, shelter and housing, consumer science, household management, design and technology, food science and hospitality, human development and family studies, education and community services (Jimmy, 2025). Home economists address the interrelationship of sustainability and human/civil rights and share a concern for vulnerable audiences. Home Economists worldwide work as scientists and practitioners. They foster new knowledge through research and empower families and their communities to develop the capacity for agency. Home Economists promote positive systemic actions that improve the quality of life and represent the integrated, multi-level approach that is core to achieving the Sustainable Development Goals. Home Economics is considered as the original field of research focusing on economic, social and ecological aspects of everyday living, which includes responsible use of resources (Jimmy, 2025).

Home economics also addresses the impact of food, health, economic, environmental, and human/political systems on the status of individuals, families, and communities. Its capacity to draw from a disciplinary diversity allows for the development of specific interpretations of important UN Sustainable Development Goals: Home Economics Education often focuses on sustainable food production. Heads of households are trained in healthy nutrition and efficient cooking to improve their

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situation but also learn about hygienic behaviour, maternal and family health. Education in everyday life management also includes aspects that help to overcome poverty such as the importance of education for girls and boys and alternative ways of income generation. However, realizing wealth-creation potential from sustainable home economics depends on targeted interventions curriculum and skills development, access to appropriate finance, market linkages, and supportive local policies that align green practices with viable business models. This study investigates how integrating green innovation into home-economics practices can be operationalized to create sustainable income and jobs for graduates and household entrepreneurs in Akwa Ibom State.

Problem Statement

Despite the clear livelihood role of home-based economic activities in Akwa Ibom and the documented benefits of green operational practices for firm performance, multiple constraints limit the potential for sustainable wealth creation from these activities (Jimmy, 2025). Empirical work in Ikot Ekpene and broader Akwa Ibom highlights persistent barriers including limited access to capital and markets, inadequate technical skills in value-adding and green production, weak linkages between educational programmes and local industry, and environmental impacts from poorly managed household production (Ezeadichie, 2022; John-Nsa et al., 2024; Ekanem et al., 2023). Furthermore, while green innovation has shown positive effects on organizational performance in selected manufacturing firms, its diffusion to home-based enterprises and informal micro-producers in Akwa Ibom remains limited due to product-scale mismatches, cost perceptions, and lack of tailored institutional support (Ekanem et al., 2023). At the same time, state-level mapping of blue-green resource opportunities signals promising sectors (aquaculture, agro-processing, eco-tourism, renewable energy) that could be harnessed with appropriate local value-chain development (Jimmy, 202). The gap between demonstrated local potential and on-the-ground adoption by home-based actors constitutes the central problem this study addresses: how to design and implement interventions that enable energy efficiency practices, driven by green innovation, to produce scalable and equitable wealth creation in Akwa Ibom State.

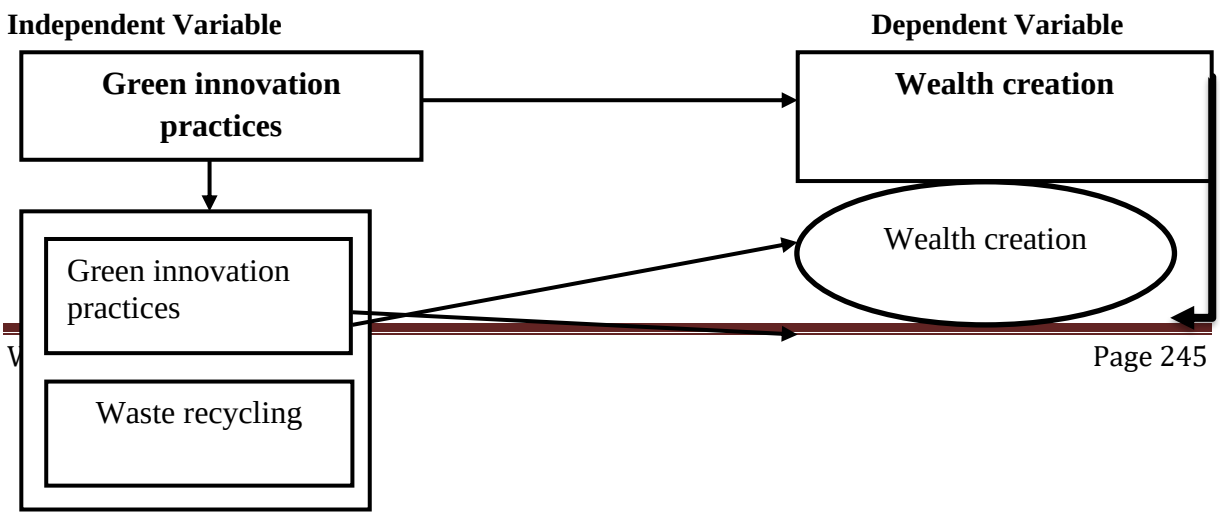
Objectives of the Study

To examine the effect of green innovation practices on wealth creation in home economies among graduates in Akwa Ibom State. Specific objectives are:

1. to determine the effect of green innovation practices on energy efficiency and wealth creation in home economics, Akwa Ibom State.
2. to ascertain the effect of waste recycling on wealth creation among home-based enterprises.

LITERATURE REVIEW

Conceptual Framework



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Fig. 1: Operational conceptual framework for green innovation practices on wealth creation in home economies. Source: Researcher's concept, 2025.

Concept of Green Innovation Practices

Green Innovation is referred to as the innovation that comprise of new or improved processes, practices, systems and products that benefit the environment and contribute to environmental sustainability. Green innovation consists of green product innovation and green process innovation. Green product innovation is the innovation of a new product or a service that causes no or less negative impact on the environment. Green process innovation is the modification or improvement of the existing production process by using technologies that are eco-friendly for the production of goods and services. To define the term "Green Innovation", Driessen and Hillebrand (2002) use a pragmatic definition, stating that, "Green Innovation does not need to be developed with the objective of reducing the environmental burden, rather to yield considerable environmental benefits". Chen, Lai *et al*., (2006) define green innovation as, "Innovation in hardware or software that involves green products or processes, including innovation in technology related to energy-saving, waste recycling, design of green product, pollution-prevention, or corporate environmental management". Green innovation incorporates all those innovations that help in creating all those products, services, or processes so that harmful impact on the environment is reduced, and in addition to this optimizes the use of natural resources. Such kind of innovation plays a critical role nowadays because it channelizes the use of natural resources to improve overall human well-being. Moreover, the creation and integration of changes in products and the processes of production could lead to sustainable development. Green innovation can result in reducing the inefficiencies and supporting judicial use of natural resources, which can play a major role in cost cutting. However, due to varied nature of different industries and firms itself, such as business form, resource situation etc. it is difficult to implement any research conclusion to create any reference model for green innovation, especially for emerging companies. Therefore, it is essential to understand green innovation practices of established firms to get a reference model. The firms which are in the initial stages of exploring green innovation can obtain useful expertise for efficient resource utilization. Green innovation is a strategic issue for the firms that aim at achieving environment upliftment as well as profitability and also actively responding to growing environmental requirements and demands. Conventionally, investing in eco-friendly patterns was considered as the most unnecessary step. But, present strict environmental regulations in combination with current conservationism trends have changed firm's competitive strategies and corporate policies and patterns (Porter and Linde 1995). Presently, the word "Green" acts a stimulus for developing consistent innovation, which can lead to the identification of new market opportunities and building of loyal customer base (Leal-Millán et al. 2016).

HOME ECONOMICS EDUCATION (HEE)

Home Economics education is a skill - oriented course which cover a wide scope of learning. It is a field of knowledge that draws information and skills from core subject areas of the arts, sciences, humanities and other related subjects. Collins English Dictionary-Complete & Unabridged (2012) defines home economics, domestic science or home science as a field of study that deals with the relationship between individuals, families, communities, and the environment in which they live. Its philosophy borders on the improvement of the quality of life of the individual family in particular and the society at large. It focuses on acquisition of skills which family requires to satisfactorily improving family living. Hence, Ukpore(as cited in Usen et al., 2014) defined Home Economics as a dynamic field that assists man with knowledge to adapt to his environment through effective utilization of available human and material resources. Saka (2001) noted that Home Economics as a vocational subject equip students with relevant skills and knowledge for gainful employment and wealth creation.

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Ejinkeonye and Uloko (2010) states that home economies is the study of the laws, conditions, principles and ideals, which concerns man's immediate physical environment on the one hand and with his nature as a social being on the other hand as well as the relationship between the two factors. It is both a body of theoretical knowledge based on exact sciences and humanities and forms of practice backed up by appropriate technologies. Its area of activity is the development, use and management of human and material resources for the greater welfare of individuals, families and human society in its entirety. It strives to solve the most pressing problems of the present as well as those of the future (Ejinkeonye & Uloko, 2010). In the same vein Anyakoha (2000) pointed out that, Home Economics as a vocational subject has increased awareness on skill acquisition for its graduates with the aim or intention to quicken their power for self-employment ventures. Home Economics education has a definite role of preparing and equipping students with skills that increase their chances of finding a job after school. it also equips the students with knowledge and skills they needs to set up their own businesses. Thus, Anozie (2006) identified nineteen occupational areas of Home Economics Education through which students can become self- reliant and consequently create wealth for the economic development of the nation. These include craft work/soft furnishing, clothing manufacturing, tailoring services, fashion and designing, baking, opening snack shops, laundry services, industrial cafeteria management, hotel management, restaurant management, street food vending, rug cleaning services, interior decoration, nursery school management, hair dressing saloon, soap and pomade making, pattern making, day care centre and dyeing. Therefore, for our purpose home economics is a vocational subject that equips learners with relevant skills and knowledge based on theoretical and practical activities in specific trades and vocations for gainful employment and wealth creation.

Opportunities for green innovation in Home Economics

1. Agriculture and Food: The Ibom Green House project, which produces vegetables like tomatoes, cucumber, pepper, and onions, demonstrates a green agriculture model. Home Economics can expand on this by: i. Promoting organic farming techniques and training.

ii. Creating sustainable value-added products, such as preserved foods, dried vegetables, and specialty spices.

iii. Establishing agripreneurship ventures focused on local, sustainable food production and processing.

2. Clothing and Textiles: Home Economics can drive sustainable practices in the textile industry by:

i. Using eco-friendly dyes and sustainable local fabrics.
ii. Training individuals in upcycling and repurposing old clothing into new products.
iii. Promoting local textile production to reduce the carbon footprint associated with imported goods.

3. Home Management and Waste Reduction: Students can be taught eco-friendly home management practices that reduce waste and create new products.

i. Recycling and waste management skills can lead to businesses that create compost from organic waste or new products from recycled materials.
ii. Energy-saving techniques and renewable energy applications can be integrated into the curriculum.

Role of education and policy

To effectively link green innovation, Home Economics, and wealth creation, several measures are recommended:

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Curriculum Development: The government and educational institutions should focus on developing a Home Economics curriculum that explicitly teaches green entrepreneurship and sustainable skills.

Empowerment: Home Economics teachers should be empowered with modern skills and knowledge to transfer state-of-the-art information to students.

Funding and resources: Increased funding for entrepreneurial education and the establishment of resource centers will help graduates and community members acquire new skills.

Green Innovation Opportunities and Wealth Creation

Home economics skills provide a practical foundation for sustainable entrepreneurship in several key areas: Sustainable food production and agribusiness: Akwa Ibom has a strong agricultural focus, including the Ibom Green Houses and plans for expanded tree crop development. Home economists can: i. develop organic farming networks and promote agroecology for improved food security and environmental sustainability. ii. engage in food processing and preservation of local crops (e.g., cassava, plantain, vegetables) using eco-friendly methods and innovative food packaging. iii. establish nutritious meal preparation services and catering, utilizing locally sourced, seasonal produce to reduce food miles and support local farmers. iv. waste-to-wealth initiatives: The state government is actively promoting waste recycling and transformation into renewable resources. Home economists can lead in and, v. composting and organic fertilizer production from biodegradable household and market waste, supporting the agricultural sector and generating income.

Implementing biogas technology at the household or community level to convert waste into clean cooking gas, reducing reliance on fuelwood and creating a clean energy source for homes. Plastic and paper recycling businesses, turning common household waste into valuable materials. Sustainable Fashion and Interior Design: Home economics expertise in clothing, textiles, and home management can be applied to eco-conscious design. Eco-friendly fashion design using local, sustainable fabrics and natural dyeing techniques (e.g., tie-dye). Upcycling and repurposing old clothing and household textiles into new, marketable products to minimize textile waste. Green interior design services that use sustainable materials, energy-efficient practices, and natural aesthetics to beautify homes, hotels, and offices. Clean Energy and Resource Management: The focus on efficient resource management within home economics can lead to business opportunities in: Offering consultancy on household energy efficiency, promoting the use of clean cooking energy sources like LPG or biogas over traditional options. Providing services related to sustainable home management, such as responsible consumption education, efficient shopping techniques, and promoting a general maintenance culture to reduce waste and save money.

Wealth Creation

Wealth creation describes a situation of prosperity. Wealth means the possession of riches, the abundance of valuable resources or material possession. Adam smith cited by Horsfall (2018) viewed wealth creation as the combination of materials, labour, land, and technology in such a way as to capture profit. Dada (2019) states that wealth creation simply refers to economic growth and better standard of living of the individual, family, and state. The source further stated that wealth creation refers to two (2) concepts; “the coping strategies” and “empowerment”. According to him, empowerment concept is a process which gives people power over the different social, economic, cultural and political forces which govern their lives. The aim of empowerment is to create true wealth and involve the people in all aspects of governance. Any wealth creation initiative must boost the human capital element such as knowledge, skills and health which increase the total productivity of individuals and human development index of the society. Heller 2003 defines wealth creation in terms of income generation

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which is the creation of assets, both in terms of physical and human capital. Green energy (GE) is frequently associated with sustainable development, which seeks to reduce global warming and its adverse effects on the environment, economy, and social justice.

Green Energy Efficiency

Green energy efficiency means using less energy for the same output, achieved through technologies like renewable sources (solar, wind) and better practices (insulation, efficient appliances) to cut costs, reduce emissions, and lessen reliance on fossil fuels, forming a key part of the sustainable energy transition. It's about reducing waste and optimizing energy use across buildings, industry, and transport to benefit both the environment and the economy. Energy from natural sources like sun, wind, or water that replenishes naturally and produces little to no greenhouse gas emissions, replacing fossil fuels. It's about maximizing useful output (like heat, light) with minimal energy input, often through better tech, while also switching to naturally replenishing sources, making energy use more sustainable and reducing carbon footprints. Implementing energy-saving measures within green energy systems, like using waste heat from solar power for desalination or optimizing wind/solar output with storage, making the entire system more effective and sustainable. In home economics, energy efficiency fosters wealth creation primarily through significant cost savings on utility bills, which in turn allows for greater savings and investment potential. Additionally, it equips individuals with vocational skills that can lead to gainful employment and new business opportunities within the green economy.

Home economics focuses on the effective utilization and management of human and material resources for the welfare of individuals and families. Energy efficiency is a core component of this, involving using less energy to achieve the same result, thereby minimizing waste. Adopting energy-efficient appliances significantly reduces electricity consumption, leading to direct cost savings. Simple energy-saving practices (e.g., turning off lights and appliances when not in use) reduce energy bills and promote sustained financial health. Investing in proper insulation, double-pane windows, and other energy-efficient home features results in long-term energy savings that accumulate wealth over time. The role that energy plays in the development of a country is pivotal. Quality of life is unfavourably affected by insufficient energy supply which hinders economic activities and growth. The rapid increase in rate of urbanisation and consequent population increase and general improvement in standard of living and economic development have led to an increase in electricity demand in Nigeria which has been difficult to meet. Energy demand is on the increase whereas electricity supply is relatively stagnant. More than half of the houses in Nigeria are not connected to the public mains, majority of which are in the urban areas. Energy efficiency and behavioural changes are among the key pillars of decarbonization of the global energy system. Residential sector is responsible for a large share of fossil fuels final consumption, therefore the growth of its energy efficiency can bring a valuable impact on decarbonization speed and scale. In countries with growing economies residential energy consumption can increase dramatically due to the desire of the population to improve their standard of living, therefore striking a balance between economic growth and energy efficiency improvement is a complex policy challenge.

Green Energy efficiency and socio-economic development

Energy is essential for daily living as fuel and to provide light and power. Social conditions are strong correlated with energy consumption. Gross inadequacy of energy services hinders social and economic development resulting in poor transport and telecommunication systems, healthcare and education. In effect adequate energy services have a strong potential to engender socio-economic development and enhance the living standards of a population. Adequate access to energy is necessary to meet basic human needs require. It is essential for the provision of potable water, healthcare and sanitation. It is

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also useful for the provision of lighting, heating, mechanical power, transport and telecommunication systems. The use of modern forms of energy leads to job creation in agriculture and industry. The efficient use of energy is bound to enhance the consumption of electricity. This is particularly so in developing economies where electricity is in short supply. This would involve educating the public on energy conservation and efficiency, as well as reviewing and upgrading energy efficient standards. This implies the use of appliances of high standards that minimize energy for more services in homes, as well as for transport and entertainment. Space heating, cooling, and hot water account for about 50% (fifty percent) of global energy consumption in buildings. Energy-efficient technologies for buildings have the potential to reduce the emission of carbon dioxide by 2 gigatonnes (Gt) and save 710 million tonnes oil equivalent (Mtoe) of energy by 2050. The operational energy utilized in buildings is of utmost importance because significant impacts of a building occur after its construction.

Effect of Waste recycling on wealth creation

Waste recycling creates wealth by generating jobs, stimulating economic growth, and producing valuable raw materials from discarded items. This "waste-to-wealth" approach shifts away from a linear "take-make-dispose" economy toward a circular one, where resources are reused and repurposed. Wastes are usually thought of as unwanted or unusable materials. Salmenperä, Pitkänen, Kautto and Saikku (2021) stated that waste is any substance which is discarded after primary use, or considered worthless, defective, and of no use. The term is often subjective, as not every application has identical raw material requirements and sometimes even objectively inaccurate. A starting point towards managing waste is the division in basic categories, ranging from municipal and agricultural waste to radioactive and explosive waste. Through proper collection of municipal solid waste, very important metals and other valuable sources can be recovered and used in new products, thus achieving significantly lower production cost and environmental impact. Success stories in waste management are reported in countries around the world. These typically showcase optimal waste transformation to wealth. Furthermore, applied waste management methods are specified. These actions should be adapted by every organization handling waste. At a managerial level, these must be considered as potential resources, commodities with significant economic, environmental and sociological added value (Themelis, et al., 2013).

Economic Impact of Green Innovation Inventions

Green innovation has reduced pollution and carbon emissions by reducing consumption, providing end-of-pipe treatments, and improving resource utilization, which has positive impacts on environmental performance. Green innovation can also stimulate the role of intellectual capital and human resource management and promote the green transformation of enterprises, thereby reducing resource consumption and pollution levels. In addition, green innovation can improve corporate environmental awareness, thereby promoting corporate environmental performance. Due to the rise in environmental performance, evaluations of companies by stakeholders have improved, the corporate image has been improved and Environment, Social, and Governance (ESG) performance has been significantly improved (Wu *et al*., 2022).

However, the impact of green innovation on economic performance is inconclusive. Some researchers consider that although higher investment is needed, the innovation on economic performance can still be positive. For instance, Porter’s hypothesis, proposed by Michael Porter, maintains that innovation triggered by environmental regulations can bring compensation effect to enterprise. By reducing energy consumption, green innovation reduces production costs for enterprises, which helps directly improve their profitability relax the financing constraints they face, reduce their financial risks, and improve their value market competitiveness and returns on investment. In addition to directly improving the

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economic performance of enterprises, green innovation can have an indirect impact on economic performance, such as enhancing the corporate image to generate price premiums, attracting investment and subsidies to ease financing constraints , reducing pollution to improve reputations and increase market share managing environmental risks, fulfilling social responsibilities and supplementing organizational learning abilities to strengthen competitive advantages. In addition, the high demand for capital for green innovation drives provincial financial development, and the additional opportunities it brings have increased employment rates. Therefore, much of the literature has regarded the rising level of green innovation as a sign of improved development quality, has assumed that green innovation will have positive economic consequences, and has conducted research on this basis.

Theoretical Review

Triple Bottom Line (TBL) Theory by John Elkington in the year **1994**. Elkington, a British writer and founder of the consultancy sustainability, coined the phrase to encourage businesses to consider social and environmental impact alongside financial profit. This framework suggests that sustainable success requires a balance of economic prosperity (profit), social equity (people), and environmental stewardship (planet). Green innovation is a core strategy for achieving this balance, as it can lead to economic benefits (e.g., cost savings from efficiency, new market opportunities) while also addressing social and environmental needs (e.g., job creation in green sectors, pollution reduction).

Literature Review

Zeng, Li and Magazzino (2024) examined the impact of green energy on economic prosperity, green economic recovery, and long-term sustainability. This study analyses 33 industrialized and developing nations between 1991 and 2022 in the context of green energy, sustainable economic growth, and green economic recovery. Pooled Ordinary Least Squares (OLS), the Fixed Effects Model (FEM), and the Random Effects Model (REM) are employed for analysis, and outcomes are analyzed using the Hausman specification test. The results show that both population increase and gross domestic product per capita significantly affect sustainable development. When compared, a hike in green energy prices contributes considerably to and positively to sustainable development. These results are helpful for policymakers and newcomers interested in green energy and renewable energy sources since they provide a framework to conduct more research and develop policy.

David W. Orr (1992) - In his influential work, Orr discusses ecological sustainability and its relevance to home economics. He emphasizes the integration of sustainability principles into daily practices such as resource management, consumption patterns, and waste reduction at the household level. Orr argues that understanding the ecological footprint of household activities is crucial for fostering sustainable living. 2) Elizabeth Shove (2003) - Shove's work in the sociology of consumption offers insights into the dynamics of everyday life and the potential for promoting sustainable practices in households. She argues that sustainable living involves not just individual behaviors but also the social norms and infrastructures that shape consumption choices. Shove's research highlights the importance of design, policy interventions, and social practices in fostering sustainable behaviors within domestic settings. 3) Harry Wilhite (2012) - Wilhite focuses on energy efficiency and conservation behaviors in households, emphasizing practical strategies for integrating sustainable practices into home economics. His research examines how technological advancements, behavioral changes, and policy interventions can enhance energy efficiency and reduce environmental impacts associated with residential energy use. 4) Terry Hargreaves (2011) - Hargreaves' work focuses on the social dimensions of sustainable consumption, emphasizing the role of social norms, identities, and lifestyles in shaping household behaviors. He explores how cultural practices and societal expectations influence consumption patterns and environmental impacts within home economics. Hargreaves suggests that promoting sustainable living

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requires addressing both individual choices and broader societal structures. These researchers and their publications contribute valuable insights into various aspects of sustainable living practices in home economics, from theoretical frameworks to practical strategies and policy implications. Their work collectively underscores the interdisciplinary nature of promoting sustainability within household settings, integrating perspectives from ecology, sociology, psychology, economics, and education.

Green innovation in Akwa Ibom firms:

Studies of manufacturing firms in Akwa Ibom provide experimental evidence that green operational practices such as cleaner production techniques, energy efficiency measures, and waste minimization are positively associated with organizational performance (e.g., productivity, cost reduction, and market reputation). Ekanem *et al*., (2023) used survey and regression methods to show that firms in the State that introduce green practices tend to report measurable performance improvements, underscoring that environmental upgrading can have direct economic benefits. Translating these lessons from formal firms to HBEs requires attention to scale, capital constraints, and appropriate technologies, but the manufacturing evidence provides an important proof-of-concept for green innovation as a wealth-creation strategy in the local context. Education, skills and the home-economics pipeline.

Pedagogical and institutional studies in Akwa Ibom indicate that Home Economics education, when taught with entrepreneurship and practical skill components, produces graduates with higher readiness to engage in small enterprise activity. Local studies and program evaluations show that embedding technical skills (food processing, value-addition, handicraft production) and business planning into Home Economics curricula increases students' interest and their technical capability to start HBEs upon graduation. This suggests that HEI-led interventions (curriculum reform, incubation, practica) can create an upstream pipeline of technically competent actors capable of adopting green production techniques if curricula include appropriate sustainability modules and hands-on training.

METHODOLOGY

The study adopted mixed research design. The methodology was designed to collect both qualitative and quantitative data, enabling a comprehensive analysis of the research problem. The study utilized interviews, questionnaire, and analysis of primary data obtained through administration of structured questionnaire. The study was conducted in Akwa Ibom State as a suitable and strategic context for studying green innovation in Nigeria. The population for this study consists of graduates from higher institutions in Akwa Ibom State. This group is chosen because they are the target demographic in understanding the integration of green practices and its implications on wealth creation. The specific institutions included in this study are the University of Uyo (UNIUYO), Akwa Ibom State University (AKSU), and College of Education, Afaha Nsit, Akwa Ibom State. The choice of these institutions was to capture both state and Federal institutions within the three senatorial districts in the study area. The population of the study was limited to final year students in 2022-2023 and 2023/2024 academic session graduates as contained in their convocation brochure. Since the population of the study is defined, the appropriate sample size of the study was determined using Taro Yamane (1967) formula: $n = \frac{N}{1+N(e)^2}$

Where: N is the total population of the study, e is the error term; n is sample size

$n = \frac{8089}{1+8089(0.05)2}$, $n = \frac{8089}{1+8089(0.0025)}$, $n = \frac{8089}{1+20.2225}$, $n = \frac{8089}{21.2225}$, $n = 381.15$ $n \approx 381$

In effect, 381 graduates from the University of Uyo (UNIUYO), Akwa Ibom State University (AKSU), and College of Education, Afaha Nsit, Akwa Ibom State will form the sample size of the study. Also, Bowley proportional formula was adopted to ensure equity distribution of instrument to the respondents.

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Bowley proportional formula = $\frac{\text{Segment population}}{\text{Total population}}$ x $\frac{sample\ size}{1}$

UNIUYO = $\frac{3661}{8089}$ x $\frac{381}{1}$ = 172, AKSU = $\frac{1,728}{8089}$ x $\frac{381}{1}$ = 82, College of Education = $\frac{2,700}{8089}$ x $\frac{381}{1}$ =127

To select a representative sample of graduates from Akwa Ibom State, the study employed stratified random sampling. This technique is particularly useful as it ensures that different categories of graduates from Federal university, Akwa Ibom State and college of education Afaha Nsit are represented proportionally. Data collected were systematically analyzed using both 'Descriptive (mean, frequency and percentage) and Inferential (regression)' statistical methods, to provide a robust understanding of the effect of green innovation practices among graduates in Akwa Ibom State. The analysis was done in stages, aligning with the objectives and research questions.

DATA ANALYSIS AND DISCUSSION OF FINDINGS

Discussion of Results

Table 1 results (see appendix 1) showed the effect of green innovation practices on energy efficiency and wealth creation in home economics, Akwa Ibom State. The result showed that the reduction in energy expenses through green innovation practices has contributed to wealth creation in my home economics enterprise was accepted at the mean value 4.56 > 3.0. This was followed by 56.6% of the respondents who stated that green innovation practices have enabled them to produce more goods or services with less energy consumption and was accepted at a mean value 4.31 > 3.0. 48.9% of the respondents strongly agreed that adopting green innovation practices (solar energy or energy-saving equipment) has improved the efficiency of their home-based enterprise and was accepted at a mean value 3.75 > 3.0. More so, 35.7% of the respondents agreed that energy-efficient practices in my home economics business have increased my overall income and savings and was accepted with a mean value of 3.72 > 3.0. Lastly, 33.5% of the respondents agreed that the use of energy-efficient appliances in their home economics activities has significantly reduced my energy costs. As reflected in the result, five out of five research items in the table were accepted, as above 3.0 benchmark. Thus, green innovation practices significantly affect energy efficiency and wealth creation in home economics, Akwa Ibom State.

The result showed that waste recycling practices have provided additional sources of revenue for my home-based enterprise and was accepted at the mean value 4.42>3.0. Recycling waste materials in home-based enterprise has helped reduce production costs was accepted at a mean value 4.36 > 3.0. Response on how income generated from waste recycling activities has contributed significantly to wealth creation in home-based enterprise was accepted at a mean value 4.17 > 3.0. In the same premise, response on how the reuse of waste materials has increased income through the creation of new or improved products was accepted at a mean value 4.01 > 3.0. More so, 42.2% of the respondents strongly agreed that recycling waste materials has improved the sustainability and profitability of business. As reflected in the result, five out of five research items in the table were accepted, as above 3.0 benchmark. Thus, waste recycling significantly contributes to wealth creation among home-based enterprises.

Appendix 4: The result revealed that reduced energy consumption has enabled me to save money for business growth and investment with a mean value 4.29 and was accepted at $\bar{x}$ > 3.0. Energy-efficient practices have increased their productivity and use of energy-efficient equipment reduced their operational costs have mean value of 4.04 and was accepted at $\bar{x}$ >3.0. The adoption of energy-saving methods contributes to wealth creation has a mean value of 3.83 and was accepted at $\bar{x}$>3.0. The result further revealed that, majority of the respondents 36.6% strongly agreed that energy efficiency practices have improved the profitability of my home-based business. The mean value of the items showed 4.04, 3.71, 4.29, 4.04 and 3.83 respectively. From the result, five (5) out of five (5) items had a mean value greater than 3.0. Based on the decision rule that a mean value > 3.0 is accepted while a mean < 3.0 is

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rejected, the researcher concluded that, wealth creation among graduates of home economics is a subject to green innovation practices.

Test of Hypotheses

Test of Hypothesis 1 (Appendix 5): Simple linear regression analysis result of effect of green innovation practices on energy efficiency and wealth creation in home economics. The result revealed that the t-calculated value of green innovation practices was 10.587 which is greater than tabulated value of 1.968. Thus, green innovation practices have significant effect on energy efficiency and wealth creation in home economics. The (R^2) coefficient of multiple determinations value of 0.350 was observed, implying that, 35.0% variation in dependent variable can be explained by changes in the independent variables while 65.0% were unexplained by the stochastic variable. This implies that, the independent variables (green innovation practices) explained 85.0 percent changes in dependent variable (energy efficiency and wealth creation in home economics) while 65.0 percent was explained by the stochastic variable. The R^{-2} adjusted value of 34.9% was observed indicating a goodness of fit of the regression model adopted in this study which is statistically significant at 5% probability level. F-stat value of 54.345 with F-prob. value of 0.000 against 1.968 t-table value and 0.05 was observed from the regression result, indicating a goodness of fit of the regression model adopted in this study which is statistically significant at 1% probability level. Since the calculated value is greater than tabulated value, null hypothesis rejected in favour of alternative hypothesis. Thus, there is a significant effect of green innovation practices on energy efficiency and wealth creation in home economics.

Test of Hypothesis 2 (Appendix 6**): Ho**: there is no significant effect of waste recycling on wealth creation among home-based enterprises**.** The estimate value of waste recycling (X_1) was statistically significant and positively related to wealth creation among home-based enterprises at 1 percent level. Thus, a unit increase in waste recycling leads to 0.599 unit increase in wealth creation among home-based enterprises. The result revealed that at $p=0.000 \leq 0.05$ level of significance and a degree of freedom (df) 323, the T-cal value was 28.369 and T-tab value was 1.968. As shown in the result, the calculated value is greater than the tabulated t-table distribution, therefore, the null hypothesis was rejected in favour of the alternate hypothesis. This means that, there is significant effect of waste recycling on institutional wealth creation among home-based enterprises. The (R^2) coefficient of multiple determinations was high with the value of 0.491, implying that, 49.1% disparity in dependent variable was elucidated by changes in the independent variable while 50.9% were unexplained by the stochastic variable. This implies that, the independent variable (waste recycling) was able to explain 49.1 percent disparities in dependent variable (wealth creation among home-based enterprises) while 50.9 percent was explained by the stochastic variable. The R^{-2} adjusted value of 49.0% was observed indicating a goodness of fit of the regression model adopted in this study which is statistically significant at 5% probability level. The Durbin-Watson stat value was 1.960 which is close to 2.5, implying that there is no evidence of autocorrelation. F-stat value of 84.788 with F-prob. value of 0.000 against 1.968 t-table value and 0.05 was observed from the regression result, indicating a goodness of fit of the regression model adopted in this study which is statistically significant at 5% probability level. Thus, the researcher accepted that there is a significant effect of waste recycling on institutional wealth creation among home-based enterprises in Akwa Ibom State.

CONCLUSION

The findings of this study reveal that green innovation practices significantly enhance energy efficiency and wealth creation in home economics. This indicates that the adoption of environmentally friendly innovations such as energy-saving techniques, sustainable production methods, and efficient resource utilization contributes meaningfully to improved economic outcomes and reduced energy consumption. The results further demonstrate that waste recycling has a significant effect on institutional wealth

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creation among home-based enterprises in Akwa Ibom State. This suggests that recycling practices not only promote environmental sustainability but also serve as a viable avenue for income generation, cost reduction, and business growth among home-based enterprises. Overall, the study underscores the importance of integrating green innovation and waste recycling practices as strategic tools for promoting sustainable economic development and wealth creation within the home economics sector.

RECOMMENDATIONS

From the above result, the researcher recommended the following;

1. Home economists and home-based enterprise operators should be encouraged to adopt green innovation practices such as energy-efficient appliances, renewable energy sources, and sustainable production processes to enhance energy efficiency and wealth creation.
2. Policies and programs should be developed to support waste recycling among home-based enterprises, including access to recycling facilities, provision of recycling equipment, and incentives for enterprises that actively engage in recycling practices.
3. Green innovation and waste recycling concepts should be fully integrated into home economics education to foster sustainable practices and entrepreneurial skills from an early stage.

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Appendix 1: Questionnaire Statements

(Please indicate your level of agreement using: **SA = Strongly Agree, A = Agree, N = Neutral, D = Disagree, SD = Strongly Disagree**)

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Sn	Statement					
	Objective 1: effect of green innovation practices on energy efficiency and wealth creation in home economics	**SA**	**A**	**D**	**SD**	**UN**
1	The use of energy-efficient appliances in my home economics activities has significantly reduced my energy costs.					
2	Adopting green innovation practices (solar energy or energy-saving equipment) has improved the efficiency of my home-based enterprise.					
3	Energy-efficient practices in my home economics business have increased my overall income and savings.					
4	Green innovation practices have enabled me to produce more goods or services with less energy consumption.					
5	The reduction in energy expenses through green innovation practices has contributed to wealth creation in my home economics enterprise.					
	Objective 2: the effect of waste recycling on wealth creation among home-based enterprises.	**SA**	**A**	**UN**	**D**	**SD**
1	Recycling waste materials in my home-based enterprise has helped reduce production costs.					
2	The reuse of waste materials has increased my income through the creation of new or improved products.					
3	Waste recycling practices have provided additional sources of revenue for my home-based enterprise.					
4	Recycling waste materials has improved the sustainability and profitability of my business.					
5	Income generated from waste recycling activities has contributed significantly to wealth creation in my home-based enterprise.					
	Energy efficiency and wealth creation in home economics	**SA**	**A**	**UN**	**D**	**SD**
1	The use of energy-efficient equipment reduced my operational costs.					
2	Energy efficiency practices have improved the profitability of my home-based business.					

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3	Reduced energy consumption has enabled me to save money for business growth and investment.					
4	Energy-efficient practices have increased my productivity					
5	The adoption of energy-saving methods contributes to wealth creation					

Appendix 2: Effect of green innovation practices on energy efficiency and wealth creation in home economics, Akwa Ibom State

Statements	SA	A	D	SD	UN	Total	x̄
1. The use of energy-efficient appliances in my home economics activities has significantly reduced my energy costs.	109 (33.5)	82 (25.2)	26 (8.0)	56 (17.2)	52 (16.0)	325 100	3.43
2. Adopting green innovation practices (solar energy or energy-saving equipment) has improved the efficiency of my home-based enterprise.	159 (48.9)	55 (16.9)	21 (6.5)	52 (16.0)	38 (11.7)	325 100	3.75
3. Energy-efficient practices in my home economics business have increased my overall income and savings.	116 (35.7)	98 (30.2)	49 (15.1)	28 (8.6)	34 (10.5)	325 100	3.72
4. Green innovation practices have enabled me to produce more goods or services with less energy consumption.	184 (56.6)	78 (24.0)	50 (15.4)	7 (2.2)	6 (1.8)	325 100	4.31
5. The reduction in energy expenses through green innovation practices has contributed to wealth creation in my home economics enterprise.	230 (70.8)	70 (21.5)	10 (3.1)	10 (3.1)	5 (1.5)	325 100	4.56

Source: Field Survey, 2025 Decision rule: Accept a mean value ≥ 3.0, otherwise reject

Appendix 3: The effect of waste recycling on wealth creation among home-based enterprises

Table 2: The effect of waste recycling on wealth creation among home-based enterprises

Statement	SA	A	D	SD	UN	Total	x̄
1. Recycling waste materials in my home-based enterprise has helped reduce production costs.	192 (59.1)	89 (27.4)	20 (6.2)	19 (5.8)	5 (1.5)	325 100	4.36
2. The reuse of waste materials has increased my income through the creation of new or improved products.	129 (39.7)	126 (38.8)	37 (11.4)	13 (4.0)	20 (6.2)	325 100	4.01

3.	Waste recycling practices have provided additional sources of revenue for my home-based enterprise.	185 (56.9)	108 (33.2)	18 (5.5)	13 (4.0)	1 (0.3)	325 100	4.42
4.	Recycling waste materials has improved the sustainability and profitability of my business.	137 (42.2)	65 (20.0)	64 (19.7)	37 (11.4)	22 (6.8)	325 100	3.79
5.	Income generated from waste recycling activities has contributed significantly to wealth creation in my home-based enterprise.	163 (50.2)	86 (26.5)	55 (16.9)	12 (3.7)	9 (2.7)	325 100	4.17

Source: Field Survey, 2025 Decision rule: Accept a mean value ≥ 3.0, otherwise reject

Appendix 4: **Wealth creation and energy efficiency**

Statements	**SA**	**A**	**D**	**SD**	**UN**	**Total**	**$\bar{x}$**
1. The use of energy-efficient equipment reduced my operational costs.	137 (42.2)	113 (34.8)	42 (12.9)	18 (5.5)	15 (4.6)	325 100	4.04
2. Energy efficiency practices have improved the profitability of my home-based business.	93 (28.6)	119 (36.6)	61 (18.8)	32 (9.8)	20 (6.2)	325 100	3.71
3. Reduced energy consumption has enabled me to save money for business growth and investment.	194 (59.7)	80 (24.6)	23 (7.1)	10 (3.1)	18 (5.5)	325 100	4.29
4. Energy-efficient practices have increased my productivity	162 (49.8)	81 (24.9)	32 (9.8)	33 (10.2)	17 (5.2)	325 100	4.04
5. The adoption of energy-saving methods contributes to wealth creation	96 (29.5)	133 (40.9)	52 (16.0)	35 (10.8)	9 (2.8)	325 100	3.83

Source: Field Survey, 2025 Decision rule: Accept a mean value ≥ 3.0, otherwise rejected

Appendix 5:

Table 4: Simple linear regression analysis result of effect of green innovation practices on energy efficiency and wealth creation in home economics

Variable	**Parameters**	**Coefficient**	**Std error**	**Tcal – value**
Constant	β_0	-69.593	242.240	-0.287
Green innovation practices (X_1)	β_1	1.088	0.103	10.587^{***}
R-Square (R^2)		0.350		
Adjusted R – Square (R^{-2})		0.349		
F – Statistics		55.345		
F – Probability		0.000		

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Durbin-Watson stat	2.135

Decision Rule: If Fcal>Ftab accept the alternate and reject Null hypothesis. Otherwise accept the null hypothesis.
(*** = 1%), (** = 5%), and (* =10%) denotes significance of coefficient at level respectively. t-tab value = 1.968
df = 323 Dependent Variable: wealthcreation, Predictors: (Constant), greeninnovation
Source: Field Survey, 2025 (SPSS Version 23)

Appendix 6:

Test of Hypothesis 2: Ho: there is no significant effect of waste recycling on wealth creation among home-based enterprises

Variables	**Parameters**	**Coefficient**	**Std error**	**Tcal – value**
Constant	β_0	68.957	22.946	3.005***
Waste recycling (X_1)	β_3	0.599	0.021	28.369***
R-Square (R^2)		0.491		
Adjusted R – Square (R^{-2})		0.490		
F – Statistics		84.788		
F – Probability		0.000		
Durbin-Watson stat		1.960		

Decision Rule: If Fcal>Ftab accept the alternate and reject Null hypothesis. Otherwise accept the null hypothesis.
(*** = 1%), (** = 5%), and (* =10%) denotes significance of coefficient at level respectively. t-tab value = 1.968
df = 323 Dependent Variable: wealthcreation, Predictors: (Constant), wasterecycling
Source: Field Survey, 2025 (SPSS Version 23)

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BEYOND TOKENISM: REIMAGINING PEACE EDUCATION IN NIGERIA'S DIVERSE SOCIETY

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Abstract
Peace education has increasingly been recognized as a critical instrument for fostering social cohesion, preventing violence and promoting sustainable peace. In Nigeria, however, despite its relevance in addressing persistent insecurity, youth restiveness and communal conflicts, peace education remains inadequately institutionalized. This study critically examines the state of peace education in Nigeria, focusing on its conceptual foundations, implementation in formal and informal contexts, policy responses and structural challenges. Employing a qualitative, desk- review methodology anchored in Galtung's Peace Theory and Critical Peace Education Theory, the study synthesizes extant literature, interrogates government policy responses, and identifies persistent knowledge gaps. Findings reveal that although peace education elements are embedded within subjects such as civic education and social studies, the absence of a coherent and stand-alone framework undermines their effectiveness. Furthermore, the study identifies a significant disconnect between formal education and indigenous peacebuilding practices, which remain underutilized despite their cultural relevance and practical efficacy. The paper argues for a paradigm shift toward a context-sensitive and integrative approach that bridges formal curricula with indigenous knowledge systems. It concludes that meaningful institutional commitment, curriculum reform and the incorporation of local peace practices are essential for repositioning peace education as a transformative tool for sustainable peace in Nigeria.
Key Words: Peace Education, Peacebuilding, Nigeria, Peace Culture, Youth

Introduction

The multidisciplinary and multifaceted nature of peace education, as emphasized by Najjuma (2011), allows for the adaptation of its goals and methodologies to suit various social, political, and economic circumstances. This renders peace education inherently interdisciplinary, addressing overarching issues that require the involvement of every individual to eradicate all manifestations of violence within a society (Carreira et al, 2014). Peace education deals with complex issues that draw on knowledge and insights from diverse perspectives and disciplines to help learners develop empathy and understanding for others. Peace education is also cross-cutting in nature, involving the participation of people from all walks of life and diverse backgrounds, including students, parents, communities, religious groups and policymakers. While conventional classroom environments play a critical role in providing students with a foundation in peace education concepts and skills, however, to genuinely cultivate a culture of peace, peace education needs to extend beyond the classroom walls and should permeate all facets of society. In fact, many experts in the field, such as Bar-Tal (2002), Gamut (2006), Navarro-Castro and Nario-Galace (2010), Kester (2012) and Barrios-Tao et al (2017) contend that peace education achieves its greatest impacts when it seamlessly

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integrates into all aspects of life, spanning from homes and communities to workplaces and media outlets.

Peace Education, in the words of Isaac (1999), is typically ascribed to any actions that are targeted at promoting knowledge and skills that empower people of diverse age groups and across all strata of society to effect positive attitudinal change in preventing and peacefully resolving conflict, or ensuring a conducive environment supportive of peace. It is a lifelong process that takes place in a variety of settings, including households, schools, workplaces and communities.

Beyond understanding conflict and seeking its peaceful resolutions, peace education equally demands the active involvement of the younger generation in taking the lead and working together to provide initiatives with a common purpose of eradicating violence from our individual lives, communities, and societies at large (Navarro-Castro & Nario-Galace, 2010). Peace education is a conflict prevention and peacebuilding tool, practised in-school and out-of-school environments to inculcate positive, transformative behaviour and the culture of peaceful co-existence among individuals or within a collective group using all available channels of socialization. The primary foundation for cultivating a culture of peace resides within the individuals themselves, as they are responsible for establishing peaceful relationships and creating structures for peace (Navarro-Castro & Nario-Galace, 2010). For any society to achieve peace, a culture of peace is a necessary prevailing condition and a culture of peace is best promoted through peace education. In this manner, peace education helps foster a culture of peace, defined by core values such as respect, tolerance, justice, and empathy (Sheikh & Akhter, 2023).

Basically, the purpose of peace education is to ensure that the underlying causes of all types and degrees of violence and conflict are critically understood and also to provide students with the necessary transformative non-violent skills needed to foster a culture of peace (Toh & Cawagas, 2010). Kester (2012) notes that peace education's overarching objective is to ultimately change conflict situations through dialogue and nonviolent disposition in order to build resilient and peaceful communities. Bajaj's (2015) study further reinforces the claim that peace education strives to develop novel structures that not only advance peace, social justice, and human rights but also transform pre-existing structures of violence. Indeed, the objective of preventing violence and fostering peace is of critical importance to peace education (Hamman, 2017).

Peace education occupies a central position in the educational contribution to peacebuilding efforts (Isaac, 1999). Kester (2010) asserts that the development of peacebuilding skills is part of peace education. Dialogue, negotiation, mediation, alternative dispute resolution, creative conflict resolution, and active listening are among these skills. To change repressive systems from a violent orientation toward a culture of peace, Kester (2010) affirms that education for peace requires intensifying deliberations on pressing issues that are desirably pertinent to the community. When implemented in accordance with the social, cultural, and national needs and wishes, peace education is more impactful and achieves greater success (Navarro-Castro & Nario-Galace, 2010). This signifies that the most successful peace education programmes, as explained by Smith (2011), are multilayered, extending beyond intergroup and interpersonal interactions, and addressing the causative factors of structural injustices and other root causes of conflict in society. Peace education holds so much importance that it can be deployed in preventing future conflicts and minimizing existing ones.

The rapid development of peace education is traceable to the fact that it has evolved from its initial, predominantly activist approach and now shifts to evidence-based techniques while fashioning out and employing programme designs that are appropriate for specific circumstances (Fitzduff & Jean, 2011). Education in this perspective is seen as a social investment rather than just a way for an individual to pursue a career. Hence, peace education acts as a reflexive educational and community-oriented technique to effect social transformation (Kester, 2012). The principles of peace education involve a blend of formal, informal and non-formal approaches. These include peace education

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integrated into the school curricula for students, community-driven peace education, and media advocacy campaigns that promote a culture of peace, reconciliation, forgiveness and tolerance. A considerable array of peace education programmes has been developed across different countries, some of which can serve as valuable sources of resources. Tinker (2016) cites noteworthy instances of some of the successful peace education programmes, and these encompass Education for Mutual Understanding (EMU) in Northern Ireland, Education for Conflict Resolution (ECR) in Sri Lanka, Nepal for Peace Education Project, and Education for Peace (EFP) in Bosnia and Herzegovina.

Against the backdrop of Nigeria's persistent and multifaceted conflict landscape, the imperative for a more deliberate and context-responsive peace education framework becomes increasingly evident. While existing efforts have acknowledged the value of peace education, they remain fragmented, inadequately institutionalized, and insufficiently aligned with the country's socio-cultural realities. This gap underscores the need for a critical re-examination of both the conceptual foundations and practical implementation of peace education in Nigeria. Accordingly, this study interrogates the current state of peace education, with particular attention to its integration within formal educational structures, its manifestation in indigenous and informal practices, and the nature of government policy responses. By synthesizing existing literature and identifying critical gaps, the paper seeks to advance a more holistic and context-sensitive approach that bridges formal curricula with indigenous knowledge systems. Ultimately, the study aims to contribute to ongoing scholarly and policy debates by proposing pathways for repositioning peace education as a transformative instrument for sustainable peace and social cohesion in Nigeria.

Theoretical Framework

This study is anchored on two complementary theoretical perspectives: Galtung's Peace Theory and Critical Peace Education Theory. These frameworks collectively provide the analytical lens for examining the state of peace education in Nigeria, evaluating government responses, and identifying gaps in both formal and informal approaches.

Galtung's Peace Theory

Norwegian sociologist Johan Galtung (1969) introduced a foundational distinction between negative peace and positive peace. Negative peace refers to the absence of direct, personal violence such as armed conflict, riots, or physical aggression. Positive peace, on the other hand, goes beyond the cessation of overt violence to address structural violence—systemic injustices embedded in social, political, and economic institutions, including poverty, inequality, ethnic marginalization, and lack of access to justice.Applying this framework to Nigeria, the recurring conflicts across the six geopolitical zones—ranging from farmer-herder clashes and religious extremism to militancy and ethnic tensions—represent failures of both negative and positive peace. Government responses have largely focused on security-centric, reactive measures (negative peace) rather than addressing root causes such as youth exclusion, resource inequality, and poor governance (positive peace). Peace education, from Galtung's perspective, must therefore go beyond teaching non-violent conflict resolution. It must empower learners to recognize and challenge structural violence, advocate for social justice, and actively participate in building equitable institutions.

This theory justifies the paper's argument that Nigeria's piecemeal integration of peace education into social studies curricula is insufficient. A standalone, well-funded peace education programme is necessary to cultivate both negative and positive peace competencies among Nigerian youth.

Critical Peace Education Theory

Critical Peace Education Theory, as articulated by Bajaj and Hantzopoulos (2016) posit that peace education should not be a neutral or value-free enterprise. Instead, it must explicitly challenge

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oppressive structures, confront discrimination, and empower learners as agents of transformative social change. Unlike traditional approaches that emphasize individual behaviour modification, critical peace education interrogates how power, privilege, and historical injustices perpetuate cycles of violence. This framework is particularly relevant to Nigeria's heterogeneous society, where religious diversity, ethnic pluralism, and regional inequalities have often been manipulated to fuel conflict. Critical peace education requires that curricula address sensitive issues such as marginalization, historical grievances, and systemic corruption—not merely promote tolerance and harmony. It also validates indigenous and community-based knowledge systems, including proverbs, folktales, and oral traditions, as legitimate pedagogical tools.

In this study, Critical Peace Education Theory supports the paper's emphasis on informal peace education channels such as Yoruba proverbs (Adegoju, 2009), Igbo proverbs (Nwankwo, 2015). Storytelling (Folami & Olaiya, 2016), and Hausa *karin magana* (Ademowo & Nuhu, 2017). These indigenous methods are not relics of the past but active, critical pedagogies capable of fostering attitudinal change and social cohesion.

Methodological Approach

This study adopts a qualitative, library-based review methodology—a design appropriate for conceptual and theoretical papers that synthesize existing knowledge, identify gaps, and offer critical analysis without primary data collection. The approach is descriptive, interpretive, and critical rather than statistical or experimental. The paper employs a narrative literature review design, which is well-suited for examining broad, complex topics such as peace education across formal and informal settings. Unlike systematic reviews that require strict protocols and meta-analysis, narrative reviews allow for thematic synthesis, critical interrogation, and the integration of diverse source types—including peer-reviewed articles, government documents, NGO reports, and policy briefs. Data for this study were sourced exclusively from secondary sources, including peer-reviewed journal articles, government and agency publications, NGO and international organization reports, books and book chapters on peace education, conflict resolution, and African indigenous knowledge systems. Data were analyzed using thematic analysis, following the six-phase framework proposed by Braun and Clarke (2006): familiarization with the data, generating initial codes, searching for themes, reviewing themes, defining themes, and producing the report. Through this process, five major themes emerged:

1. Formal peace education in Nigerian schools
2. Informal and traditional peace education (proverbs, folktales, storytelling)
3. Government response and policy frameworks (NERDC, IPCR)
4. Challenges militating against peace education implementation
5. Gaps in the existing literature

Each theme was critically examined, synthesized, and presented with supporting evidence from the reviewed sources. Divergent findings (e.g., Olowo, 2016), arguing that peace education is unnecessary as a standalone subject versus (Uko et al., 2015) advocating for a standalone curriculum) were noted and discussed to present a balanced analysis.

Formal Peace Education

Peace education is a primary pillar for preventing armed conflict and violence, saving lives and freeing up limited

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*resources for social needs. (*The Global Partnership for the Prevention of Armed Conflict (GPPAC), 2018).

Formalized peace education, as the name suggests, refers to a well-organised and structured educational system of teaching and learning that is delivered within the four walls of the classroom to help students and learners acquire knowledge and skills on non-violent conflict resolution. This is because educational settings like schools are most appropriate and well-suited for peace education pedagogy due to the conduciveness of the academic environment, which can positively impact and influence attitudinal disposition of younger people towards building a culture of peace within their colleagues, families and society at large. Although formal peace education is naturally taught in school, an argument has however been advanced in recent times that conferences, workshops and symposia can also be employed as a veritable platform for the teaching of formal peace education.

Unfortunately, in Nigeria, peace education as a separate subject has not been institutionalized despite the establishment of an agency with a clear mandate to design and implement peace education in schools. Instead of making it a stand-alone subject, the piecemeal approach has barely made any significant impact in achieving the objectives of the peace education programme. It is in response to this that peace scholars and civil society organizations who understand the importance of peace education have taken up the gauntlet to teach the subject and equally canvass for its introduction into Nigeria's education curriculum.

For instance, West Africa Network for Peacebuilding (WANEP) (2002), while advocating for the inclusion of peace education in Nigerian schools as a stand-alone subject, pilot-tests its practicability using the primary and secondary school platforms to design and implement a West Africa-specific peace education programme. The programme specifically targets children between the ages of 3 and 17 years in selected schools in Enugu, Delta and Rivers states. Thirty pilot schools were picked and subjected to a 3-month mock class teaching on peace education. The success of the peace education project tested in Nigeria and six other West African countries informed WANEP's support for the teaching of peace education in schools to stem the increasing rates at which the younger generation is involved in deadly conflicts in the West African sub-region

Emah (2008), whose research on fostering gender equity with the aid of filmed drama as a peace education technique, derives evidence from 400 randomly sampled students from six schools in three South-south States of Nigeria that filmed drama as a peace education tool improves attitudinal change to gender parity among youth. The research further discovers that males' and females' perceptions about gender equity are significantly different before experiencing peace education (filmed drama), but after exposure to peace education, there was hardly any major difference between males and females in their attitude towards gender equity. Filmed drama, simulation, role play, case study and other related tools are proposed as effective peace education techniques to stimulate youth to positive behavioural change.

Omirin and Funke's (2015) study on twenty secondary schools in the South-west Nigerian to gauge the perception of teachers on the influence of peace education reveals that through subjects like social studies, government, history and religious studies, peace education is being taught in schools and is critical in building and promoting human relations. Their research acknowledges the importance of peace education in reforming students and uniting and protecting the populace, and can equally play a prominent role in curbing crises in Nigeria. While the message of peace education could be popularized formally within the school, informal settings (family, community), although less organized but very effective, offer a large platform for peace education and ultimately translate to societal peace. The researchers want the government to go beyond facilitating the introduction of peace education in the curriculum, but also to monitor the implementation to achieve its objectives.

The survey carried out by Irene (2016) among eight secondary schools, involving 174 students within Ibadan township in Oyo State to appraise the effectiveness of peace clubs as a catalyst for peace in Nigerian schools, presents proof that peace clubs and other related peace architecture can empower

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youth with necessary conflict transformation and peacebuilding skills to instil a culture of peace and non-violent conduct. Although peace clubs are established in schools, they can also function effectively in informal settings such as households and communities to promote positive attitudinal change and encourage good social habits among the citizens

Data sourced by Ubogu (2016) from eighty-nine teachers selected from 124 public and private secondary schools in Delta State to measure peace education as a strategic tool for peace building and peace culture in Nigeria underscores the compatibility of peace and cultural harmony as necessary ingredients for peace education to prevent and resolve disputes peacefully. The introduction of peace education in primary and secondary schools by the government forms part of the paper's recommendations

The work of Obidike et al (2016) on "Peace Education in Nigeria: Imperative for Conflicts Resolution and Economic Recovery" traces insufficient or a lack of peace education to the recurring conflict across the six geopolitical zones since the independence period. They relate the lack of conflict resolution attributes by Nigerians to the dearth of knowledge and training on peace education. One of the key recommendations made is the inclusion of a peace education programme at both the formal and informal settings, involving active participation of stakeholders such as community leaders, churches, mosques, town union members and other relevant social organisations

A research undertaken among two hundred respondents across secondary schools and lecturers in higher institutions of learning in Ondo State on the impacts of integrating peace education into Nigeria's educational system by Olowo (2016) demonstrates the relevance of peace education in curbing crime, violence and other social vices in Nigeria. The paper claims in its findings that peace education and social studies have no major differences and are almost similar, hence no justification for the introduction of peace education as a separate subject. The researcher explains further that there is ample evidence that Nigeria is desirous of peace education, considering the rampant social vices among the youth and the mounting insecurity challenges that the country is facing.

Fabarebo et al (2019), whose evaluation on available curriculum for peace education in Nigeria's primary school from the religion perspective using the content analysis method, harp on the need for stakeholders to support and be involved in the formulation of peace education desirable for pre-primary and primary educational systems. Once peace education is integrated into the school curriculum, social practices, including social relations, will be strengthened, thereby promoting peaceful coexistence in the country. The research, which focuses on religious principles and practices as key components of peace education, envisages a gradual reduction in all kinds of violent conflict as religious teachings are more entrenched at tertiary institutions in Nigeria. The authors call for an extension of peace education practices beyond the classroom environment and under the supervision of parents and community members. They recommend a review of the current curricula to accommodate a peace education programme for the enhancement of peace and conflict resolution in a heterogeneous society like Nigeria

In their paper titled " Strategies in Peace Education and National Cohesion: The Nigerian Perspective", Ofoego and Charles (2020) maintain that despite the sincerity of purpose on the part of the successive governments to promote national integration, conflicts and violence have continued to pose a threat to Nigeria’s unity. Nigeria, being a peace-loving country, believes strongly in unity, harmony, equality and justice in accordance with its overall philosophy as stipulated in the National Policy on Education. They explained that formally, some decisive steps had since been taken by the government to integrate certain components of peace education into the country's educational system and had taken various forms such as civic education, social studies, citizenship education, and global education. They made instances to the 9-year Basic Education Curriculum published in 2006 by the Nigerian Educational Research and Development Council (NERDC) to expand the new basic social studies curriculum to contain topical issues such as peace and conflict, child/women trafficking, youth restiveness and so forth. A new and restructured Social Studies curriculum was then disaggregated from Civic Education and infused with peace education, gender education, and family life education. The

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improved curriculum was a deliberate effort to familiarize the youth with peace education. The authors therefore call for a change of strategies for effective peaceful co-existence by focusing attention on cultivating the culture of peace among the Nigerian populace through incorporating peace education in the school curriculum

Ohere's (2021) investigation on Peace as an Authentic Foundation of Education from the Confucian and Perspectives, discovers that the educational system in Nigeria places little premium on peace and peace education, which ought to teach and equip students with relevant skills to effect peaceful changes within the families, communities and the country at large. Hence, the country is constantly under severe security threats such as kidnappings, political thuggery, armed robbery, ethnic clashes, militancy, and religious extremism. He argues further that these have, in turn, impacted negatively on Nigeria's educational system and caused untoward hardship to the students, teachers/lecturers and society as a whole because peace is the ultimate foundation of education. To achieve social cohesion and peace education in Nigeria, he suggests Confucius ' proposition that right attitudinal disposition should be the guiding principle to social life, as men have an innate desire for peace.

Informal Peace Education

Informal peace education can be described as a channel through which various peace education techniques, including traditional methods, are learnt and taught in a non-formal channel to strengthen the culture of peace and equip citizens with skills, values, and knowledge about peace promotion, conflict resolution and peacebuilding that enhance harmonious relationships in society. It takes place outside the framework of the formal school system, such as churches, mosques, IDP camps, markets, communities, families, farm settlements and any accessible environment. Non-formal peace education is largely embedded within the social, religious, and cultural context and delivered informally through plays, music and dancing, dramas, idioms, stories, jingles, literature, prose, legends, and media (traditional and new). Although non-formal channels of peace education might not be methodical and well-coordinated, unlike what is obtainable in a formalised setting, it is powerful and very effective in promoting peace in any society. As a matter of fact, the customs and traditions of several tribes in Nigeria are enriched with series of peace education messages that encourage and promote social cohesion and peaceful co-existence.

Traditionally, Nigerian society has its own methods of engendering peace and resolving conflicts through oral expressions using proverbs, folktales, wise sayings, idioms, songs and so forth, which teach the virtue of unity, forgiveness, and peaceful coexistence. Peace education across several cultures in Nigeria is embedded in oral forms, which are wrapped in deeply rich African cultures and traditions. However, one of such popular channels through which traditional peace values and messages are propagated and promoted across different tribes and cultures in Nigeria is the proverb. Proverbs, for instance, are expressed in metaphorical language and act as a repository of native wisdom and knowledge and are very philosophical, which evokes profound intellectual reflection and thinking in the interpretation and analysis of issues. Besides its metaphorical importance, proverbs are also an embodiment of narrations that depict true life experiences and can be interpreted in different ways to suit different circumstances.

Adegoju (2009), whose research focuses on the rhetorical import of the Yoruba proverbs in the resolution of social conflicts, maintains that the wisdom inherent in Yoruba proverbs transcends cultural boundaries and is incredibly germane in understanding various conflict situations in Africa and in proffering strategies for resolving them. The author analyzes some Yoruba proverbs and categorises them under different segments depending on their relevance to the nature of conflict and specific conflict situations. For instance, on the inevitability of conflict as a social process, he mentions some Yoruba proverbs to justify the presence of conflict as part of human nature and one of which is “A kì í mòón gún mò ón tè, kí iyán ewùrà má lémo” (No matter how carefully we pound water yam, a few

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lumps will remain). The interpretation of this proverb is that conflict is unavoidable in life because there will always be conflicts of interest regardless of the way we comport and conduct our relationships with others, therefore, we have to learn to deal with the situation. On the importance of managing conflict, the author proposes "Adìe bà lókùn, ara kò rokùn, arakò ro adíe" (The fowl perches on a rope, the rope is unsteady and the fowl feels uneasy) and "Àìsàn làá wò, a kì í wo ikú" (It is sickness that can be cured, we cannot cure death). The former connotes that the price of conflict is heavy to pay, and should conflict arise, everyone will be affected one way or the other; hence, we should all strive to give peace a chance. The latter emphasizes the avoidance or timely intervention of conflict before degenerating into loss of human lives because once death occurs, it is irreversible unlike sickness that can be managed or cured. On probing strategies in conflict resolution, "Bí igi bá wó lu igi, tòkè là á kó gbé kúrò" (If trees fall on trees, the topmost has to be removed first). This means that when resolving or mediating in any conflict situation, it is important to first attend to the most pressing issue to pave the way to resolve other underlying issues. On dispositions necessary for realistic conflict resolution, "Bí a bá fi owó òtúnbá omo wí, à sì tún fi owó òsì fà á móra" (If we chastise a child with the right hand, we should draw him or her near ourselves with the left hand). It means justice should be tempered with mercy, and we should have a large heart to accommodate or overlook the misdeeds of others. The paper concludes by saying that the richness and versatility of the Yoruba proverbs can be tapped to peacefully resolve conflicts across Africa instead of engaging in violent crisis

According to Nwankwo (2015), the application of Igbo proverbs as a social stabilization and conflict prevention tool demonstrates that if properly utilized, proverbs could play a major role in moulding human character and positively impacting a child's upbringing. It is laced with lots of moral lessons to, as the case may be, praise, warn, educate and correct children's misconduct when going astray. The author presents some proverbs to buttress his arguments. For example, he uses *ọkọ kọwa ḿmadụ,íbe ya akọ ya* (be your brother's keeper) and Gidi gidi bụ ugwu éze (unity is strength) to project selflessness, oneness and spirit of brotherhood as good virtues that promote cooperation and hospitality. The paper recommends that early exposure of children to philosophical proverbs will imbibe in them indigenous knowledge and wisdom that will aid their development and nurture them to be of high moral character for a stable and peaceful society.

Using qualitative interviews to extract information from 28 participants (18 women and 10 men) who were known to be versatile in storytelling within Ife and Modakeke communities, Folami and Olaiya (2016) assess how gendered storytelling stimulates peace in a post-conflict society. The research finds that storytelling was used as a veritable and effective instrument to build enduring peace by both men and women after the prolonged crisis between the two communities. Other methods of conflict resolution, such as peace training, community reconciliation, judicial commissions and panels of inquiry previously employed to resolve the crisis failed to achieve a lasting peace. But the two communities embraced storytelling as a healing power through the construction of symbols, signs and gestures which helped in strengthening security and building sustainable peace. Storytelling through folktales, moonlight tales, songs, drama and entertainment is a double-edged sword peace building instrument used positively to transition either from conflict situations to an enduring peace or used negatively to trigger or reignite latent conflict. Although the gendered storytelling which this paper emphasizes obtains evidence that stories narrated by males and females are a potent weapon to positively shape the mindset of the listeners, the stories shared by women have more meaningful and penetrating impacts during the peacebuilding processes than those of men. In its conclusion, the paper appeals to the government to ensure that storytellers are elevated to professional peacebuilders

Ademowo and Nuhu's (2017) paper probes the use of proverbs as an indigenous knowledge among the Hausa tribe of Northern Nigeria for peace building and conflict management. They argue that among Hausas in the Northern part of Nigeria, proverbs are popular peacebuilding tools that check their excesses and correct their wrongdoings because it is considered a demonstration of stark truth based on common sense and the social experience of people. The paper explains that the proverb in

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Hausaland is called "Karin Magana", and it has historical and significant antecedents of the Hausa culture. Hausas value and appreciate relationships and associations, and in a typical Hausa community, people are noticeably gathered in popular spots known as "*majalisa",* which literally means assembly ground or hanging out point. Proverbs are copiously utilized in *majalisa* to address and solve diverse issues such as marital problems, religious intolerance and so forth. For instance, Hausa proverbs such as *Zama lafiya yafi zama dan sarki* ((living in peace is better than being a prince) and *Hakuri maganin zaman duniya* (Patience is a therapy for peaceful co-existence) emphasize the importance of peace as a priceless asset in human life. They also claim that patience is a good virtue that all must cultivate instead of being impatient. Their findings reveal that the studied proverbs have rich and underlying connotations and interpretations for conflict management and peace building beyond their literal meanings. The authors conclude that proverbs can be adapted and applied to address different conflict-related issues like impacting knowledge, promoting love and kindness, curbing social vices and so forth. They advocate for the dedication of more efforts to popularize the application of indigenous methods of managing conflicts.

Ofoego and Charles (2020) believe that traditionally, peace education in Nigeria has been an age-long informal practice among different tribes, placing prominence on good character, peaceful co-existence and mutual respect. Therefore, the development of peace education can be traced to the indigenous system of education in Nigeria. They explain that although it was not explicitly stated in the educational system then, traditional proverbs, folk tales and songs were very popular in the pre-colonial era as a form of peace education to teach values that built positive relations in the community.

State Policy Frameworks and Institutional Responses to Peace Education in Nigeria

Government engagement with peace education in Nigeria has evolved largely through institutional frameworks and curriculum policy initiatives, albeit with limited transformative impact. A central actor in this regard is the Nigerian Educational Research and Development Council (NERDC), established in 1988 with the statutory mandate to design, develop, and mainstream educational curricula, including peace education, across formal and non-formal sectors. This mandate was further reinforced when NERDC was incorporated into the Presidential Implementation Committee tasked with integrating peace and conflict prevention strategies into national development planning.

In executing this responsibility, NERDC was assigned key functions, including the development of peace and conflict resolution curricula at the pre-tertiary level and the capacity-building of teachers and school administrators to effectively deliver such content. To operationalize these objectives, the Council articulated a multi-pronged strategy encompassing teacher training, curriculum review and realignment, integration of emergent societal issues, development of stereotype-free instructional materials, promotion of indigenous languages in pedagogy, and enhanced stakeholder participation in curriculum design. Despite these clearly defined policy intentions, implementation has been largely constrained by bureaucratic inertia and limited institutional commitment. Rather than establishing peace education as a distinct and standalone subject, government efforts have predominantly taken the form of partial integration into existing subjects such as social studies and civic education. For instance, the 9-year Basic Education Curriculum introduced in 2006 incorporates elements of peace education—such as conflict resolution, human rights, and value reorientation—but only in a fragmented and non-systematic manner. This piecemeal approach has significantly weakened the coherence and effectiveness of peace education delivery.

In addition to NERDC, the establishment of the Institute for Peace and Conflict Resolution (IPCR) in 2000 represents another institutional effort to promote peacebuilding through research and policy support. Furthermore, several Nigerian universities and research institutions now offer programmes in peace and conflict studies, contributing to the intellectual and professional development of the field.

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However, these initiatives remain largely confined to higher education and have not sufficiently translated into widespread foundational learning at the basic education level.

Overall, government responses to peace education in Nigeria reflect a pattern of rhetorical commitment without commensurate structural and policy depth. The absence of a dedicated curriculum framework, inadequate implementation mechanisms, and over-reliance on integration strategies continue to undermine the potential of peace education as a tool for sustainable conflict transformation.

Structural and Institutional Constraints to the Effective Implementation of Peace Education in Nigeria

The effective institutionalization and implementation of peace education in Nigeria are constrained by a range of interrelated structural, policy, and socio-cultural challenges. A major limitation lies in the insufficient political will and institutional commitment on the part of the government. Although initial efforts were made to recognize the importance of peace education, these have not translated into sustained policy action or systematic implementation. As a result, peace education remains peripheral within the national education framework rather than being prioritized as a strategic tool for national development and conflict transformation. Closely related to this is the issue of inadequate funding. The education sector in Nigeria has historically suffered from low budgetary allocation, and peace education—being a relatively new and specialized field—receives even less financial attention. The development of curricula, training of specialized personnel, production of instructional materials, and implementation of programmes all require substantial investment, which is currently lacking.

Another critical challenge is the limited contextualization of peace education content. Much of the existing curriculum and pedagogical approaches are derived from Western models, which may not fully capture or address Nigeria's unique socio-cultural realities and conflict dynamics. This lack of localization reduces the relevance and effectiveness of peace education in addressing grassroots conflict situations.In addition, there is a widespread lack of awareness and understanding of peace education among key stakeholders, including educators, policymakers, and the general public. The absence of sustained advocacy and public enlightenment campaigns has contributed to weak societal support and limited demand for its integration into the educational system.

The shortage of adequately trained personnel further compounds the problem. Peace education requires specialized knowledge and pedagogical skills, yet there is a dearth of qualified experts in the field. Many teachers currently tasked with delivering peace-related content lack the requisite training, thereby undermining the quality and impact of instruction.

Finally, the pressures of globalization present both direct and indirect challenges. While globalization facilitates knowledge exchange, it has also contributed to the erosion of indigenous cultural values and traditional conflict resolution mechanisms that historically promoted social harmony. The increasing influence of external cultural norms, particularly among younger generations, has led to a decline in the appreciation and application of local peacebuilding practices.

Taken together, these challenges underscore the need for a comprehensive, context-sensitive, and well-resourced approach to reposition peace education as a viable instrument for sustainable peace and national cohesion in Nigeria.

Gaps in the Literature

Despite the growing body of literature on peace education in Nigeria, significant conceptual, methodological, and empirical gaps persist, limiting both scholarly advancement and practical application.First, existing studies disproportionately emphasize formal peace education within school

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settings, often neglecting the rich and dynamic contributions of informal and indigenous peacebuilding mechanisms. Where informal approaches are discussed, analyses tend to be largely descriptive and lack robust empirical validation or contemporary case-based evidence.

Second, there is a notable scarcity of documented, real-time examples demonstrating the successful application of traditional conflict resolution mechanisms in present-day Nigeria. This limits the ability to assess their relevance, adaptability, and scalability within modern peace education frameworks.

Third, scholarly attention has been narrowly concentrated on proverbs as the dominant form of indigenous peace pedagogy, resulting in the marginalization of other important cultural forms such as storytelling, music, rituals, and community-based mediation practices. This creates an incomplete understanding of the breadth of indigenous knowledge systems available for peacebuilding.Additionally, several studies in the field suffer from weak methodological rigour, lack of originality, and unclear analytical focus, thereby reducing their contribution to policy and practice. Many works remain largely theoretical without offering actionable, evidence-based recommendations for implementation.

Furthermore, while literature on peace education in Nigeria is abundant, there is a critical deficit in studies that propose practical, context-sensitive, and scalable intervention models. This gap undermines efforts to translate academic discourse into effective policy and educational reform. Finally, the current practice of embedding peace education within subjects such as social studies, religious studies, and government has led to conceptual ambiguity. Some scholars erroneously equate these subjects with peace education, thereby obscuring its distinct pedagogical identity and limiting advocacy for its recognition as a standalone discipline.

Addressing these gaps requires a shift toward interdisciplinary, empirically grounded, and policy-oriented research that bridges theory and practice while foregrounding Nigeria's socio-cultural realities.

Conclusion

Peace education represents a critical yet underutilized strategy for addressing Nigeria's complex conflict landscape. Although efforts have been made to incorporate peace-related concepts into the educational system, these remain fragmented and insufficient. Government responses have been characterized by bureaucratic inertia and tokenistic commitment rather than decisive action. While formal classroom settings provide the most natural environment for systematic peace pedagogy, the complementary significance of informal channels cannot be overstated. Nigeria cannot afford to neglect its rich cultural heritage, which has historically facilitated conflict resolution and community peacebuilding. Therefore, the pedagogical techniques embedded in any future peace education curriculum must copiously integrate traditional peace practices that are sensitive to Nigeria's religious and cultural diversity as a prerequisite for successful outcomes.

Recommendations

1. Institutionalization of Peace Education as a Standalone Subject- Government at all levels must transcend tokenistic approaches and demonstrate strong political commitment by introducing peace education as a distinct, standalone subject within the national basic education curriculum. This initiative should commence at the elementary level to facilitate the early moulding of young minds and the gradual internalization of peace values.

2. Strengthening Teacher Capacity and Professional Development- Peace education is a specialized pedagogical field requiring expertise beyond conventional teacher training. Consequently, all teachers and educators deployed to deliver peace education must undergo rigorous, certified training

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programmes in peace pedagogy, conflict resolution, and non-violent communication. Continuous professional development and refresher courses should be mandated periodically.

3. Curriculum Localization and Cultural Sensitivity- The peace education curriculum must be adapted to reflect Nigeria's peculiar local realities, religious diversity, and cultural pluralism. Curriculum developers should deliberately incorporate indigenous peace practices—including proverbs, folktales, storytelling, and traditional conflict resolution mechanisms—as legitimate pedagogical content rather than mere cultural artefacts.

4. Public Enlightenment and Sustained Advocacy Campaign- A well-coordinated, sustained public awareness programme on the values and significance of peace education should be launched nationwide. The National Orientation Agency (NOA), with its extensive grassroots network across the 774 local government areas, should be empowered to disseminate peace education messages and galvanize public acceptance and community ownership.

5. Leveraging Social Media and Digital Platforms- Given the pervasive influence of social media among Nigerian youth, government and civil society organizations should leverage platforms such as Twitter, Instagram, TikTok, and YouTube to disseminate peace education content, share success stories, and engage young people in interactive peacebuilding dialogues.

6. Dedicated Funding and Alternative Resource Mobilization- Special budgetary allocations should be earmarked for the implementation of peace education programmes. Recognizing persistent fiscal constraints, the government should explore alternative funding mechanisms, including public-private partnerships, corporate social responsibility initiatives, and international development assistance. It is axiomatic that sustainable peace is a prerequisite for business viability and economic prosperity.

7. Documentation and Revitalization of Indigenous Peace Practices - Research institutions and universities should receive targeted funding to document, preserve, and revitalize indigenous peace practices across Nigeria's diverse ethnic groups. Contemporary case studies where traditional methods have successfully resolved disputes should be systematically documented and integrated into peace education curricula.

8. Establishment of Peace Clubs and Extracurricular Activities - Primary and secondary schools should be encouraged to establish and sustain peace clubs, debate societies, and peer mediation programmes. These extracurricular platforms provide practical opportunities for students to apply peace education concepts in real-life interpersonal and intergroup contexts.

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