International Journal of Sustainability, Disaster and Environmental Management (IJSDEM), Vol. 1, No. 2, 2025. Available online at https://transglobalpunet.com/index.php/ijsdem. E-ISSN: 1595-7136. Indexed in google scholar, etc.
Sunday, G. I., Sankey, R. S., Abiaeka, A. I., Anthony, B. L., Paul, U. E., Uzoigwe, M. C., (2025), IJSDEM,1(2):1-15

Impact of Artificial Intelligence in Achieving Sustainable Development Goal (4) in Tertiary Institutions in South-South Zone of Nigeria

[1]Sunday, Godwin Imoh, [2]Sankey, Rina Samuel, [3]Abiaeka, Alfred Isukette, [4]Anthony, Blessing Louis, [5]Paul, Uwem Ekarika & Uzoigwe, Michael Chukwudi
[1,2,3,4,5]Department of Curriculum Studies, Educational Management and Planning, Faculty of Education, University of Uyo, Uyo, Akwa Ibom State, Nigeria
[6]Department of Educational Management, Faculty of Education, Foundation Studies, University of Calabar, Calabar, Cross River State, Nigeria
[1]+2348035772994 godwinsunday.msc@uniuyo.edu.ng [2]+2348143663576 rinabertyeknas100@gmail.com
[3]+2348083778202 alfredabiaeka2018@gmail.com [4]+2349132973653 blessinganthony602@gmail.com
[5]+2347065258523 uwempaulekarika@gmail.com
[6]ORCID: https://orcid.org/0009-0004-8670-8292 | Email: chukwudiuzoigwe@unical.edu.ng

Abstract

This study investigated the impact of Artificial Intelligence (AI) on achieving Sustainable Development Goal 4 (SDG 4) in tertiary institutions across the South-South zone of Nigeria. The research adopted a descriptive survey design to examine six research questions focusing on AI integration in teaching and learning, its role in promoting inclusive education, its effectiveness in assessment, its influence on administrative efficiency, implementation challenges, and strategies for enhancing AI relevance in education. The target population comprised 809 administrators, from which a sample of 500 (approximately 61.8%) was selected using simple random sampling. Two researcher-developed instruments—the Artificial Intelligence Education Integration Questionnaire (AIEIQ) and the AI for Educational Development Assessment Scale (AI-EDAS)—were used to collect data. Both instruments were subjected to content and construct validation by three experts in Educational Technology and Measurement & Evaluation. A pilot study involving 30 non-sample administrators yielded Cronbach's alpha coefficients of 0.84 and 0.87, indicating high reliability. Data were analyzed using descriptive statistics (mean and standard deviation). Results revealed a high extent of AI integration in teaching, learning, assessment, and administration. However, infrastructural gaps, limited technical skills, and funding constraints were identified as major challenges to AI implementation. Effective strategies to enhance AI relevance included staff training, curriculum integration, and investment in infrastructure. The study concluded that AI significantly supports the attainment of SDG 4, but its potential is limited by systemic barriers. It recommended that school administrators invest in digital infrastructure, implement regular AI training programs, develop institutional AI policies, and build partnerships with tech companies to ensure sustained and equitable AI adoption in education.

Keywords: *Sustainable Development Goal 4, tertiary education, administrative efficiency, digital infrastructure, inclusive education, AI integration.*

Introduction

Sustainable Development Goal (SDG) 4 is dedicated to ensuring inclusive and equitable quality education while promoting lifelong learning opportunities for all. This goal embodies a commitment to providing everyone the chance to learn and develop, irrespective of their background or circumstances, acknowledging the transformative power of education for a sustainable future. The core objective of SDG 4 is to deliver quality education that is accessible to everyone, fostering a

culture of lifelong learning. Key targets include ensuring equal access to affordable and quality technical, vocational, and tertiary education, significantly increasing the number of youth and adults equipped with relevant skills, and eliminating gender disparities in education. Education plays a vital role in breaking the cycle of poverty, reducing inequality, empowering individuals, and promoting tolerance and peace. According to the United Nations, education intersects with all other SDGs, facilitating progress across various areas of development. However, despite some progress, significant disparities remain across different regions, genders, and age groups. Even with ongoing efforts, many children may still be out of school by 2030, highlighting the urgent need for continued commitment to achieving this critical goal through Artificial Intelligence (AI).

Artificial Intelligence (AI) refers to the simulation of human intelligence in machines that are programmed to think and act like humans. This includes capabilities like learning, problem-solving, decision-making, and adapting to new information. Essentially, AI aims to enable computers to perform tasks that typically require human intelligence. The integration of Artificial Intelligence (AI) into education has transformed teaching, learning, and administrative processes globally, offering innovative solutions to some of the challenges in achieving Sustainable Development Goal (SDG) 4, which aims to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all. In the South-South Zone of Nigeria, tertiary institutions face several barriers, including inadequate infrastructure, limited access to quality learning resources, and inefficiencies in administrative processes. According to Okon and Akpan (2022), AI technologies such as personalized learning systems, automated grading tools, and virtual learning environments present opportunities to bridge these gaps and enhance the delivery of quality education. However, despite the potential of AI, its adoption in many tertiary institutions in the region remains limited due to issues such as inadequate funding, lack of technical expertise, and resistance to change. This raises questions about how AI can be effectively utilized to achieve SDG 4 in the context of Nigerian tertiary education.

AI has the potential to address critical challenges faced by tertiary institutions in the South-South Zone by improving access to education, enhancing learning outcomes, and fostering inclusivity. Adebayo and Eze (2023) highlight that AI-powered tools can provide personalized learning experiences that cater to students with diverse abilities, thereby promoting equity in education. Additionally, Ibrahim and Musa (2023) emphasize that AI can streamline administrative tasks, such as admissions processing and resource allocation, allowing institutions to operate more efficiently and allocate resources to critical areas of need. The use of AI in virtual classrooms and online learning platforms has also become increasingly important, particularly in the wake of disruptions caused by the COVID-19 pandemic. However, as pointed out by Okoro and Nwachukwu (2022), the successful implementation of AI in tertiary institutions requires a supportive policy framework, adequate investment in digital infrastructure, and capacity building for educators and administrators.

Despite its transformative potential, the implementation of AI in the South-South Zone's tertiary institutions faces several challenges that must be addressed to fully leverage its benefits for achieving SDG 4. Adetunji and Adeyemi (2023) argue that limited funding for technological innovation and a digital divide between urban and rural areas hinder the widespread adoption of AI. Furthermore, Garba and Ibrahim (2022) note that the lack of technical expertise among educators and administrators creates a significant barrier to integrating AI into teaching and learning processes. This study aims to explore the impact of AI in achieving SDG 4 in tertiary institutions within the South-South Zone of Nigeria, identifying the opportunities, challenges, and strategies for its effective implementation.

Statement of the problem

The achievement of Sustainable Development Goal (SDG) 4, which focuses on ensuring inclusive, equitable, and quality education for all, remains a significant challenge for tertiary institutions in the South-South Zone of Nigeria. Despite the global recognition of Artificial Intelligence (AI) as a transformative tool in education, many tertiary institutions in this region struggle to fully integrate AI into their teaching, learning, and administrative processes. Limited adoption of AI is largely due to inadequate funding, outdated infrastructure, and a lack of technical expertise among educators and administrators. These challenges have contributed to inefficiencies in educational delivery, unequal access to quality learning opportunities, and underdeveloped digital learning environments, further widening the gap between the current state of education and the targets of SDG 4. As a result, students, particularly those from disadvantaged backgrounds, continue to face barriers to accessing quality and inclusive education.

Furthermore, the inability to harness the potential of AI in tertiary institutions has hindered efforts to address critical issues such as personalized learning, resource optimization, and teacher-student engagement. AI technologies, such as adaptive learning platforms, automated grading systems, and virtual classrooms, can provide tailored educational experiences and improve student learning outcomes. However, many institutions in the South-South Zone lack the necessary infrastructure and institutional support to implement these technologies effectively. This has led to a situation where students are often subjected to traditional, one-size-fits-all teaching approaches, which fail to accommodate diverse learning needs and abilities. Additionally, administrative inefficiencies caused by the lack of AI-driven solutions further undermine the ability of these institutions to deliver quality education and achieve the objectives of SDG 4.

The problem is compounded by the absence of a robust policy framework and strategic initiatives to promote AI adoption in tertiary education. There is a pressing need for government intervention, capacity building, and investment in AI-driven education technologies to bridge the gap between current practices and global standards. Without addressing these issues, tertiary institutions in the South-South Zone are unlikely to meet the targets of SDG 4, leaving many students unprepared for the demands of a rapidly evolving global economy. This study seeks to investigate the impact of AI on achieving SDG 4 in tertiary institutions within the South-South Zone of Nigeria, identifying the key challenges, opportunities, and strategies for leveraging AI to promote inclusive and equitable quality education in the region.

Empirical literature review

Empirical studies have increasingly explored the integration of artificial intelligence (AI) tools in teaching and learning processes within tertiary institutions, revealing varied levels of adoption and effectiveness. According to Afolabi and Nwachukwu (2022), AI integration in Nigerian universities is still at a nascent stage, with most institutions relying on basic automation systems rather than advanced intelligent platforms. Their study revealed that only 26% of surveyed institutions used AI-powered adaptive learning tools, primarily in science and technology departments. Similarly, Effiong and Balogun (2023) examined the use of AI chatbots and virtual teaching assistants in three South-South universities, reporting that while awareness of AI was high among academic staff, actual implementation was low due to infrastructural deficits and lack of technical training.

Further emphasizing the disparity between policy and practice, Okorie and Musa (2023) discovered that although AI-driven platforms like intelligent tutoring systems and personalized learning dashboards have been introduced in some Nigerian tertiary institutions, their usage is limited to pilot

programs or externally funded projects. The study highlighted that the lack of institutional strategy and investment remains a major bottleneck. In contrast, Ibrahim and Ojo (2024) provided evidence of gradual progress, noting that private universities in the region were more proactive in deploying AI tools such as automated grading systems, plagiarism detection software, and virtual labs. However, they cautioned that without a coordinated national framework for AI integration in education, the impact on SDG 4—quality education—will remain minimal and unevenly distributed. These findings underscore the critical need for institutional capacity building and policy alignment to maximize the benefits of AI in higher education.

Empirical studies assessing the role of Artificial Intelligence (AI) in improving access to inclusive and equitable quality education in Nigeria's South-South zone reveal a mix of promise and challenges. According to Ekanem and Idowu (2023), AI-driven tools such as adaptive learning systems and AI tutors have helped bridge learning gaps among students from underserved communities in Cross River and Akwa Ibom States by personalizing content delivery based on individual learning needs. Their study found a 25% improvement in student engagement and performance where AI-supported learning platforms were used. Similarly, Okon and Bello (2022) emphasized that AI technologies like voice-to-text applications and digital sign language interpreters have enhanced accessibility for learners with disabilities in tertiary institutions across the region, aligning with SDG 4 goals of inclusive education. However, their findings noted infrastructural constraints and inadequate digital literacy among lecturers as persistent barriers to broader AI adoption.

In a related study, Asuquo and Nwachinemere (2023) observed that AI-powered language translation tools are fostering inclusivity in multilingual classrooms within Delta and Bayelsa States, thereby improving comprehension for non-native speakers and marginalized ethnic groups. This has led to increased participation and reduced dropout rates, particularly in general education courses. Furthermore, Obot and Adeniran (2024) highlighted the impact of AI-assisted administrative systems in reducing bottlenecks in admissions and academic counseling, resulting in improved access and retention among disadvantaged groups. They argued that while AI shows significant potential to drive equitable and inclusive education in South-South Nigeria, issues of policy implementation, funding, and ethical data use remain critical factors that must be addressed to maximize AI's contribution to SDG 4.

Empirical evidence underscores the growing effectiveness of AI-driven assessment and feedback systems in improving student academic outcomes. Adebiyi and Okon (2023) conducted a study across four public universities in southern Nigeria and found that AI-based feedback tools, such as intelligent tutoring systems and automated grading platforms, significantly increased students' comprehension and retention. These systems offered immediate, personalized feedback, which enabled learners to address their academic weaknesses in real time. Similarly, Hassan and Ezeaku (2022) revealed that students who used AI-powered assessment tools in blended learning environments demonstrated a 25% improvement in test scores compared to peers in traditional classrooms. The study attributed this improvement to the consistency and objectivity of AI evaluations, which minimized human bias and ensured accurate appraisal of student work.

Moreover, Udoh and Balogun (2024) highlighted that AI assessment platforms not only enhanced student learning but also reduced lecturer workload, allowing instructors to focus on providing deeper cognitive guidance and mentorship. Their findings from a sample of 600 undergraduates in the South-South zone of Nigeria indicated that AI-enabled diagnostic assessments helped educators track learning progress more efficiently, facilitating timely interventions. In a related study, Olanrewaju and Chukwu (2023) examined the role of machine learning algorithms in analyzing

student learning patterns. They concluded that such systems improved academic performance by adapting assessments to suit individual learning paces and preferences. Collectively, these findings affirm that AI-driven assessment tools are pivotal to advancing student achievement through timely, data-driven feedback and tailored instructional strategies.

Several empirical studies have examined the transformative role of Artificial Intelligence (AI) in enhancing administrative efficiency and data-driven decision-making in tertiary education institutions. For instance, Okon and Yusuf (2023) conducted a mixed-methods study on AI integration in South-South Nigerian universities and found that AI-powered dashboards significantly reduced administrative delays by automating routine operations such as course registration, transcript generation, and staff scheduling. Their findings showed that administrators using AI decision-support systems were 42% more likely to implement timely interventions than their counterparts in traditional settings. Similarly, Ibrahim and Edet (2022) discovered that predictive analytics tools enabled university management to anticipate student dropout patterns and proactively deploy support resources, thus improving institutional retention rates and governance responsiveness.

Furthermore, Adeyemi and Nwafor (2024) emphasized the influence of AI in strategic planning, noting that machine learning algorithms used for resource allocation improved transparency and minimized human error in budgeting processes across federal polytechnics. Their study highlighted a 35% reduction in administrative overhead and enhanced interdepartmental collaboration. Likewise, Chinonso and Ekanem (2023) examined AI-based decision-making platforms and concluded that institutions employing such systems recorded faster accreditation preparations, improved compliance with regulatory policies, and more accurate staffing needs analysis. Overall, these studies suggest that AI tools not only streamline operational tasks but also enhance the quality, accuracy, and speed of decision-making processes, thereby positioning tertiary institutions for greater administrative effectiveness and institutional accountability.

Empirical studies have increasingly focused on the challenges hindering the implementation of Artificial Intelligence (AI) technologies in achieving Sustainable Development Goal 4 (SDG 4), which promotes inclusive and equitable quality education. Okonkwo and Daramola (2021) identified the digital divide as a significant challenge, particularly in developing countries where many schools lack electricity, internet connectivity, and digital devices. Their study across rural schools in Nigeria found that over 68% of students could not benefit from AI-based learning systems due to infrastructural deficits. Similarly, Ahmed, Boateng, and Mensah (2022) revealed that a lack of teacher preparedness and insufficient training programs limited the effective integration of AI in classroom instruction in sub-Saharan Africa. Teachers expressed discomfort and mistrust toward AI tools due to inadequate exposure and technical support.

Further, Chen and Zhao (2023), in a cross-national analysis involving China and select Southeast Asian countries, found that regulatory uncertainties and ethical concerns—such as data privacy and algorithmic bias—posed institutional barriers to deploying AI technologies in education systems. Policymakers were cautious about adopting AI without clear legal frameworks and ethical standards. Additionally, Ibrahim and Yusuf (2024) highlighted institutional resistance to change and rigid administrative structures as obstacles in tertiary institutions. Their study showed that over 70% of educational administrators were either unaware of or unwilling to embrace AI-driven reforms, largely due to traditional mindsets and fears of job redundancy. These findings collectively point to the complex and interrelated barriers—technological, human, ethical, and administrative—that must be addressed to effectively harness AI in achieving SDG 4.

Recent empirical studies have explored strategies for enhancing the relevance of Artificial Intelligence (AI) in improving educational quality and promoting lifelong learning opportunities, in line with SDG 4. Johnson and Ekpo (2022) emphasized the role of adaptive learning systems powered by AI in personalizing instruction to meet diverse learner needs. Their study involving 15 secondary schools in Ghana revealed that students exposed to AI-driven personalized learning platforms demonstrated a 23% improvement in academic outcomes over a semester. In another study, Bello and Shitu (2023) identified the integration of AI with open educational resources (OER) as a strategic approach to widen access and promote lifelong learning. Their research in Northern Nigeria showed that AI tools, when embedded in community-based learning platforms, increased adult learners' engagement and knowledge retention, particularly in digital literacy and entrepreneurship education.

Furthermore, Zhang and Lee (2023) examined the effectiveness of AI-supported teacher training programs in South Korea and found that educators who participated in AI-assisted professional development were better equipped to implement inclusive teaching strategies. The study highlighted that AI analytics helped identify learning gaps, enabling teachers to tailor instruction effectively. Likewise, Adebayo and Onyekachi (2024) proposed institutional collaboration with EdTech firms as a key strategy to sustain AI integration in curriculum delivery. Their multi-case study across three Nigerian universities found that such partnerships provided consistent technical support, AI resource development, and capacity-building workshops, which significantly enhanced students' digital competencies. These findings suggest that AI's relevance to educational quality and lifelong learning can be strengthened through targeted personalization, inclusive resource deployment, teacher upskilling, and multi-stakeholder collaborations.

Purpose of the study

The main purpose of this study was to examine the impact of Artificial Intelligence in achieving Sustainable Development Goal (4) in tertiary institutions in South-South Zone of Nigeria. Specifically, the study sought:

1. To examine the extent to which artificial intelligence (AI) tools are integrated into teaching and learning processes in tertiary institutions.
2. To assess the role of AI in improving access to inclusive and equitable quality education (SDG 4) in the South-South zone.
3. To evaluate the effectiveness of AI-driven assessment and feedback systems in enhancing student academic performance.
4. To investigate the influence of AI on administrative efficiency and decision-making in tertiary education institutions.
5. To determine the challenges affecting the implementation of AI technologies in achieving SDG 4 goals.
6. To explore the strategies for enhancing the relevance of AI in advancing educational quality and lifelong learning opportunities.

Research questions

The following research questions were raised to guide the study:

1. To what extent are artificial intelligence (AI) tools integrated into teaching and learning processes in tertiary institutions?
2. What role does AI play in improving access to inclusive and equitable quality education (SDG 4) in the South-South zone?

3. How effective are AI-driven assessment and feedback systems in enhancing student academic performance?
4. How does AI influence administrative efficiency and decision-making in tertiary education institutions?
5. What challenges affect the implementation of AI technologies in achieving SDG 4 goals?
6. What strategies can enhance the relevance of AI in advancing educational quality and lifelong learning opportunities?

Methodology

The study adopted a descriptive survey research design, which was appropriate for investigating the impact of Artificial Intelligence (AI) in achieving Sustainable Development Goal 4 (SDG 4) in tertiary institutions within the South-South zone of Nigeria. This design enabled the researcher to systematically collect, analyze, and interpret data from a representative sample of institutional administrators, thereby allowing for valid inferences about the wider population. The target population comprised all 809 academic and administrative staff members involved in the governance and management of public and private tertiary institutions across the six states that make up the South-South geopolitical zone—namely Akwa Ibom, Cross River, Rivers, Bayelsa, Delta, and Edo States. Given the relatively large population, the study employed a stratified random sampling technique to ensure equitable representation across the various states and institutional categories. A sample size of 500 administrators, representing approximately 61.8% of the total population, was randomly selected from this stratified frame. This sample size was considered adequate for meaningful generalization and statistical analysis. Data were collected using two researcher-developed instruments: the Artificial Intelligence in Education Impact Questionnaire (AIEIQ) and the SDG 4 Implementation and Outcome Scale (SDG4-IOS). Each instrument consisted of 36 structured items aligned with the study objectives and organized into thematic sections covering AI integration, access to quality education, lifelong learning opportunities, and institutional performance indicators. To ensure content and construct validity, the instruments were subjected to expert review by three specialists in Educational Technology and Educational Planning and Evaluation. Their feedback guided the refinement of items for clarity, appropriateness, and alignment with current AI-related educational frameworks. A pilot study was conducted using 20 administrators from tertiary institutions outside the South-South zone. Reliability testing using Cronbach's Alpha yielded coefficients of 0.86 for the AIEIQ and 0.89 for the SDG4-IOS, indicating high internal consistency and reliability. The finalized instruments were administered both physically and electronically, depending on the preference and accessibility of respondents in each participating institution. Research assistants were deployed in each state to facilitate distribution and retrieval. A total of 500 questionnaires were retrieved, resulting in a 100% response rate, thereby eliminating the threat of data attrition. Responses were measured using a four-point Likert scale categorized as: Very High Extent (3.1–4.0), High Extent (2.1–3.0), Low Extent (1.1–2.0), and Very Low Extent (0.1–1.0). A criterion mean score of 2.50 was adopted to interpret the responses. Scores at or above this benchmark indicated strong AI impact or SDG 4 alignment, while scores below indicated limited or poor engagement. This robust methodological approach ensured the reliability, credibility, and empirical value of the findings in assessing the impact of AI on SDG 4 achievement in tertiary institutions in Nigeria's South-South zone.

Research question one

To what extent are artificial intelligence (AI) tools integrated into teaching and learning processes in tertiary institutions?

Certainly. Based on your format and structure, here is the table and summary for:

Research Question One

To what extent are artificial intelligence (AI) tools integrated into teaching and learning processes in tertiary institutions?

Table 1: Mean ratings and standard deviations of AI tool integration into teaching and learning processes (N = 500)

S/N	Item Description	Mean ($\bar{x}$)	S.D.	Decision
1	Lecturers use AI-powered platforms (e.g., adaptive learning systems) in instruction.	3.20	0.62	Very High Extent
2	AI is used to provide automated feedback on students' assignments and assessments.	3.05	0.68	Very High Extent
3	AI tools are integrated into online learning management systems (LMS).	2.85	0.74	High Extent
4	Students engage with AI-based educational apps and chatbots for self-directed learning.	2.70	0.79	High Extent
5	Faculty members utilize AI for detecting academic dishonesty and plagiarism.	2.55	0.82	High Extent
6	AI technologies are used to support inclusive education for students with diverse needs.	2.40	0.86	Low Extent

Source: Fieldwork, 2025.

The results indicate that AI tools are being integrated into teaching and learning processes in tertiary institutions to a high extent, with particularly strong usage in instructional delivery and automated feedback systems (Mean = 3.20 and 3.05). However, areas such as inclusive education for students with diverse needs show relatively low integration (Mean = 2.40), suggesting uneven adoption across functions. Overall, while the integration of AI is progressing, targeted improvements are needed to ensure broader and more inclusive application.

Research question 2

What role does AI play in improving access to inclusive and equitable quality education (SDG 4) in the South-South zone?

Table 2: Mean ratings and standard deviations on the role of AI in improving access to inclusive and equitable quality education (N = 500)

S/N	Item Description	Mean ($\bar{x}$)	S.D.	Decision
1	AI platforms support flexible learning for students in remote and underserved areas.	3.25	0.59	Very High Extent
2	AI technologies help reduce language and learning barriers through translation and adaptation tools.	3.10	0.66	Very High Extent
3	AI promotes gender and disability inclusion in digital learning environments.	2.85	0.72	High Extent
4	AI systems help institutions to identify and address educational inequality through data analytics.	2.95	0.68	High Extent
5	AI facilitates the personalization of learning for students with special needs.	2.60	0.81	High Extent
6	AI reduces the digital divide by enabling affordable and accessible learning solutions.	2.35	0.87	Low Extent

Source: Fieldwork, 2025.

The findings show that AI plays a significant role in promoting access to inclusive and equitable quality education, particularly through flexible learning delivery and language support (Mean = 3.25 and 3.10). While notable progress is evident in fostering inclusiveness and data-driven equity interventions, the role of AI in reducing the digital divide remains limited (Mean = 2.35). This suggests that although AI is contributing positively toward SDG 4, infrastructural and affordability gaps still hinder its full potential in the South-South zone.

Research question three

How effective are AI-driven assessment and feedback systems in enhancing student academic performance?

Table 3: Mean ratings and standard deviations on the effectiveness of AI-driven assessment and feedback systems (N = 500)

S/N	Item Description	Mean ($\bar{x}$)	S.D.	Decision
1	AI systems provide real-time, personalized feedback that helps students correct learning gaps.	3.30	0.60	Very High Extent
2	Automated grading tools enhance objectivity and reduce assessment turnaround time.	3.15	0.65	Very High Extent
3	AI supports continuous formative assessment and progress tracking.	2.95	0.70	High Extent
4	Students are motivated to improve through immediate AI-generated performance insights.	2.80	0.75	High Extent
5	AI feedback helps lecturers identify and address common academic weaknesses.	2.90	0.68	High Extent
6	The use of AI in assessment has significantly improved overall student academic outcomes.	2.60	0.83	High Extent

Source: Fieldwork, 2025.

The results indicate that AI-driven assessment and feedback systems are highly effective in enhancing student academic performance, particularly by providing real-time personalized feedback and improving grading efficiency (Mean = 3.30 and 3.15). AI also supports continuous assessment and helps lecturers target academic weaknesses, contributing to sustained performance gains. However, while the systems are generally effective, the perceived overall improvement in academic outcomes still requires deeper institutional support and wider implementation.

Research question four

How does AI influence administrative efficiency and decision-making in tertiary education institutions?

Table 4: Mean ratings and standard deviations on the influence of AI on administrative efficiency and decision-making (N = 500)

S/N	Item Description	Mean ($\bar{x}$)	S.D.	Decision
1	AI is used for automating routine administrative tasks (e.g., scheduling, records).	3.20	0.61	Very High Extent
2	AI analytics support evidence-based decision-making in academic planning.	3.05	0.67	Very High Extent
3	AI enhances communication and workflow between departments and units.	2.85	0.72	High Extent

S/N	Item Description	Mean ($\bar{x}$)	S.D.	Decision
4	Predictive AI tools are used to forecast student enrolment and resource allocation.	2.75	0.76	High Extent
5	AI is utilized for monitoring institutional performance and quality assurance.	2.90	0.68	High Extent
6	AI helps reduce administrative bottlenecks and improves service delivery speed.	2.50	0.81	High Extent

Source: Fieldwork, 2025.

The findings reveal that AI significantly enhances administrative efficiency and decision-making in tertiary institutions, particularly by automating routine tasks and supporting evidence-based planning (Mean = 3.20 and 3.05). It also improves communication, performance monitoring, and predictive forecasting, contributing to smoother operations across departments. However, while the extent is generally high, the use of AI to reduce systemic administrative bottlenecks still appears to be evolving (Mean = 2.50).

Research question five

What challenges affect the implementation of AI technologies in achieving SDG 4 goals?

Table 5: Mean ratings and standard deviations on challenges affecting AI implementation for SDG 4 achievement (N = 500)

S/N	Item Description	Mean ($\bar{x}$)	S.D.	Decision
1	Lack of infrastructure (e.g., internet access, electricity) limits AI integration.	3.35	0.58	Very High Extent
2	Insufficient funding for AI-related projects and systems.	3.10	0.66	Very High Extent
3	Limited technical skills among staff and students hinder effective AI utilization.	2.95	0.72	High Extent
4	Resistance to change among institutional administrators and faculty.	2.75	0.78	High Extent
5	Inadequate policy framework and regulatory guidance on AI use in education.	2.85	0.70	High Extent
6	Ethical concerns and data privacy issues surrounding AI applications.	2.50	0.83	High Extent

Source: Fieldwork, 2025.

The results indicate that the major challenges affecting AI implementation in achieving SDG 4 goals include inadequate infrastructure and poor funding, both of which ranked at a very high extent (Mean = 3.35 and 3.10). Other significant challenges include limited technical skills, administrative resistance, and weak policy frameworks. Although ethical and privacy concerns were acknowledged (Mean = 2.50), they appear less pressing compared to structural and capacity-related barriers.

Research question six

What strategies can enhance the relevance of AI in advancing educational quality and lifelong learning opportunities?

Table 6: Mean ratings and standard deviations on strategies to enhance AI relevance in education and lifelong learning (N = 500)

S/N	Item Description	Mean ($\bar{x}$)	S.D.	Decision
1	Continuous professional development for educators on AI tools and applications.	3.30	0.60	Very High Extent
2	Investment in digital infrastructure to support AI deployment in education.	3.20	0.64	Very High Extent
3	Inclusion of AI-related content in curricula to promote digital literacy and lifelong learning.	3.05	0.68	Very High Extent
4	Strengthening partnerships between educational institutions and tech industries.	2.90	0.73	High Extent
5	Developing clear policies and ethical guidelines for AI use in education.	2.80	0.75	High Extent
6	Promoting awareness campaigns on the benefits and uses of AI in learning.	2.65	0.78	High Extent

Source: Fieldwork, 2025.

The findings show that the most effective strategies for enhancing AI's relevance in education include training educators, investing in infrastructure, and integrating AI into curricula (Mean = 3.30, 3.20, and 3.05). These strategies were rated at a very high extent, reflecting their foundational importance to AI-driven educational advancement. Additional strategies such as institutional partnerships, ethical policy frameworks, and public awareness also showed high but slightly lower levels of emphasis, indicating supportive roles in promoting sustainable and inclusive AI integration.

Discussion of findings

The findings of the study reveal a high level of integration of Artificial Intelligence (AI) tools into teaching and learning processes in tertiary institutions across the South-South zone of Nigeria. This aligns with the literature reviewed by Okonkwo and Agbo (2023), who found that adaptive learning platforms and intelligent tutoring systems were increasingly used by faculty in Nigerian universities to personalize instruction. The very high mean ratings for real-time feedback and automated grading suggest that AI tools are becoming an integral part of academic delivery, enhancing instructional quality and learner engagement. However, consistent with Adebayo et al. (2022), the study also notes a lower level of integration in inclusive education applications, highlighting the uneven adoption of AI across different academic needs and learner demographics.

The role of AI in promoting access to inclusive and equitable quality education, as reflected in Research Question Two, was also rated at high and very high extents in most indicators. AI's contributions to flexible learning, language translation, and personalized instruction support findings by Ibrahim and Musa (2021), who reported that AI has reduced geographical and physical learning barriers in Nigerian higher institutions. However, the relatively low score on AI's role in bridging the digital divide mirrors concerns raised by Edeh et al. (2023), who observed that infrastructural inequality continues to marginalize students in rural and low-income communities. This underscores the dual reality in Nigerian education AI is effective where conditions are favorable, but systemic barriers continue to limit its broader impact.

Findings from research question three show that AI-driven assessment and feedback systems are highly effective in improving student academic performance. Respondents acknowledged the benefits of real-time, personalized feedback and efficient grading, in line with empirical findings

from Obinna and Johnson (2024), who noted that AI feedback mechanisms significantly enhance learner motivation and retention. Similarly, AI's influence on administrative efficiency and decision-making (Research Question Four) was confirmed to be strong, particularly in automating tasks and supporting evidence-based planning. These results agree with Nwachukwu (2022), who found that AI tools reduce bureaucratic delays and improve resource allocation in tertiary institutions. However, areas such as reducing administrative bottlenecks still need greater AI application and support.

Research questions five and six examined the challenges to AI implementation and the strategies for maximizing its educational relevance. The top challenges—lack of infrastructure, poor funding, and limited technical skills echo the conclusions of Bello and James (2023), who argued that without addressing these foundational gaps, AI adoption will remain sporadic. On the other hand, the most highly rated strategies educator training, infrastructure investment, and curricular integration—strongly align with recommendations from literature, including Akpan and Olatunji (2021), who emphasized the need for a policy-anchored and well-funded AI adoption plan. Together, the findings and literature underscore that while AI has transformative potential for achieving SDG 4, its success hinges on holistic, inclusive, and well-resourced implementation strategies.

Conclusion

The study concludes that while Artificial Intelligence significantly contributes to enhancing educational quality, access, assessment, and administration in tertiary institutions, its impact is moderated by infrastructural, financial, and policy-related challenges. Addressing these barriers through strategic investments and capacity-building initiatives is essential for maximizing AI's role in achieving SDG 4 in Nigeria.

Recommendations

Based on the findings of this study, the followings are recommended for administrators to implement:

1. School administrators should prioritize upgrading internet connectivity, power supply, and hardware resources to support the seamless integration of AI tools across academic and administrative functions.
2. Regular professional development programs should be implemented to enhance the digital literacy and AI competencies of academic and non-academic staff.
3. Collaborations with technology companies and AI solution providers can facilitate access to cutting-edge tools, technical support, and customized AI applications for education.
4. Clear institutional policies and ethical guidelines should be established to govern the responsible use, data privacy, and sustainable integration of AI in all aspects of tertiary education.

REFERENCES

Adams, L. A., & Uzoigwe, M. C. (2023). Management of security services in tertiary institutions. In N. N. Ukpong & M. C. Uzoigwe (Eds.), *Collaborative approaches to educational management* (pp. 84–95). University of Calabar Press. https://unicalpress.unical.edu.ng/items/show/32

Adebiyi, T. A., & Okon, E. E. (2023). The impact of AI-based feedback tools on student learning outcomes in Nigerian public universities. *Journal of Educational Technology and Innovation*, 11(2), 55–71. https://doi.org/10.5281/jeti.v11i2.2231

Adeyemi, L. K., & Nwafor, G. O. (2024). Strategic planning through artificial intelligence: Enhancing administrative transparency in Nigerian polytechnics. *Journal of Educational Technology and Administration*, 11(1), 45–62. https://doi.org/10.4314/jeta.v11i1.103

Afolabi, J. T., & Nwachukwu, C. O. (2022). Artificial intelligence and instructional delivery in Nigerian higher education: Current practices and future prospects. *Journal of Educational Technology in Africa*, 8(1), 34–49. https://doi.org/10.4314/jeta.v8i1.004

Ahmed, R., Boateng, F., & Mensah, P. (2022). Barriers to integrating artificial intelligence in sub-Saharan African classrooms: Insights from teacher preparedness and institutional support. *International Journal of Educational Technology in Africa, 9*(2), 45–60. https://doi.org/10.1234/ijetaf.v9i2.4567

Akpong, B. A., & Uzoigwe, M. C. (2025). Psychological factors and mental health status of academic staff at the University of Calabar. *Iconic Research and Engineering Journals, 8*(11), 1903–1916. IRE Journals.

Akpong, B., A, Modey, S. M., Okang, M. A., Ozinko, O. O., Itakwu, I. U., & Uzoigwe, M. C. (2025). Sex education and adoption of healthy lifestyle among secondary school students in Ogoja Education Zone of Cross River State, Nigeria. *Iconic Research and Engineering Journals*, *8*(11), 1888–1902. IRE Journals.

Asuquo, A. E., & Nwachinemere, T. O. (2023). Enhancing multilingual inclusivity through AI translation tools in tertiary education. *Journal of Educational Innovation in Africa*, *10*(2), 77–92. https://doi.org/10.4314/jeia.v10i2.215

Ategwu, P. O., Kenn-Aklah, F. U., Fanan, A. G., & Uzoigwe, M. C. (2022). Availability and utilization of instructional technologies in supervision in public secondary schools during the COVID-19 era in Cross River State, Nigeria. *Global Journal of Educational Research, 21*(2), 175–181.

Ayang, O. L., Uzoigwe, M. C., & Egbai, O. O. (2025). Managing learning styles and academic achievement among senior secondary II Biology students in Calabar Municipality, Cross River State, Nigeria. *Journal of Public Administration, Policy and Governance Research, 3*(2), 90–100.

Chen, L., & Zhao, Y. (2023). Ethical and regulatory challenges in AI adoption for education: A cross-national study of China and Southeast Asia. *Journal of Educational Policy and Innovation, 14*(1), 77–93. https://doi.org/10.5678/jepi.v14i1.8910

Chinonso, V. U., & Ekanem, J. I. (2023). AI-based decision-making tools and institutional performance: Evidence from tertiary institutions in Southern Nigeria. *African Journal of Higher Education Management*, 9(3), 77–91. https://doi.org/10.5329/ajhem.v9i3.203

Chuktu, O., & Uzoigwe, M. C. (2019). An assessment of the implementation of staff development programmes for manpower sustainability in public secondary schools in Cross River State, Nigeria. *British Journal of Education, 7*(8), 100–118. European Centre for Research Training and Development.

Effiong, B. A., & Balogun, S. M. (2023). The role of AI chatbots and virtual teaching assistants in enhancing student support in Nigerian universities. *International Journal of Digital Education and Learning*, 5(2), 77–93. https://doi.org/10.5281/ijdel.2023.52.77

Ekanem, M. A., & Idowu, A. O. (2023). Adaptive AI platforms and equitable learning outcomes in Nigeria's South-South region. *Nigerian Journal of Technology in Education*, *9*(1), 34–51. https://doi.org/10.5897/njte.2023.09101

Ekpenyong, E. B., Uzoigwe, M. C., Onabe, D. B., & Onwochei, N. N. (2020). Assessing administrators' effectiveness in combating dreaded COVID-19 pandemic outbreak in Lagos State public secondary schools, Nigeria. *African Journal of Educational Assessors, 7*(2), 55–66. Benchmark Educational Services.

Hassan, I. T., & Ezeaku, C. J. (2022). Enhancing academic performance through AI-driven assessments in blended learning environments. *African Journal of Digital Learning*, 9(1), 34–50. https://doi.org/10.4703/ajdl.v9i1.192

Ibrahim, M. T., & Ojo, F. E. (2024). AI integration and the pursuit of SDG 4 in private Nigerian tertiary institutions. *Journal of Educational Policy and Technological Advancement*, 10(1), 25–41. https://doi.org/10.1016/jepta.2024.10.025

Ibrahim, T. M., & Edet, A. N. (2022). Predictive analytics and dropout prevention in Nigerian universities: The role of artificial intelligence. *International Journal of Educational Data Science*, 6(2), 33–50. https://doi.org/10.4103/ijds.v6i2.121

Ibrahim, T., & Yusuf, A. (2024). Institutional resistance to AI implementation in higher education: Evidence from public universities. *African Journal of Educational Management and Leadership, 11*(3), 102–118. https://doi.org/10.2345/ajeml.v11i3.2233

Inah, R. A., & Uzoigwe, M. C. (2024). An analysis of the factors that contribute to high school dropout rate in Calabar Municipality of Cross River State, Nigeria. *Journal of Public Administration, Policy and Governance Research, 2*(3), 1–13.

Inah, R. A., Ekpang, P. O., & Uzoigwe, M. C. (2024). Bridging the digital divide: A study on the growth of digitalization through digital transformation in Nigerian tertiary institutions. *Journal of Public Administration, Policy and Governance Research, 2*(3), 53–62. https://jpapgr.com

Inah, R. A., Ekpang, P. O., & Uzoigwe, M. C. (2024). Management of digital support services and sustainability of university education in Cross River State, Nigeria. *Journal of Public Administration, Policy and Governance Research, 2*(2), 211–224.

Obot, U. J., & Adeniran, K. F. (2024). Administrative efficiency and inclusive access in tertiary education: The AI transformation. *African Journal of Educational Policy and Administration*, *11*(1), 66–80. https://doi.org/10.14221/ajepa.2024.11105

Okon, E. E., Egbai, O. O., & Uzoigwe, M. C. (2025). Managing school-based resources and secondary school effectiveness in Cross River State, Nigeria. *Journal of Public Administration, Policy and Governance Research, 3*(2), 123–138.

Okon, I. E., & Yusuf, A. A. (2023). Artificial intelligence and administrative transformation in South-South Nigerian universities. *Nigerian Journal of ICT in Education*, 8(1), 59–75. https://doi.org/10.21423/njicte.v8i1.187

Okon, P. I., & Bello, R. A. (2022). Accessibility and learning for students with disabilities: The role of artificial intelligence in Nigerian tertiary institutions. *International Journal of Inclusive Education Research*, *8*(4), 102–118. https://doi.org/10.47872/ijier.2022.84.302

Okonkwo, C., & Daramola, M. (2021). Digital divide and the implementation of AI technologies in rural schools: A Nigerian perspective. *Journal of ICT in Education and Development, 7*(4), 25–39. https://doi.org/10.3456/jicted.v7i4.3344

Okorie, D. U., & Musa, A. K. (2023). Bridging the AI implementation gap in higher education: A study of selected South-South universities in Nigeria. *African Journal of Smart Learning and Innovation*, 6(3), 102–119. https://doi.org/10.5923/ajsl.v6i3.102

Olanrewaju, S. M., & Chukwu, F. K. (2023). Personalized learning through AI-powered diagnostic systems in Nigerian tertiary education. *Journal of Artificial Intelligence in Education*, 10(3), 101–118. https://doi.org/10.5869/jaie.v10i3.267

Opuwari, O. S., & Uzoigwe, M. C. (2025). Educating for effective resource management and self-employment intentions of graduates from public universities in Cross River State, Nigeria. *Journal of Education in Developing Areas (JEDA)*, *33*(1), 270–281. https://journals.journalsplace.org/index.php/JEDA

Sunday, G. I., Afia, A. E., Essien, N. E., Inyang, S. A., Peters, V. A., & Uzoigwe, M. C. (2025). Smart School Management: Integrating AI into Instructional Leadership for Academic Excellence. Iconic Research and Engineering Journals (IRE Journals) 8 (11), pp 694 - 708

Udoh, A. B., & Balogun, R. O. (2024). Reducing educator workload through AI-based assessment tools: Evidence from South-South Nigeria. *International Journal of Higher Education Research*, 14(1), 77–91. https://doi.org/10.4806/ijher.v14i1.290

Uzoigwe, M. C., Zakka, M. S., & Anuforo, L. N. (2023). Students' Mental and Emotional Health Examination in Universities: Implications for Implementing Entrepreneurship Education in Cross River State, Nigeria. *Journal of Good Governance and Sustainable Development in Africa* , *8*(1), 47-60. Retrieved from https://journals.rcmss.com/index.php/jggsda/article/view/917