JOURNAL ON COMMUNICATIONS

ISSN:1000-436X

Scopus®

REGISTERED

www.jocs.review

Adaptive Learning Systems, Intelligent Tutoring Systems and Students' Learning in Universities in North-Central Nigeria

NWACHUKWU, Precious Nneoma

BAKWAPH, Peter PhD

IYALA, Felix PhD

Department of Education Foundations,
Faculty of Education,
Veritas University,
Abuja-Nigeria.

Abstract

This study investigated the relationship between Artificial intelligence-based adaptive learning systems, intelligent tutoring systems and students' learning in universities in North-central Nigeria. The study was guided by two (2) research objectives, questions, and corresponding hypotheses. The study was anchored on the Technology Acceptance Model (TAM) and adopted a correlational research design. The population comprised 10,787 students across nine universities in North-Central, from which a sample size of 399 was selected using a stratified random sampling. Data was collected using a validated questionnaire and analysed through Pearson's Product-Moment Correlation, and Regression analysis was used to test the formulated hypotheses at a 0.05 level of significance. The finding revealed that both the adaptive learning systems and the intelligent tutoring systems have a weak positive relationship with students' learning (r=0.055) and were not statistically significant. Consequently, both hypotheses were accepted. The result indicated that although AI technologies have the potential to enhance personalised and interactive learning, their current utilisation in universities within the North-central zone of Nigeria has not significantly influenced students' learning outcomes. This weak relationship suggests low acceptance and utilisation of AI tools, which aligns with TAM constructs of perceived usefulness and perceived ease of use. The study concludes that the limited impact of these technologies may be linked to low perceived usefulness and ease of use, as well as infrastructural and institutional challenges affecting their adoption. It is recommended that universities should improve technological infrastructure, enhance digital literacy and provide adequate support systems to facilitate the effective integration of AI tools in teaching and learning.

KEY WORDS: Adaptive Learning Systems, Intelligent Tutoring Systems, Students' Learning and Artificial Intelligence

Introduction

Learning is central to the higher education system and plays a critical role in human capital development. However, universities, particularly in developing regions, continue to face challenges such as overcrowded classrooms, inadequate instructional resources, the absence of technological infrastructure, erratic power supply, reliance on traditional forms of instructional delivery and a plethora of other issues that have continued to affect students' learning, limit pedagogical innovation and reduce overall academic outcomes in many institutions. Chen et al. (2020) clarify this by stating that before the invention of computers and

other associated technologies, most human activities, such as teaching, learning, and even the management of higher learning institutions, were executed through mechanical processes that solely relied on human effort and engagement. In the light of these realities, universities are increasingly seeking innovative approaches to enhance the quality of teaching and learning.

In recent years, the integration of digital technologies, particularly Artificial Intelligence (AI) in education, has gained significant attention due to advancements in information and communication technology. Yayat & Lusiana (2023) stated that Artificial Intelligence (AI) has transformed multiple sectors, owing to its vast potential and widespread use, supported by rapid technological development. As a result, there is an increasing need for educational institutions to adopt these tools for enhancing learning outcomes (Bakwaph, 2022).

Historically, since the Dartmouth conference of 1956, the field of AI has witnessed tremendous advancements and recorded huge successes in complementing human efforts (Ali et al., 2023). Artificial Intelligence refers to the development of computer systems and machines programmed to perform tasks, typically requiring human intelligence, and is considered to have brought about tremendous changes impacting society in several ways (Ogunode & Gregory, 2023). The machines are programmed to perform learning, reasoning, problem-solving, perception, and natural language understanding tasks. The application of AI implies the creation of algorithms and machines that can stimulate the human intellect, capable of analysing and learning from large data (Munoz, 2023). Recent reports revealed an exponential increase in the use of technology in Education. This may be consequent upon the fact that Education reflects the technological waves and societal changes (UNESCO, 2023). In corroboration, Feng & Li (2024) avouched that AI is considered one of the most revolutionary and disruptive technologies in the 21st century, bringing about unprecedented changes. Diverse AI tools such as adaptive learning systems, intelligent tutors, and other AI-powered assistive technologies could be integrated into aspects of university management to enhance teaching and learning.

In particular, AI-powered adaptive learning platforms are tools that can provide personalised learning experiences tailored and adapted to suit individual learning styles, needs, and pace. According to Joshi (2024), AI-driven adaptive learning systems consist of numerous interconnected elements that are coordinated to provide students with personalised learning experiences. AI adaptive learning platforms utilise machine learning algorithms, predictive analysis, and natural language processing to analyse extensive datasets, enabling them to systematically tailor content, strategies, and feedback to address learners' needs. Adaptive learning platforms are designed to provide personalised learning experiences by adjusting

instructional content, pace, feedback and teaching strategies to match learners' individual needs, abilities and learning styles.

Additionally, an AI intelligent tutoring system can enhance learning, it can actively get students involved in the learning process, and transform them from passive learners to active learners. Marouf et al. (2024) asserted that the intelligent tutoring system (ITS) refers to a computer program powered by AI that mimics human tutors and seeks to provide students with quick, personalised teaching or feedback. The intelligent tutoring system (ITS) is designed in ways that enable it to address the diverse learning styles and paces of students, which traditional classroom settings often struggle to accommodate. The ITS utilises data from various sources, including student interactions, assessments, and behavioural metrics, to create personalised learning paths (Marouf et al., 2024).

Despite the tremendous potential AI holds, the North Central region of Nigeria continues to face infrastructural and institutional challenges that limit the adoption of digital technologies. These include: inefficient management, limited access, poor educational quality, and inadequate infrastructure. These problems hinder economic progress and widen gaps in educational outcomes (Suleiman & Muktar, 2020; Ukhurebor, 2024; Amadi, 2021). According to Abubakar et al. (2024), these combined issues have led to a stretched educational system that has impeded students' academic achievement, hindering their ability to engage completely with their studies, get essential help, and compete successfully with peers from other regions of the country. Furthermore, the use of AI tools in these institutions has been slow and hindered by numerous factors.

This paper thus explores how AI tools such as Adaptive learning systems and Intelligent tutoring systems relate to students' learning in universities in North-central Nigeria.

Statement of the Problem

In recent times, trends in students' learning in universities in the North-central states of Nigeria have continued to face significant challenges despite ongoing efforts by the government and other educational stakeholders to improve educational quality. Persistent issues such as inadequate infrastructure, limited instructional resources, overcrowded classrooms and reliance on traditional teaching methods have constrained student engagement and learning outcomes.

Although the emergence of artificial intelligence (AI) offers innovative solutions for enhancing teaching and learning through personalised instruction, automated assessment and data-driven decision-making, its adoption within universities in the region remains limited and uneven.

Factors such as poor technological infrastructure, low digital literacy, insufficient funding and ethical concerns surrounding AI implementation have hindered its integration.

Consequently, a gap exists between the potential of AI to transform educational practices and its actual utilisation in managing teaching and learning processes. In addition, there is a scarcity of empirical studies that examine the Utilisation of Artificial Intelligence tools and Students' learning In Universities in North-Central Nigeria. This study, therefore, seeks to address this gap by investigating how AI technologies can enhance learning with a view to improving learning outcomes, students' engagement and overall educational quality in universities within the region. It is based on this realisation that the current study is set to examine the Relationship between Artificial Intelligence tools and students' learning in universities in North-central Nigeria**.**

Research Questions

The study is guided by the following research questions;

1. What is the relationship between the adaptive learning system and students' learning in Universities in the North-central zone of Nigeria?
2. What relationship do intelligent tutoring systems have with students' learning in Universities in the North-central zone of Nigeria?

Hypotheses

The following hypotheses were tested at the 0.05 level of significance

H_{01}. There is no significant relationship between Adaptive learning systems and students' learning in Universities in the North-central zone of Nigeria

H_{02}. There is no significant relationship between intelligent tutoring systems and students' learning in Universities in the North-central zone of Nigeria

Literature Review

Learning is an innate human capacity rooted in personal experiences, cognitive awareness, personal biases, opinions, cultural background, and environment. Swargiary (2024) views learning as an individualised experience that expands knowledge, shifts viewpoints, and enhances practical abilities. A key limitation of conventional teaching and learning methods is their rigid, one-size-fits-all approach, which fails to account for differences in students' prior knowledge, learning preferences, objectives, and needs. Augustus (2024) opined that the conventional learning paradigm encompasses direct interactions between students and educators within the classroom, formal engagements with instructors beyond the classroom, and both formal and informal exchanges with peers to enhance comprehension of the subject matter. This approach to learning limits students' potential and places a huge burden on the

teachers, which ends up reducing the level of attention given to each student as a result of a huge imbalance in the teacher-learner ratio (Augustus, 2024). Fixed learning paths may not suit every learner. In contemporary Education, course designers prioritise the creation of personalised learning pathways tailored to individual needs, motivations, interests, behavioural patterns, and abilities.

Izuegbunam and Osuafor (2021) conducted a study on the Effect of an Adaptive Learning Approach on Students' Retention in Chemistry in Awka Education Zone of Anambra State. The purpose of the study was to determine the effect of the adaptive learning approach (ALA) on students' retention in chemistry in Awka Education Zone. Two research questions and three hypotheses guided the study. The design of the study was a Quasi-experimental design. The population of the study was 1,942 senior secondary three (SS3) students offering chemistry in Awka Education Zone, out of which a sample size of 109 students was drawn using purposive and random sampling techniques for the study. The instrument for data collection was the Chemistry Achievement Test (CAT), validated by three experts. The reliability of CAT was established using the Kuder-Richardson Formula 20 to be 0.70. Research questions were answered using mean and standard deviation, while analysis of covariance was used to test the null hypotheses. The result of the study showed that students taught using the Adaptive Learning approach had higher mean gain scores in retention than those taught using conventional instructional methods. The findings of the study revealed that there was a significant difference between the mean retention scores of students taught chemistry using the Adaptive Learning approach and the conventional instructional method in favour of ALA. It was concluded that ALA is an effective instructional approach for improving students' retention in chemistry. The study recommended that chemistry teachers should always form a pre-assessment test covering all such basic knowledge needed to understand the chemistry concept to be taught, to uncover areas where students need remedial instruction.

The study by Izuegbunam and Osuafor (2021) was conducted in Awka, employed a quasi-experimental design, with a population of 1,942 senior secondary three (SS3) students offering chemistry in Awka Education Zone and a sample size of 109 students. While this current study will use a correlational research design, with a population consisting of students in all the Universities in the North Central states of Nigeria, a modified questionnaire was used to collect data, Pearson's product-moment to answer research questions and regression analysis to test hypotheses

Oteyola et al. (2017) investigated the Effects of Two Selected Intelligent Tutors on Pre-service Physics Teachers' Academic Performance in Colleges of Education in South-Western Nigeria. The study's main purpose was to determine the effect of intelligent tutors on the retention of Physics concepts at the colleges of Education. This is with the ultimate goal of proffering solutions to the challenges of achieving some of the objectives of Physics Education in the nation. The study adopted a non-equivalent pre-test-post-test control group design. The population comprises all part II physics students in colleges of Education in South-western Nigeria. Three colleges of Education were purposively selected from three states in South-western Nigeria based on proximity, willingness to participate in the experiment, availability of ICT facilities, and a favourable academic calendar. The sample for the study comprises 99 NCE II physics students. The instrument used for the study was locally developed intelligent tutoring systems labelled (ITPA) and adapted intelligent tutoring systems labelled (ITPB), and the control groups were taught the topics of Vector and Circular Motion. Intelligent Tutoring Performance Test (ITPT), an achievement test, was used as a pre- and post-test for academic performance. Data collected were analysed using mean, standard deviation, t-test, one-way Analysis of Variance (ANOVA), and post-hoc analyses. The findings from the study showed that both the locally developed (ITPA) and adapted (ITPB) increased students' academic performance significantly, and better retention of Physics concepts. The study concludes that both the locally developed and adapted intelligent tutoring systems (ITPA and ITPB) significantly improve the academic performance and retention of physics concepts among pre-service physics teachers. The study also recommended that ITS should be integrated into the pre-service of teachers to aid better academic performance, more development, and adaptation of intelligent systems tailored to suit the local context, and that teachers should be trained on the use of ITS to ensure effective integration into the classroom.

The study by Oteyola et al. (2017) concentrated on the South Western Zone of Nigeria; the target population was Physics students only. It adopted a non-equivalent pre-test-post-test control group design, with a small sample size, an achievement test was used as an instrument for data collection, and the methods of data analysis were mean, standard deviation, t-test, one-way Analysis of Variance (ANOVA), and post-hoc analyses. This creates a gap in the literature as the current study seeks to investigate the Relationship between Artificial Intelligence tools and students' learning in universities in North-central Nigeria by adopting a correlational research study, a population of students in all the Universities in North-central, using a questionnaire to collect data, Pearson's product-moment and regression for data analysis.

Theoretical Framework

The Technology Acceptance Model (TAM) developed by Fred Davis in 1989 is one of the most applied theoretical frameworks for explaining and predicting users' acceptance and utilisation of information technologies. It was originally adapted from the social psychological theories of reasoned action (TRA) proposed by Martin Fishbein and Icek Ajzen. TAM specifically focuses on the determinants of technology acceptance by introducing two core constructs: Perceived Usefulness (PU) and Perceived Ease of Use (PEOU). PU refers to the extent to which a user believes the technology will enhance their performance, while PEU defines the degree to which a user perceives the technology as easy to use. Both constructs jointly shape users' attitude towards the technology, which in turn influences their behavioural intentions to use it.

Historically, the 1980s saw the development and usage of personal computers, research on technological adoption was on the rise during this period, and the theory was born out of the need to understand the successful adoption of technology by individuals and organisations. This theory sought to explain the potential of technology and the willingness of individuals to accept innovative technology.

The TAM model provides a useful framework for examining how university staff and students perceive Artificial Intelligence technologies in terms of their usefulness and ease of use. These perceptions may explain the psychological and practical factors that may influence the adoption of AI in Nigeria. The rationale behind adopting the Technology Acceptance Model is that it explains and underscores the importance of perceived usefulness and perceived ease of use as determinants of AI adoption by university staff for job effectiveness and students to improve their learning. It provides a strong theoretical basis for examining how AI can be adopted in universities to enhance personalised learning and improve teaching efficiency. Applying TAM to this research will help assess the readiness of Nigerian Universities in the North-Central states to integrate AI into their systems. By evaluating administrators' and students' perceptions of AI's usefulness and ease of use, policymakers and university administrators can develop strategies to facilitate the adoption of AI. This may include providing training programs, improving infrastructure, and addressing challenges related to AI integration.

Methodology

This study employed a quantitative research approach using a correlational research design to examine the relationship between selected AI tools and the management of teaching and learning in universities in North-central Nigeria. The population of the study comprised 10787 students drawn from nine (9) universities within the North-central geopolitical zone of Nigeria.

A sample size of 399 students was determined using the Taro Yamane Formula. Stratified random sampling was employed to ensure that all categories of universities- federal, state and private were adequately represented. Data was collected using a questionnaire titled Relationship between Artificial Intelligence tools and students' learning in universities in North-central Nigeria (RAITSLUNCN). The instrument consisted of 16 items (8 items per variable) structured on a 4-point Likert scale. To ensure the validity of the instrument, it was subjected to face and content validity by experts in Educational Research and Measurement and Evaluation. Based on their assessments, the instrument got a validity index of 0.80. The instrument was later pilot tested on 30 university staff within the population but outside the sample area, and it yielded a Cronbach's alpha coefficient of 0.71. Pearson's Product-Moment Correlation was used to answer the research questions, while Regression analysis was used to test the hypotheses of the study at a 0.05 level of significance.

Ethical considerations were strictly observed. Participation was voluntary, and respondents were assured of the confidentiality and anonymity of their responses.

Results

The research questions were answered using Pearson's Product-Moment Correlation was used to answer the research questions, while Regression analysis was used to test the hypotheses of the study at a 0.05 level of significance.

Research Questions 1: What is the relationship between adaptive learning systems and students' learning in Universities in the North-central zone of Nigeria?

Table 1: Pearson's Product-Moment Correlation on the Strength of Relationship between Adaptive Learning Systems and Students' Learning in Universities in the North-Central Zone of Nigeria

Variables	N	$\bar{X}$	Std.Dev.	r
Adapted Learning Systems	399	27.02	3.60	0.055
Students' Learning	399	70.85	8.99	

Table 1 shows the strength of the relationship between adaptive learning systems and students' learning in Universities in the North-central zone of Nigeria. The result reveals that the calculated value of Pearson's product-moment correlation (r) is given as 0.055. This value is below the benchmark correlation value of 0.50. This implies that there is a weak positive relationship between adaptive learning systems and the management of teaching and learning in Universities in the North-central zone of Nigeria.

The statistical analysis presented in Table 1, which reveals a Pearson's product-moment correlation coefficient (r) of 0.055 between adaptive learning systems and the management of

teaching and learning, offers a critical insight into the current state of educational technology in North-Central Nigerian universities. With a benchmark correlation value set at 0.50, the obtained value of 0.055 indicates a weak positive relationship. This finding is not merely a statistical observation; it carries profound implications for university administrators, policymakers, and educators. It suggests that the mere presence of adaptive learning technologies does not automatically translate into effective management or improved learning outcomes. Instead, it points to a significant disconnection between technology acquisition and the practical, pedagogical integration required to manage teaching and learning effectively.

The primary implication of this weak relationship is that the adoption of adaptive learning systems is largely superficial**.** A correlation of 0.055 implies that the introduction of these systems has had a negligible impact on how teaching and learning are managed within these institutions. It suggests that universities in the North-Central zone may be prioritizing the procurement of technology as a "checklist" approach to modernization over the complex process of embedding these tools into the curriculum and administrative framework. Consequently, while the hardware or software may be present on campus, it is likely functioning in isolation, failing to influence the strategic management of educational delivery.

Furthermore, this finding highlights a critical gap in digital literacy and technical training among both faculty and administrative staff. Adaptive learning systems are designed to be dynamic, using data to tailor instruction to individual student needs. For this data to effectively influence the "management of teaching and learning," educators must possess the competence to interpret the analytics generated by these systems and adjust their pedagogical strategies accordingly. The weak correlation suggests that this data utilization is not happening. Educators may lack the necessary skills to harness the adaptive features of the systems, defaulting to traditional teaching methods instead. Thus, the technology becomes an add-on rather than a transformative tool, resulting in a minimal impact on the educational management process.

Another significant implication is the potential misalignment of infrastructure and context**.** The North-Central zone, like many parts of Nigeria, faces challenges regarding power supply and internet connectivity. A weak positive relationship may indicate that the operational environment is hindering the efficacy of these adaptive systems. Even if the management is committed to using these tools, inconsistent technical performance can render them unreliable, preventing their full integration into the teaching management process. This suggests that investments in technology are failing to yield desired returns because they are not supported

by the necessary foundational infrastructure, leaving the systems underutilized and their potential unfulfilled.

In addition, this finding serves as a warning to policymakers and university leadership regarding resource allocation**.** Investing in adaptive learning systems requires significant financial resources. A correlation of 0.055 signals a poor return on investment (ROI). It implies that funds currently being directed toward software licenses and hardware could be better utilized elsewhere unless a strategy is developed to deepen the integration of these tools. The management of teaching and learning requires a holistic approach where technology supports specific educational objectives.

In conclusion, the weak positive relationship (r=0.055) between adaptive learning systems and the management of teaching and learning in universities in the North-Central zone of Nigeria serves as a wake-up call. It demonstrates that technology is not a panacea. To bridge this gap and achieve a stronger correlation, universities must move beyond the mere acquisition of technology. They must invest in comprehensive training programs for staff, upgrade supporting infrastructure, and develop a pedagogical framework that actively integrates adaptive systems into the core management of student learning. Without these structural and human-centric interventions, the potential of adaptive learning to revolutionize university education in the region will remain untapped.

Research Question 2: What relationship do intelligent tutoring systems have with students' learning in Universities in the North-central zone of Nigeria?

Table 2: Pearson's Product-Moment Correlation on the Strength of Relationship between Intelligent Tutoring Systems and Students' Learning in Universities in the North-Central Zone of Nigeria

Variables	**N**	$\bar{X}$	**Std.Dev.**	**r**
Intelligent Tutoring Systems	399	24.90	3.94	0.055
Students' Learning	399	70.85	8.99	

Table 2 shows the strength of the relationship between intelligent tutoring systems and students' learning in Universities in the North-central zone of Nigeria. The result reveals that the calculated value of Pearson's product-moment correlation (r) is given as 0.055. This value is below the benchmark correlation value of 0.50. This implies that there is a weak positive relationship between intelligent tutoring systems and the quality of teaching and students' learning in Universities in the North-central zone of Nigeria.

The statistical analysis presented in Table 2, which examines the relationship between Intelligent Tutoring Systems (ITS) and the quality of teaching and students' learning in

universities within the North-Central zone of Nigeria, yields a result that is both revealing and concerning. With a calculated Pearson's product-moment correlation coefficient (r) of 0.055 significantly below the benchmark of 0.50. The study establishes that there is a weak positive relationship between these variables. This negligible correlation suggests that the deployment of "intelligent" educational technology has not translated into the expected enhancement of teaching quality or student performance. The implications of this finding are multifaceted, pointing to fundamental issues regarding the integration of technology, the readiness of the academic environment, and the alignment of digital tools with pedagogical goals.

The primary implication of this weak relationship is that Intelligent Tutoring Systems are failing to fulfill their core promise: the personalization of learning. ITS are designed to simulate the benefits of a one-on-one human tutor by providing immediate feedback and tailored learning paths. A correlation approaching zero suggests that this personalization is either not occurring or is ineffective. It implies that in these universities, the ITS may be functioning merely as electronic repositories of information rather than as interactive pedagogical agents. Consequently, the "quality of teaching" has not seen a paradigm shift; the technology is present, but it is not acting as an intelligent scaffold for student learning.

Furthermore, this finding highlights a significant pedagogical disconnect. A weak correlation implies that the introduction of ITS has not influenced the actual instructional strategies employed by lecturers. If the quality of teaching is to improve through technology, educators must integrate the data and feedback generated by these systems into their lesson planning and classroom interactions. The low r-value suggests that teaching practices remain largely traditional and detached from the ITS platform. Educators may be viewing the ITS as a supplementary add-on rather than a central component of the instructional design. Consequently, the technology runs parallel to the classroom instruction without enhancing it, resulting in a negligible impact on the overall quality of education.

Another critical implication relates to infrastructure and usability. For an Intelligent Tutoring System to be effective, it requires consistent power supply, high-speed internet, and compatible hardware. In the North-Central zone, where these infrastructural amenities are often erratic, the effectiveness of sophisticated ITS can be severely compromised. The weak correlation likely reflects the frustration of both students and teachers who cannot access the systems reliably or who face latency issues that disrupt the learning flow. When the technological experience is fraught with technical hurdles, the cognitive load required to navigate the system outweighs the pedagogical benefits, leading to poor learning outcomes and a refusal by instructors to adopt the technology meaningfully.

Additionally, this finding suggests a mismatch in software relevance and curriculum alignment. Intelligent Tutoring Systems are often pre-programmed with specific content and logic that may not align perfectly with the local curriculum or the specific learning needs of students in North-Central Nigeria. A correlation of 0.055 indicates that the "intelligence" of the system is not resonating with the students. If the system's content is generic or culturally irrelevant, it will fail to engage students or deepen their understanding. This implies that universities may be purchasing "off-the-shelf" foreign solutions without localizing or adapting them to the Nigerian educational context, thereby rendering them impotent in driving quality learning.

In addition, the findings serve as a crucial indicator for resource allocation and policy direction. Investing in Intelligent Tutoring Systems is often expensive, involving licensing fees, hardware procurement, and maintenance. A correlation of 0.055 suggests a poor return on investment. It implies that simply pouring funds into high-tech solutions is not a magic bullet for educational quality.

In conclusion, the weak positive relationship between Intelligent Tutoring Systems and the quality of teaching and learning in North-Central Nigerian universities serves as a critical diagnostic tool. It reveals that the current deployment of these systems is ineffective. To bridge this gap and move toward the benchmark of effective integration, university management must look beyond procurement. They must invest in robust infrastructure, provide comprehensive training for lecturers on how to utilize ITS data for pedagogical improvement, and ensure that the software content is rigorously aligned with the local curriculum. Without these foundational changes, the "intelligence" in these tutoring systems will remain dormant, failing to uplift the quality of education it was meant to serve.

Test of Hypotheses

Two null hypotheses formulated for the study were tested at a 0.05 level of significance using Regression Analysis, and the results are presented below:

H_{01}. There is no significant relationship between Adaptive learning systems and students' learning in Universities in the North-central zone of Nigeria

Table 3: Regression Analysis on the Relationship between Adaptive Learning Systems and Students' Learning in Universities in the North-Central Zone of Nigeria

Model	Sum of Squares	df	Mean Square	F	P-value.	Decision
Regression	97.440	1	97.440	1.215	0.273	Accepted
Regression	31842.770	397	80.209			
Total	31940.210	398				

Dependent Variable: STUDENTS' LEARNING

Predictors: (Constant), ADAPTIVE LEARNING SYSTEMS Table 3 indicates the relationship between adaptive learning systems and the management of teaching and learning in Universities in the North-central zone of Nigeria. Results indicate that the F calculated value is 1.215, with a p-value of 0.273, which is higher than the 0.05 level of significance at degrees of freedom of 1 and 397. Hence, hypothesis 3 is accepted, meaning there is no significant relationship between the adaptive learning system and students' learning in Universities in the North-central zone of Nigeria.

The statistical results presented in Table 3, With a calculated F-value of 1.215 and a p-value of 0.273 well above the conventional 0.05 level of significance. The study accepts the null hypothesis. This statistical conclusion implies that there is no significant relationship between the adaptive learning system and the management of teaching and learning, nor does it have a significant impact on students' learning. This finding is critical; it moves beyond suggesting a "weak" relationship to asserting that, statistically speaking, the relationship is virtually non-existent. The implications of this statistical insignificance are profound, signaling a systemic failure in the deployment and utilization of educational technology in the region.

The most immediate implication of this finding is that adaptive learning systems are currently redundant in the educational management equation. In theory, adaptive systems should provide data that allows university managers to monitor student progress, identify at-risk learners, and allocate resources more effectively. However, the acceptance of the null hypothesis suggests that this feedback loop is broken. The "management of teaching and learning" is operating completely independently of the adaptive systems. This implies that university administrators and educators are not utilizing the data generated by these platforms to make pedagogical decisions. Consequently, the substantial investments made in acquiring these systems are yielding zero return in terms of measurable management improvements, rendering the technology a "white elephant" within the academic infrastructure.

Furthermore, this result highlights a critical failure in pedagogical integration. A p-value of 0.273 indicates that the variance in students' learning outcomes cannot be attributed to the use of adaptive learning systems. This suggests that the presence of these systems in the classroom does not alter the trajectory of student success or failure. It implies that teaching practices remain static and unresponsive to the capabilities of the technology. Educators may be treating adaptive learning platforms as glorified textbooks or repositories for lecture notes rather than as dynamic tools that shape the learning process. If the system does not significantly relate to learning, it means students are likely engaging with the technology passively, if at all, to satisfy course requirements rather than to enhance their understanding.

Another significant implication pertains to user competence and training. The lack of a significant relationship points to a fundamental gap in the ability of faculty and students to harness these complex systems. Adaptive learning systems require a certain level of digital literacy to function effectively as teachers must curate content, and students must navigate adaptive pathways. The statistical evidence suggests that these competencies are lacking. It is likely that the "intelligence" of the system is bypassed because users do not know how to interact with it meaningfully. This suggests that the training provided to staff and students has been inadequate, failing to bridge the gap between technical operation and pedagogical application.

In addition, this finding serves as a stark warning regarding policy formulation and resource allocation. The acceptance of the null hypothesis confirms that the current strategy of technology implementation is flawed. It implies that the policy of simply purchasing and deploying adaptive learning systems, without addressing the human and infrastructural ecosystem required to support them, is futile. For policymakers and university leaders in the North-Central zone, this result should act as a catalyst for a radical review of their ICT strategies. It demonstrates that technology adoption is not a linear process where input equals output.

In conclusion, the statistical insignificance of the relationship between adaptive learning systems and educational management/outcomes (p=0.273) is a clear indicator of dysfunction. It reveals that the technology has failed to become an integral part of the university's academic DNA. To move from statistical insignificance to significance, universities must stop viewing technology acquisition as an end in itself. Instead, they must focus on the "soft" infrastructure such as training, curriculum integration, and data-driven decision-making that allows these systems to actually influence teaching and learning. Without this shift, adaptive learning systems will remain a statistically irrelevant background noise in the North-Central educational landscape.

H02. There is no significant relationship between intelligent tutoring systems and students' learning in Universities in the North-central zone of Nigeria

Table 4: Regression Analysis on the Relationship between Intelligent Tutoring Systems and Students' Learning in Universities in the North-Central Zone of Nigeria

Model	Sum of Squares	Df	Mean Square	F	P-value.	Decision
Regression	9.980	1	9.440	0.112	0.726	Accepted
Residual	31930.229	397	80.429			
Total	31940.210	398				

Dependent Variable: STUDENTS' LEARNING

Predictors: (Constant), INTELLIGENT TUTOR SYSTEM

Table 4 indicates the relationship between tutor learning systems and the students' learning in Universities in the North-central zone of Nigeria. Results indicate that the F calculated value is 0.112 at the p-value of 0.726 which is higher than the 0.05 level of significance at degrees of freedom of 1 and 397. Hence, hypothesis 4 is accepted, meaning there is no significant relationship between intelligent tutor systems and students' learning in Universities in the North-central zone of Nigeria.

The statistical evidence presented in Table 4, regarding the relationship between Intelligent Tutoring Systems (ITS) and students' learning in universities within the North-Central zone of Nigeria, presents a stark verdict. With an F-calculated value of 0.112 and a p-value of 0.726 far exceeding the 0.05 threshold of significance. The null hypothesis is accepted. This confirms that there is no significant relationship between the use of these intelligent systems and the learning outcomes of students. A p-value of 0.726 indicates that there is a 72.6% probability that the observed results are due to random chance rather than any actual effect of the technology. This finding of statistical irrelevance carries deep implications for the stakeholders in the Nigerian educational sector, ranging from pedagogical strategy to economic policy.

The first and most immediate implication is that Intelligent Tutoring Systems in the region are failing to deliver their core pedagogical promise. By definition, an ITS is designed to provide immediate, customized instruction and feedback to facilitate deeper learning. The lack of a significant relationship suggests that these systems are not acting as "tutors" in any meaningful sense. It implies that the "intelligence" of the software is either misaligned with the curriculum or too generic to address the specific learning needs of Nigerian students. If the technology were functioning as intended, we would expect to see at least some variance in student performance attributable to its use. The fact that there is none suggests that the interaction between the student and the system is superficial; students may be clicking through the system without the cognitive engagement necessary to drive learning gains.

Furthermore, this finding highlights a profound disconnect in educational integration. The statistical insignificance strongly suggests that ITS are not embedded into the core assessment or grading structures of these universities. When a tool is integral to the learning process, usage and performance usually correlate with outcomes. The lack of correlation here implies that the system is likely viewed by both students and instructors as optional or peripheral. Educators may be assigning work on these platforms but treating it as a "tick-box" activity that does not influence the main trajectory of the students' grades or understanding. Consequently, the systems exist in a vacuum, failing to influence the central metrics of academic success.

Another critical implication is the mismanagement of scarce financial resources. The procurement of Intelligent Tutoring Systems typically involves significant capital expenditure, often funded by dwindling university grants or Tetfund interventions. An F-value as low as 0.112 suggests that the investment is yielding no discernible return in terms of student performance. In an educational environment where infrastructure, library resources, and traditional learning aids are often underfunded, diverting funds to a technology that shows zero statistical impact is economically inefficient. This finding suggests a "hype-driven" procurement process where universities acquire technology to appear modern, without a strategic plan for how that technology will translate into academic value.

In addition, the result points to underlying technical and infrastructural barriers. The probability that the results are due to chance (0.726) is so high that it suggests the technology is effectively neutralized by the environment. This could be attributed to the erratic power supply and poor internet connectivity common in the North-Central zone, which can render real-time, adaptive systems unresponsive or frustrating to use. If students cannot access the "tutor" when they need it, the system loses its adaptive advantage and becomes a static, useless artifact. Therefore, the lack of significance is not necessarily a failure of the software concept, but a failure of the ecosystem required to support high-tech educational tools.

In conclusion, the acceptance of the null hypothesis regarding Intelligent Tutoring Systems in the North-Central zone is a damning indictment of the current implementation strategy. A p-value of 0.726 signals that these systems, in their current form, are statistically irrelevant to the learning process. This serves as a clarion call for university administrators to cease the uncritical acquisition of foreign software and instead focus on building the necessary digital infrastructure and training frameworks required to make these tools functionally significant. Without such a shift, "intelligent" tutoring will remain a meaningless add-on to the academic experience.

Discussions

Findings on hypothesis 1 showed that adaptive learning systems are not significantly related to students' learning in Universities in the North-central zone of Nigeria. On the contrary, Izuegbunam and Osuafor (2021) conducted a study on the effect of an adaptive Learning Approach on students' retention in chemistry in Awka Education Zone of Anambra State. The findings of the study revealed that there was a significant difference between the mean retention scores of students taught chemistry using the Adaptive Learning approach and the conventional instructional method in favour of ALA. Luo and Hsiao-Chin (2023) conducted a study on the Influence of AI-powered adaptive Learning Platforms on Student Performance in Chinese

Classrooms. The findings from the study revealed a significant positive association between the integration of AI-powered platforms and student outcomes. Findings on the study revealed that students exposed to personalised learning experiences exhibited improved academic achievements compared to those in traditional classrooms.

Findings on hypothesis 2 showed there is no significant relationship between intelligent tutoring systems and students' learning in Universities in the North-central zone of Nigeria. On the contrary, Oteyola et al. (2017) in "Effects of Two Selected Intelligent Tutors on Pre-service Physics Teachers' Academic Performance in Colleges of Education in South-Western Nigeria" The findings from the study showed that both the locally developed (ITPA) and adapted (ITPB) increased students' academic performance significantly, and better retention of Physics concepts. Furthermore, Menor and Ballera (2019) conducted a study on the Impact of an Intelligent Tutoring System in Programming: A Case Study in Improving the Academic Performance of Students in Tertiary Education. Findings from the study reveal that the experimental group, which used the ITS, showed a significant improvement in academic performance and problem-solving skills compared to the control group. However, there was no significant difference in analytical skills between the experimental and control groups. The findings suggest that it can be an effective tool for enhancing learning outcomes in programming courses.

Conclusion

This study investigated the relationship between adaptive learning systems, intelligent tutoring systems and students' learning in universities in North-central Nigeria. The findings explicitly showed that both the adaptive and intelligent tutoring systems have a weak positive relationship with students' learning. However, there is no significant relationship between them and students' learning. This suggests that despite the recognised potential of AI in enhancing personalised and interactive learning, its current application within the universities in the region has not been fully implemented, and as such, there is no substantial improvement in students' learning. The lack of a significant relationship may be attributed to limitations peculiar to the North-central region. AI holds a transformative potential, but its impact in the North-central universities remains minimal, necessitating the need for deliberate efforts to incorporate it into students' learning.

Recommendation

a. University administrators must prioritize comprehensive training for faculty and staff to ensure they possess the requisite digital skills to effectively operationalize these technologies in the classroom.
b. Stakeholders should invest in robust supporting infrastructure, specifically consistent power supply and high-speed internet, to resolve the operational failures that currently render adaptive systems irrelevant.
c. Universities need to move beyond superficial adoption by fully integrating intelligent tutoring systems into the core curriculum and grading rubrics rather than treating them as optional add-ons.
d. Software developers and educators should collaborate to localize the content of intelligent tutoring systems to align with the specific cultural context and academic syllabi of North-Central Nigerian students.
e. Policymakers must discontinue the "checklist" procurement of foreign educational technologies without first conducting rigorous pilot tests to verify their potential to improve learning outcomes.
f. University management must establish a data-driven decision-making framework where analytics from learning systems are actively utilized to guide pedagogical strategies rather than being ignored.

References

Abubakar, U., Onasanya, S. A., & Ibrahim, H. A. (2024). Student perspectives and impact of AI integration in pedagogical practices in Nigerian tertiary institutions: *Advances in Mobile Learning Educational Research,* 4(2), 1135-1148. https://doi.org/10.25082/AMLER.2024.02.008

Ali, S. M., Dick, S., Dillon, S., Jones, M. L., Penn, J., & Staley, R. (2023). Histories of artificial intelligence: a genealogy of power. BJHS Themes. 8:1-18. https://doi.org/10.1017/bjt.2023.15

Amadi, A. C. (2021). Ethical considerations in the use of artificial intelligence in education. Int J Educ Technol Ethics. 8(1):15-30.

Augustus, M. (2024). Hybrid learning in Nigerian Universities: merits, challenges, and framework.

Bakwaph, P. K., & Tor, G. M. (2022). Impact of information and communication technology on the management of public Universities in Benue State, Nigeria. *London Journal of Research in Management and Business.* 22(2).

Chen, L., Chen, P. and Lin, Z. (2020). Artificial intelligence in Education: a review. *IEEE Access*,8. https://doi.org/10.1109/ACCESS.2020.2988510M.

Feng, T. & Li, Q. (2024). Artificial intelligence in educational management: opportunities, challenges and solutions.

Izuegbunam, A. G. &. Osuafor, A. M. (2021). Effect of adaptive learning approach on students' retention in chemistry in Awka Education zone of Anambra state. *Journal of Research & Method in Education (IOSR-JRME)* 11(6).

Joshi, M. (2024). Adaptive Learning through Artificial Intelligence. *International Journal on Integrated Education.* 7. 41-43. DOI:10.2139/ssrn.4514887.

Marouf, A., Al-Dahdooh, R., Abu Ghali, M. J., Mahdi, A. O., Abunasser, B. S. & Abu-Naser, S. S. (2024). Enhancing Education with artificial intelligence: the role of intelligent tutoring systems: *International Journal of Engineering and Information Systems (IJEAIS*). 8(8).

Menor, J. V. & Ballera, M. (2019). The impact of an intelligent tutoring system in programming: A case study in improving the academic performance of students in tertiary education. *International Journal of Simulation: Systems, Science & Technology.* 10.5013/IJSSST.a.20.S2.26.

Munoz, G. F. R. & Chimbo, K. M. O (2023). Application of artificial intelligence techniques in the administrative management of higher Education institutions: An analysis of their effectiveness in process optimisation and strategic decision-making. 13(2).

Suleiman, N. A., & Muktar, M. U. (2020). Access to quality higher Education in Nigeria: Challenges and prospects. *Journal of Education and Practice,* 11(9), 95-101.

Swargiary, K. (2024). The impact of AI-driven personalised learning and intelligent tutoring systems on student engagement and academic achievement: Ethical implications and the digital divide. https://ssrn.com/abstract=4897241.

Oteyola, T. A., Idowu, L., & Adeyanju, L. J. (2017). Effects of two selected intelligent tutors on pre-service physics teachers' academic performance in colleges of Education in South Western Nigeria: *European Journal of Education Studies*. 3 (6). doi:http://dx.doi.org/10.46827/ejes.v0i0.773.

Ukhurebor, K., Efanodor-Obeten, H., Otsupius, A., Jokthan, G., Opateye, J., Wada, Z., Sinan, I., Bello, A., Ahmed, M., Balogun, V., & Jatta, L. (2024). The sustainability of university Education toward national development: The Nigerian perspective. *Journal of Infrastructure, Policy and Development.* 8(5), 2959.

UNESCO. (2023). ChatGPT and Artificial Intelligence in higher Education: quick start guide. United Nations Educational, Scientific and Cultural Organisation.

Yayat, S. & Lusiana, L. (2023). Artificial Intelligence: positive and negative roles in Education management. *The Annual International Conference on Education.*