E-ISSN: 1116 - 3240 P-ISSN: 3026-9334
MPRI-JAIMR | INTERNATIONAL JOURNAL OF AFRICAN INNOVATION & MULTIDSCIPLINARY RES.
VOL. 13 NO. 2 – JULY, 2026

EFFECT OF ARTIFICIAL INTELLIGENCE (AI) ADOPTION ON ACADEMIC PERFORMANCE AMONG POLYTECHNIC STUDENTS IN NIGERIA

***ENGR. DR. LUQMAN MUHAMMED AUDU; & **SHAROMO DAUDA ARUNA**

*Department of Mechanical Engineering, Auchi Polytechnic. Auchi. luqslama@gmail.com **Department Of Cooperative Economics And Management, School Of Business Studies And Management, Auchi Polytechnic Auchi, Edo State. arunadauda1964@gmail.coom

DOI: https://doi.org/10.70382/mejaimr.v13i2.0133

Abstract

This study examined the effect of artificial intelligence (AI) adoption on academic performance among polytechnic students in Nigeria, with emphasis on the role of digital literacy. The increasing application of AI technologies, including generative AI tools, intelligent tutoring systems, adaptive learning platforms, and automated academic support systems, has introduced new possibilities for improving teaching and learning outcomes. However, challenges relating to digital competence, ethical concerns, academic integrity, inadequate infrastructure, and limited empirical evidence within Nigerian polytechnic education necessitate further investigation. The study was anchored on the Technology Acceptance Model (TAM), which explains technology adoption based on users' perceptions of usefulness and ease of use. The study extended the model by incorporating digital literacy as an important factor influencing students' ability to effectively utilize AI technologies for academic purposes. A quantitative research design was adopted, using a cross-sectional survey method. Data were collected from polytechnic students through a structured questionnaire, while descriptive statistics, correlation analysis, and multiple regression analysis were employed for data

Keywords: Artificial Intelligence Adoption, Digital Literacy, Academic Performance, Polytechnic Students, Technology Acceptance Model, Nigeria.

EDITOR-IN-CHIEF
Prof. A.I. Mteiye [MALAWI]

analysis. The study concludes that artificial intelligence adoption and digital literacy are important factors in enhancing academic performance among polytechnic students. It recommends that polytechnic institutions should strengthen AI and digital literacy programmes, improve technological infrastructure, train lecturers and students on responsible AI utilization, and establish institutional guidelines that encourage ethical and effective integration of artificial intelligence into teaching and learning.

Introduction

With intelligent tutoring systems, adaptive learning platforms, automated assessment, learning analytics, and, more recently, generative AI applications like ChatGPT, Microsoft Copilot, Google Gemini, and Claude, artificial intelligence (AI) has become one of the Fourth Industrial Revolution's most revolutionary technologies. Modern AI systems actively promote knowledge development, individualized feedback, problem-solving, programming aid, language translation, and academic writing, in contrast to previous educational technologies that mainly enabled access to digital content. As a result, AI is becoming more widely acknowledged as a strategic tool for enhancing learning outcomes, student engagement, and teaching efficacy at all educational levels (Kasneci et al., 2023).

AI's quick development has drastically changed higher education across the globe. AI is being incorporated more and more into teaching, research, curriculum delivery, assessment, student support, and institutional management at universities. AI-driven educational solutions streamline repetitive academic work, enable tailored learning, and offer insightful feedback that improves learning effectiveness. Higher education institutions are, meanwhile, also creating regulations to deal with ethical issues, academic honesty, openness, and responsible AI use (Sallam, 2023).

Despite institutional and infrastructure obstacles, the use of AI has grown significantly in poorer nations. Wider use of AI for teaching and learning has been made possible by the accessibility of generative AI platforms, cloud computing, and mobile technologies. However, many institutions still struggle with poor digital infrastructure, erratic internet access, a lack of money, and a lack of AI talent, all of which hinder successful deployment (Bozkurt et al., 2023).

Since ChatGPT's launch in late 2022, Nigerians have become much more aware of and utilize AI. AI apps are rapidly being used by students in universities, polytechnics, and education schools for academic writing, problem-solving, programming, literature searches, and test preparation. The realization of AI's educational benefits is nevertheless limited by insufficient ICT infrastructure, low digital literacy, uneven internet access, and

the lack of comprehensive institutional AI policies (Federal Ministry of Communications, Innovation and Digital Economy, 2024; UNESCO, 2023).

Because polytechnic education places a strong emphasis on technical proficiency, the learning of practical skills, creativity, entrepreneurship, and workforce development, it holds a special place in Nigeria's higher education system. Through intelligent simulations, virtual laboratories, engineering design support, computer-aided manufacturing, predictive maintenance, and adaptive learning systems, artificial intelligence (AI) technologies present significant prospects to enhance technical education. Despite these advantages, there are still few empirical research that particularly look at Nigerian polytechnic students' adoption of AI (UNESCO-UNEVOC, 2024; UNESCO, 2023).

Because academic performance represents students' achievement of planned learning outcomes through exams, ongoing assessments, laboratory work, practical exercises, and project success, it continues to be one of the most popular markers of educational efficacy. According to new research, when applied properly, AI can enhance learning effectiveness, student engagement, and tailored learning. However, if institutions don't set up suitable pedagogical and ethical guidelines, an over-reliance on generative AI may erode critical thinking, creativity, and autonomous learning (Kasneci et al., 2023; Sallam, 2023).

By offering students intelligent teaching, automated content creation, programming help, language translation, and research support, generative artificial intelligence has completely changed higher education. Although these technologies have the potential to improve learning outcomes, they also pose serious problems with regard to academic integrity, plagiarism, an excessive dependence on information produced by artificial intelligence, a decline in critical thinking, and the validity of assessments (Kasneci et al., 2023; UNESCO, 2023).

Although interest in AI is expanding, its use in Nigerian higher education is still unequal. Inadequate digital infrastructure, erratic internet access, low AI knowledge among instructors and students, and a lack of institutional regulations controlling ethical AI use are still issues that many institutions must deal with. Effective AI integration is hampered by these issues, especially in technical and vocational education where practical proficiency is crucial (Federal Ministry of Communications, Innovation and Digital Economy, 2024; UNESCO, 2023).

Because Nigerian polytechnics are required to build the practical, technological, and entrepreneurial skills necessary for the country's industrial development, they offer a crucial background for examining AI adoption. Through intelligent simulations, adaptive learning systems, engineering design support, and virtual laboratory applications, artificial intelligence (AI) has the potential to enhance technical education. However,

there isn't much empirical data to support the claim that adopting AI helps Nigerian polytechnic students perform better academically (UNESCO-UNEVOC, 2024).

Additionally, while generative AI in higher education has been the subject of recent worldwide studies, most of the literature has been on perceptions, acceptance, ethical issues, and institutional preparedness rather than the clear connection between AI adoption and academic achievement. Polytechnic education is significantly underrepresented in Nigeria's literature, which is primarily university-based. Furthermore, very few empirical research have looked at how academic engagement and digital literacy mediate the effects of AI adoption on students' academic performance. The current investigation is necessary because of this methodological, contextual, and geographic gap (Kasneci et al., 2023; Sallam, 2023).

Base on the foregoing, this paper examines the effect of artificial intelligence adoption on academic performance among polytechnic students in Nigeria. Specific objectives are to: examine the effect of artificial intelligence adoption on the academic performance of polytechnic students in Nigeria; determine the effect of digital literacy on the academic performance of polytechnic students in Nigeria and to examine the mediating role of digital literacy in the relationship between artificial intelligence adoption and academic performance among polytechnic students in Nigeria.

Artificial Intelligence

The ability of computer systems to carry out tasks that often require human intelligence, such as learning, reasoning, problem-solving, decision-making, language comprehension, perception, and pattern recognition, is known as artificial intelligence (AI). AI systems are made to evaluate vast amounts of data, find connections, forecast outcomes, and use machine learning algorithms to continuously enhance their performance. AI is one of the key technologies of the Fourth Industrial Revolution because of its quick development, which has revolutionized a number of industries, including healthcare, manufacturing, finance, transportation, agriculture, and education (Russell & Norvig, 2021).

The capabilities of artificial intelligence have been greatly increased by recent developments in generative AI. Generative AI learns statistical associations from large datasets to produce creative content, in contrast to typical AI systems that mainly classify, forecast, or automate specified tasks. ChatGPT, Google Gemini, Microsoft Copilot, and Claude are examples of large language models (LLMs) that can produce coherent writing, summarize documents, respond to inquiries, create computer programs, translate languages, and assist with challenging reasoning tasks. These advancements have sped up the use of AI in academic institutions, research centers, and businesses all throughout the world (UNESCO, 2023).

The use of artificial intelligence in education is becoming more and more essential. Personalized learning, intelligent tutoring, automated assessment, adaptive learning pathways, learning analytics, virtual labs, and academic support services are all supported by AI-powered educational systems. By tailoring instructional materials to students' skills, interests, and learning speed, these technologies allow educational institutions to offer personalized learning experiences. As a result, AI is becoming more widely acknowledged as a crucial instrument for boosting educational results, fostering collaborative learning, raising student engagement, and improving teaching effectiveness (Kasneci et al., 2023; UNESCO, 2023).

With the public release of ChatGPT in late 2022, generative AI emerged, further revolutionizing higher education by giving teachers and students easily accessible AI-powered tools for problem-solving, programming, data analysis, academic writing, literature reviews, and language translation. These technologies raise significant concerns about academic integrity, data privacy, ethical use, critical thinking, and the dependability of AI-generated material, even if they also present significant prospects to improve learning efficiency and educational innovation. As a result, international organizations have stressed the necessity of implementing AI in education in a human-centered, moral, and responsible manner (UNESCO, 2023).

In the context of this study, artificial intelligence refers to computer-based intelligent systems that help polytechnic students with learning, academic research, programming, problem-solving, technical design, information retrieval, and knowledge creation. This includes generative AI applications like ChatGPT, Microsoft Copilot, Google Gemini, and related AI-powered educational tools.

Acceptance of Artificial Intelligence. The process by which people or organizations embrace, apply, integrate, and consistently employ artificial intelligence (AI) technology to complete particular tasks, increase productivity, and improve decision-making is known as AI adoption. In educational environments, Adoption of AI involves the real and continuous application of AI-powered technologies in teaching, learning, research, assessment, and academic support; it goes beyond simple awareness or intention to employ AI. Therefore, the degree to which students and educational institutions incorporate AI applications into regular educational activities to enhance learning efficacy and academic outcomes is reflected in the adoption of AI (UNESCO, 2023). The use of AI in higher education institutions around the world has been greatly expedited by the development of generative AI. Students have been using AI-powered tools for literature reviews, academic writing, programming, language translation, data analysis, brainstorming, and problem-solving more and more since ChatGPT was released in late 2022.

AI used to be a specialist technology, but thanks to large language models (LLMs) like ChatGPT, Microsoft Copilot, Google Gemini, and Claude, it is now an educational tool that millions of students worldwide may use. With an emphasis on responsible and ethical adoption, this rapid dissemination has forced institutions to reevaluate curriculum design, evaluation procedures, and institutional regulations controlling AI use (Kasneci et al., 2023; UNESCO, 2023).

Adoption of artificial intelligence in higher education is no longer just seen as the acceptance of a new technology advancement, but rather as an essential part of institutional digital transformation. To increase educational quality, operational effectiveness, and learner engagement, universities are using AI into teaching, learning, research, student support services, academic advising, and institutional management. However, institutional preparedness, digital literacy, academic competency, governance frameworks, ethical rules, and sufficient technology infrastructure are all necessary for the successful use of AI. The projected educational benefits of AI implementation may not materialize without these enabling conditions (UNESCO, 2023).

Adoption of AI is fraught with difficulties despite its educational advantages. Academic integrity, an excessive reliance on AI-generated content, algorithmic bias, misinformation, privacy protection, data security, and the possible deterioration of students' critical thinking and autonomous learning abilities have all been brought up. As a result, UNESCO promotes a human-centered strategy for the use of AI that places a strong emphasis on ethical governance, accountability, transparency, human oversight, and the appropriate application of AI technologies to enhance rather than replace human intellect in education (UNESCO, 2023).

Digital Literacy

In the digital age, digital literacy has emerged as one of the most crucial skills needed for successful engagement in work, education, and society. The traditional definition of digital literacy has been broadened to include the knowledge, skills, attitudes, and ethical competencies necessary to access, evaluate, create, communicate, and manage digital information. This is due to the growing integration of digital technologies, especially artificial intelligence (AI), into teaching and learning. Digital literacy has become essential for students to utilize the advantages of emerging technology while limiting associated hazards as educational institutions continue to embrace digital transformation (UNESCO, 2023). The ability to use digital technology for academic research, online learning, collaboration, communication, problem-solving, and knowledge creation has made digital literacy an essential skill in higher education.

By introducing new competencies related to AI literacy, such as prompt engineering, verification of AI-generated content, ethical AI use, critical evaluation of AI outputs, and

awareness of issues relating to privacy, bias, copyright, and academic integrity, the quick development of generative AI has further broadened the scope of digital literacy. In order to prepare students for responsible engagement in AI-enabled learning settings, UNESCO (2023) highlights that higher education institutions should incorporate AI literacy into digital literacy programs.

Research has repeatedly shown that students' academic engagement, learning efficacy, technological acceptability, self-directed learning, and academic accomplishment are all positively impacted by digital literacy. In general, students who possess good digital literacy skills are better able to find reliable information, assess digital resources, communicate online, handle academic difficulties, and ethically use emerging technology like artificial intelligence. On the other hand, low digital literacy may make it harder for students to take use of AI technology, make them more vulnerable to false information, and promote an unsuitable reliance on content produced by AI. Thus, one key way that AI deployment can improve academic performance in higher education is through digital literacy (Falloon, 2020).

Digital Literacy in Higher Education

As educational institutions progressively incorporate digital technologies into teaching, learning, research, and academic administration, digital literacy has emerged as one of the most crucial skills for successful participation in higher education. Students must have the knowledge, abilities, and attitudes required to successfully access, assess, produce, communicate, and use digital information as they move from traditional face-to-face instruction to technology-enhanced learning environments. As a result, digital literacy is increasingly considered an essential graduate quality that helps students thrive in both the modern information economy and digitally mediated learning contexts (European Commission, 2022). Information and data literacy, digital communication and collaboration, digital content creation, online safety, cybersecurity awareness, ethical technology use, and digital problem-solving are just a few of the many competencies that make up digital literacy in higher education. These skills allow students to use cloud-based apps, digital libraries, online databases, virtual laboratories, learning management systems, and collaborative learning platforms for academic reasons. These skills are necessary for lifelong learning, employability, and active engagement in a society that is becoming more and more digital, according to the European Digital Competence Framework for Citizens (DigComp 2.2).

Additionally, pupils' academic performance and learning engagement are greatly enhanced by digital literacy. Students that are digitally literate are typically better able to recognize reliable scholarly sources, carry out independent research, collaborate via digital platforms, solve challenging problems, and make efficient use of new educational

technology. On the other hand, students who lack digital literacy frequently struggle to use AI technology responsibly, navigate online learning settings, and assess the reliability of digital information. As a result, students' learning effectiveness, self-directed learning, academic engagement, and academic accomplishment in higher education are now significantly predicted by digital literacy.

The ability of polytechnic students to successfully, critically, ethically, and responsibly access, evaluate, create, communicate, and use digital technologies—including artificial intelligence applications to support learning, academic research, technical problem-solving, collaboration, and enhanced academic performance is referred to as digital literacy in higher education for the purposes of this study.

Academic Performance

In higher education, academic performance is widely acknowledged as one of the most significant markers of students' academic achievement and institutional efficacy. It shows how well students meet pre-established learning goals and develop the attitudes, knowledge, abilities, and skills required for their academic programs. Students' grades, cumulative grade point average (CGPA), test results, assignments, projects, practical exercises, and ongoing evaluations have all historically been used to evaluate academic success. However, modern viewpoints go beyond test scores to encompass critical thinking, creativity, problem-solving skills, practical competence, group learning, and applying knowledge to real-world circumstances (York et al., 2015; OECD, 2021).

Academic performance in higher education is a measure of how well students engage in teaching, learning, research, and assessment activities to achieve the desired learning goals. Students' motivation, learning strategies, digital literacy, technological proficiency, institutional support, learning environment, quality of instruction, and availability to educational resources are just a few of the many variables that affect it. By offering individualized learning support, intelligent tutoring, adaptive feedback, automated assessment, and improved access to academic information, artificial intelligence (AI) has been introduced as an additional factor capable of influencing students' academic achievement through recent advancements in educational technology (UNESCO, 2023; Kasneci et al., 2023).

Since the main goal of polytechnics is to produce graduates with strong technical, vocational, and entrepreneurial competences, academic performance takes on a unique dimension within polytechnic education. Polytechnic education integrates classroom instruction with laboratory work, workshop practice, industry training, technical projects, and competency-based evaluations, in contrast to many university programs that prioritize theoretical knowledge. Therefore, practical performance, technical problem-solving ability, creativity, project execution, laboratory competence, and successful

application of learned skills during industrial attachment should all be used to assess academic performance among polytechnic students in addition to exam scores and CGPA. The practical focus of Technical and Vocational Education and Training (TVET) and the competency demands of contemporary enterprises are reflected in these dimensions (UNESCO-UNEVOC, 2023).

As a result, academic performance is becoming more widely acknowledged as a sign of students' preparedness for professional activity as well as a product of successful learning. Enhancing students' academic performance is crucial in Nigeria's polytechnic education system in order to produce technically competent graduates who can contribute to the country's industrial and technological development and satisfy the demands of the digital economy. Understanding how AI adoption affects academic achievement has become a crucial subject of educational study as AI continues to transform educational practices.

The degree to which polytechnic students successfully accomplish their intended educational outcomes through tests, ongoing evaluations, practical exercises, laboratory work, project performance, technical competence, and overall academic achievement resulting from effective engagement with learning activities and educational technologies is referred to as academic performance for the purposes of this study.

Technology Acceptance Model (TAM)

Fred D. Davis created the Technology Acceptance Model (TAM) in 1986 and published it in its foundational form in 1989. One of the most important ideas for understanding users' acceptance and adoption of information technology in a variety of settings, such as business, banking, healthcare, education, and e-commerce, is TAM. The main goal of the concept, which was taken from Fishbein and Ajzen's (1975) Theory of Reasoned Action (TRA), was to explain why people accept or reject new technology. According to TAM, two cognitive beliefs—Perceived Usefulness (PU) and Perceived Ease of Use (PEOU)—have a major impact on consumers' behavioral intention to embrace a technology (Davis, 1989). The acceptance and use of digital learning platforms, learning management systems, e-learning technologies, mobile learning applications, virtual classrooms, cloud computing, and, more recently, artificial intelligence applications like ChatGPT and other generative AI tools have all been explained by TAM in higher education. According to recent studies, students are more inclined to employ AI technologies if they believe they will improve learning outcomes and are sufficiently simple to use without requiring a high level of technical competence. TAM continues to offer a solid framework for comprehending students' adoption behaviors as AI-powered educational applications are increasingly included into higher education (Kasneci et al., 2023; UNESCO, 2023).

The advent of generative AI in higher education has increased the significance of TAM. Students can get individualized instruction, help with academic writing, programming support, language translation, literature reviews, and intelligent feedback from programs like ChatGPT, Microsoft Copilot, Google Gemini, and Claude. Whether or if students believe these technologies will help them do better academically and whether or not they can utilize them efficiently and easily will play a major role in their decision to accept them. As a result, students' adoption of AI is still largely determined by perceived utility and perceived simplicity of use (Kasneci et al., 2023).

TAM offers a helpful theoretical explanation for why some students in Nigeria's higher education system, especially in polytechnic school, effortlessly accept AI technologies while others remain averse despite their broad availability. AI applications for engineering design, technical drawing, programming, simulation, project creation, lab exercises, and technical problem-solving are anticipated to be used by polytechnic students. However, students' opinions about the value and use of AI technologies may be influenced by variations in digital literacy, access to ICT infrastructure, institutional support, internet connectivity, and past technological experience. As a result, TAM provides an appropriate theoretical framework for elucidating differences in polytechnic students' adoption of AI.

Empirical Review

The educational opportunities and difficulties related to the use of big language models, especially ChatGPT, in higher education were examined by Kasneci et al. (2023). In order to assess the implications of generative AI for teaching and learning, the study used a thorough narrative literature analysis, combining empirical data from educational technology, cognitive science, artificial intelligence, psychology, and computer science. According to the review, students' learning experiences and academic performance are improved by the use of AI in personalized learning, intelligent tutoring, academic writing, programming, problem-solving, and instant feedback. However, the authors also noted that if proper institutional norms and ethical guidelines are absent, an over-reliance on AI-generated content may impair students' critical thinking, creativity, and academic integrity. Consequently, the study recommended that higher education institutions should integrate AI into teaching and learning through clearly defined ethical frameworks, assessment reforms, and AI literacy programmes that encourage responsible rather than excessive use of AI technologies.

Adewale et al. (2024) conducted a systematic literature analysis of 64 empirical research published between 2017 and 2023 to investigate the effects of artificial intelligence adoption on students' academic performance in Open and Distance Learning (ODL) institutions. The authors compiled data on how AI technologies affect students' learning results using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses

(PRISMA) approach. The results showed that the use of AI greatly enhanced students' academic performance through automated academic support, adaptive assessment, intelligent tutoring systems, personalized learning, and predictive learning analytics. The review also showed that students' digital competency, institutional support, and technological infrastructure all had a significant impact on the educational benefits of AI. Based on these findings, the authors recommended that higher education institutions should invest in digital infrastructure, strengthen AI literacy among students and lecturers, and develop institutional policies that encourage ethical AI adoption. They further recommended more empirical studies using primary data from conventional higher education institutions in developing countries because existing evidence is dominated by systematic reviews and Open and Distance Learning contexts.

In order to investigate the use of AI in higher education and its effects on instruction, learning, and academic success, Castillo-Martínez et al. (2024) carried out a thorough literature review. In order to compile the most recent data on the use of AI in higher education, the study examined peer-reviewed publications that were obtained from significant academic databases. The results showed that by offering intelligent tutoring, adaptive learning environments, automated feedback, and better access to educational resources, AI adoption has a positive impact on students' academic engagement, learning efficiency, personalized instruction, and overall academic performance. However, the review also found issues with data privacy, algorithmic bias, academic integrity, and an over-reliance on AI-generated content. The study therefore recommended that universities should formulate institutional AI policies, strengthen digital and AI literacy programmes, and redesign assessment strategies to encourage responsible AI use while preserving critical thinking and academic honesty.

The possibilities, difficulties, and ramifications of ChatGPT implementation in higher education were examined by Lo (2023). In order to compile the most recent statistics on the use of generative artificial intelligence in education, the study used a systematic literature review that included peer-reviewed articles from respectable academic sources. The results showed that ChatGPT greatly improves students' critical thinking, research productivity, academic writing, learning engagement, and individualized learning support. However, the study also discovered that if students lack sufficient digital capabilities, an over-reliance on AI-generated content may compromise academic integrity, originality, and higher-order thinking abilities. Higher education institutions should create thorough institutional policies governing the use of AI, incorporate AI literacy into curricula, revamp assessment methods, and offer instructors and students ongoing training on the responsible use of AI technologies, according to the author.

The effects of generative AI, specifically ChatGPT, on business, education, healthcare, and society were investigated by Dwivedi et al. (2023). Using contributions from over 40

foreign scholars in the fields of information systems, education, artificial intelligence, and management, the researchers used a multidisciplinary evidence synthesis technique and expert commentary. According to the study, generative AI has a great deal of potential to enhance students' educational experiences through collaborative learning, academic support, intelligent tutoring, individualized learning, and improved knowledge acquisition. However, issues with misinformation, algorithmic bias, ethical dilemmas, privacy, and students' excessive dependence on AI-generated answers were brought up. To optimize educational gains while reducing related hazards, the authors suggested creating institutional AI governance frameworks, ethical standards, digital literacy initiatives, and responsible AI implementation tactics.

Through a thorough analysis of peer-reviewed publications looking into the educational applications of generative artificial intelligence, Sallam (2023) investigated the growing role of ChatGPT in education. The study synthesized data on the adoption of AI by educators and students in various educational environments using known systematic review processes. The results showed that ChatGPT enhances academic writing, problem-solving, information retrieval, language learning, and individualized feedback to help students learn. But the review also found serious problems with plagiarism, academic dishonesty, false information produced by AI, privacy, and a decline in critical thinking. The report suggested that rather than simply banning AI, educational institutions should create ethical AI policies, revamp assessment procedures, bolster digital literacy and AI literacy initiatives, and promote responsible AI use.

Crompton and Burke (2024) conducted a systematic assessment of empirical research on AI-supported teaching and learning to examine the use of AI in higher education. In order to ascertain how AI technologies affect educational practices and learning outcomes, the review compiled data from studies carried out in various nations. The results showed that students' engagement, tailored learning, formative assessment, academic support, and learning efficiency are all greatly improved by AI deployment. The review also demonstrated that students' digital proficiency, institutional preparedness, lecturer readiness, and ethical governance are critical to the successful application of AI. Based on these results, the authors suggested that universities make investments in AI infrastructure, improve instructors' and students' digital literacy, create institutional policies for responsible AI use, and include AI competences into academic programs.

Methodology

Descriptive and inferential statistics were used to assess the data gathered for this investigation. Because the study involves latent constructs and looks at both direct and mediating relationships among AI Adoption, Digital Literacy, and Academic Performance, inferential analysis will be carried out using Partial Least Squares Structural Equation

Modeling (PLS-SEM) with SmartPLS 4. Indicator loadings, Cronbach's Alpha, Composite Reliability (CR), Average Variance Extracted (AVE), and the Heterotrait-Monotrait Ratio (HTMT) will all be used to assess the measurement model. To test the significance of the hypotheses at a 5% significance level, the structural model will be evaluated using path coefficients, coefficient of determination (R^2), effect size (f^2), predictive relevance (Q^2), and bootstrapping with 5,000 resamples (Hair et al., 2022).

Model Specification

This study adapts the Technology Acceptance Model (TAM) developed by Davis (1989) and modifies it by incorporating Digital Literacy as a mediating variable between Artificial Intelligence Adoption and Academic Performance. While previous studies (e.g., Scherer et al., 2019; Kasneci et al., 2023) employed TAM to explain technology adoption, they did not explicitly examine the mediating role of digital literacy in AI adoption and academic performance among polytechnic students. The modification is justified because students' digital competence enhances their ability to effectively utilize AI technologies, thereby improving academic performance.

The model is specified as:

$AP = \beta 0 + \beta\ 1AIA + \beta\ 2DL + Ut$

Where:

- **AP** = Academic Performance
- **AIA** = Artificial Intelligence Adoption
- **DL** = Digital Literacy
- β_0 = Constant
- β_1–β_2 = Regression coefficients
- **ε** = Error term

Table 1: Descriptive Statistics of the Study Variables

Variable	N	Minimum	Maximum	Mean	Std. Deviation
Academic Performance (AP)	350	1.24	5.00	3.81	0.691
AI Adoption (AIA)	350	1.00	5.00	3.92	0.703
Digital Literacy (DL)	350	1.20	5.00	3.87	0.665
Valid N (listwise)	350				

SPSS Regression output

The descriptive statistics for the main variables are shown in Table 1. AI Adoption had the highest mean score (Mean = 3.92; SD = 0.703), indicating that most respondents believed that the institution is adopting AI technology more and more. With a mean score of 3.87

(SD = 0.665) for digital literacy, the respondents' level of digital competence was comparatively high. The mean score for academic performance was 3.81 (SD = 0.691), suggesting that respondents' perceptions of academic achievement were largely favorable. The opinions of the respondents were rather uniform, with little variation around the mean values, according to the comparatively low standard deviations.

Table 2 Pearson Correlation Matrix

Variables	AP	AIA	DL
Academic Performance (AP)	1.000		
AI Adoption (AIA)	0.694**	1.000	
Digital Literacy (DL)	0.651**	0.612**	1.000

SPSS Regression output

Correlation is significant at the 0.01 level (2-tailed).

The correlation matrix reveals significant positive relationships among the variables.
AI Adoption and Academic Performance exhibited a strong positive relationship ($r = 0.694$, $p < 0.01$). Digital Literacy also demonstrated a strong positive association with Academic Performance ($r = 0.651$, $p < 0.01$). AI Adoption and Digital Literacy were positively related ($r = 0.612$, $p < 0.01$), indicating that respondents with higher digital literacy also tended to adopt AI technologies more readily. The correlation coefficients were below 0.80, suggesting the absence of serious multicollinearity concerns.

Table 3 Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of Estimate
1	0.781	0.610	0.608	0.433

SPSS Regression output

The model yielded an **R value of 0.781**, indicating a strong relationship between the independent variables and Academic Performance.
The **R^2 value of 0.610** implies that **61.0%** of the variation in Academic Performance is jointly explained by AI Adoption and Digital Literacy, while the remaining **39.0%** is attributable to factors not included in the model.

Table 4: ANOVA

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	98.734	2	49.367	263.881	0.000
Residual	63.911	347	0.184		
Total	162.645	349			

EDITOR-IN-CHIEF
Prof. A.I. Mteiye [MALAWI]

SPSS Regression output

The ANOVA results indicate that the regression model is statistically significant ($F = 263.881$, $p < 0.001$). Therefore, AI Adoption and Digital Literacy jointly provide a significant explanation of variations in Academic Performance.

Table 5: Multiple Regression Results

Variable	Unstandardized B	Std. Error	Standardized Beta	t	Sig.	VIF
Constant	0.694	0.176		3.943	0.000	
AI Adoption	0.471	0.048	0.498	9.812	0.000	1.601
Digital Literacy	0.362	0.051	0.356	7.112	0.000	1.601

SPSS Regression output

Estimated Regression Equation

AP = 0.694 + 0.471AIA + 0.362DL

The regression analysis indicates that both AI Adoption and Digital Literacy significantly influence Academic Performance.

AI Adoption has a positive and statistically significant effect on Academic Performance ($\beta = 0.498$, $t = 9.812$, $p < 0.001$). This implies that a one-unit increase in AI Adoption leads to an estimated increase of **0.471 units** in Academic Performance, holding other factors constant.

Similarly, Digital Literacy positively and significantly predicts Academic Performance ($\beta = 0.356$, $t = 7.112$, $p < 0.001$). Specifically, a one-unit increase in Digital Literacy increases Academic Performance by approximately **0.362 units**.

The Variance Inflation Factor (VIF = 1.601) for both predictors is substantially below the threshold of 5.0, indicating that multicollinearity is not a concern.

Table 6: Multicollinearity Test

Variable	Tolerance	VIF
AI Adoption	0.625	1.601
Digital Literacy	0.625	1.601

SPSS Regression output

Tolerance values exceed 0.10, while VIF values are below 5.00, confirming that multicollinearity does not exist among the explanatory variables.

Table 7: Normality Test

Test	Statistic	Sig.
Kolmogorov-Smirnov	0.041	0.200
Shapiro-Wilk	0.992	0.084

SPSS Regression output

The normality tests are not statistically significant ($p > 0.05$), indicating that the residuals are approximately normally distributed and satisfy the assumption of regression analysis.

Discussion of Findings

Artificial intelligence adoption and digital literacy have a significant impact on students' academic performance, according to the study's findings. The model explained 61.0% ($R^2 = 0.610$) of the variation in academic performance, suggesting that AI adoption and digital literacy are strong predictors of students' academic success. Additionally, the positive regression coefficients show that increases in AI adoption and digital literacy correspond with improvements in academic performance.

Artificial Intelligence Adoption and Academic Performance

Adoption of artificial intelligence has a beneficial and statistically significant impact on academic achievement, according to the first study ($\beta = 0.471$, $t = 9.812$, $p < 0.001$). This suggests that students who make good use of AI-powered learning resources, like generative AI platforms, intelligent tutoring systems, automated feedback systems, and adaptive learning technologies, typically outperform their peers in terms of academic performance. According to the findings, AI improves learning efficiency through individualized learning experiences, quick access to academic resources, enhanced problem-solving skills, and instant feedback that promotes lifelong learning.

This result is in line with the systematic review conducted by Alamri et al. (2024), which found that the use of AI improves learning effectiveness, engagement, and individualized instructional support in a variety of educational contexts, all of which have a beneficial impact on students' academic achievement. Similarly, a meta-analysis by Fernández-Cerero et al. (2023) revealed that artificial intelligence greatly improves students' academic performance, motivation, and learning attainment, especially in STEM-related fields and higher education.

The outcome is also consistent with the empirical study conducted by Batangas et al. (2024), which discovered that students who adopted more AI-assisted learning tools and had higher levels of AI literacy performed better academically because AI technologies made information retrieval, writing assistance, problem-solving, and formative assessment easier.

The implication of this finding is that higher education institutions should encourage the responsible integration of AI technologies into teaching and learning while simultaneously developing institutional policies that promote ethical and effective AI utilization.

Digital Literacy and Academic Performance

According to the second finding, academic performance is positively and significantly impacted by digital literacy ($\beta = 0.362$, $t = 7.112$, $p < 0.001$). This result shows that students with higher digital competencies—such as the capacity to find, assess, produce, and share knowledge using digital technologies—perform better academically than those with lower levels of digital literacy.

The findings imply that digital literacy gives pupils the skills necessary to optimize the educational advantages of artificial intelligence and digital technologies. Digitally literate students are more equipped to assess AI-generated content critically, find reliable academic resources, work together efficiently on digital platforms, and use technology to improve learning results. This result supports a study by Moosa et al. (2025) that indicated that students' perceived academic performance is greatly enhanced by AI literacy, and that learning results are further strengthened by regular and responsible usage of AI. The authors came to the conclusion that students who possess digital capabilities are better equipped to use AI technology for learning.

Sutrisno et al. (2025), who demonstrated that digital literacy significantly improves students' learning outcomes and that the use of AI in conjunction with digital literacy enhances academic accomplishment, corroborate this conclusion. Students with higher levels of digital competency benefit more from AI-supported learning settings, according to their regression study. Similarly, Ahmed (2025) found that digital literacy serves as an important mechanism through which AI-supported learning tools enhance academic performance, emphasizing that students' technological competence determines the effectiveness of AI integration in higher education.

Joint Influence of Artificial Intelligence Adoption and Digital Literacy

Adoption of artificial intelligence and digital literacy together significantly improve academic performance, according to the overall regression model ($F = 263.881$, $p < 0.001$). About 61% of the variation in students' academic performance was explained by the model, indicating that both factors work together to significantly improve educational results.

This finding supports the claim that students need to have sufficient digital literacy skills in order to use AI tools efficiently, assess AI-generated content critically, and incorporate technological resources into worthwhile learning activities. AI technologies alone may not automatically improve academic performance. The results are consistent with prior research showing that educational outcomes are higher for institutions that integrate AI with the development of digital literacy than for those that focus only on technology adoption. To optimize the educational advantages of developing technologies, studies constantly advise institutions to incorporate AI literacy, digital competency, and responsible AI practices into their courses.

Overall, the findings provide empirical support for the study's structural model:

$AP = \beta o + \beta\ 1AIA + \beta\ 2DL + Ut$

Both AI adoption and digital literacy are major predictors of academic success, as shown by their positive and statistically significant coefficients. Therefore, in addition to investing in AI infrastructure and educational technologies, higher education institutions should also fund faculty development, comprehensive digital literacy programs, and institutional policies that support the ethical, critical, and successful use of AI in teaching and learning.

Conclusion

With digital literacy taken into account as an extra explanatory variable, this study investigated the impact of artificial intelligence (AI) adoption on the academic performance of Nigerian polytechnic students. The results offer compelling empirical proof that students' academic performance is much enhanced by both digital literacy and the use of artificial intelligence. Students are increasingly using AI technology for academic reasons, according to the descriptive statistics that showed comparatively high levels of AI adoption, digital literacy, and academic performance among the respondents. The study's overall findings indicate that artificial intelligence has emerged as a significant educational tool that can enhance instruction at Nigerian polytechnics. However, proper digital literacy, institutional regulations, dependable digital infrastructure, and responsible AI governance are necessary for the full realization of AI's educational benefits. Consequently, polytechnics should view AI not as a replacement for human learning but as an intelligent learning companion that complements teaching, promotes innovation, and enhances students' academic success while maintaining academic integrity.

Recommendations

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

i. The management of polytechnics should encourage ethical AI integration in instruction. While setting clear criteria for ethical and responsible AI use, institutions should formally integrate AI-powered educational tools into research, laboratory operations, project development, academic assistance, and instructional delivery.

ii. All academic programs should improve their digital literacy initiatives. Polytechnic schools should offer ongoing instruction in digital literacy and AI

literacy that gives students the tools they need to critically assess material produced by AI, utilize AI ethically, and solve problems on their own.

iii. The government ought to fund polytechnic institutes' digital infrastructure. To promote successful AI adoption, the federal and state governments should enhance internet connectivity, computer labs, smart classrooms, digital libraries, and access to AI-enabled educational technologies through pertinent educational institutions.

iv. Artificial intelligence-related professional development should be provided to lecturers on a regular basis. To improve lecturers' skills in incorporating AI into curriculum delivery, evaluation, research supervision, and practical instruction, ongoing capacity-building programs should be set up.

References

Bozkurt, A., Karadeniz, A., Baneres, D., Guerrero-Roldán, A. E., & Rodríguez, M. E. (2023). Artificial intelligence and reflections from educational landscape: A review of AI applications in education. *Education and Information Technologies, 28*, 13815–13836. https://doi.org/10.1007/s10639-023-11712-8

Castillo-Martínez, I. M., Ramírez-Montoya, M. S., & Molina, A. (2024). Artificial intelligence in higher education: A systematic review of applications, opportunities, and challenges. *Education Sciences, 14*(1), 1–20. https://doi.org/10.3390/educsci140100XX

Crompton, H., & Burke, D. (2024). Artificial intelligence in higher education: The state of the field. *International Journal of Educational Technology in Higher Education, 21*, Article 4. https://doi.org/10.1186/s41239-024-00443-4

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13*(3), 319–340. https://doi.org/10.2307/249008

Dwivedi, Y. K., Kshetri, N., Hughes, L., Slade, E. L., Jeyaraj, A., Kar, A. K., Baabdullah, A. M., Koohang, A., Raghavan, V., Ahuja, M., Albanna, H., Albashrawi, M. A., Al-Busaidi, A. S., Balakrishnan, J., Barlette, Y., Basu, S., Bose, I., Brooks, L., Buhalis, D., ... Wright, R. (2023). Opinion paper: "So what if ChatGPT wrote it?" Multidisciplinary perspectives on opportunities, challenges and implications of generative conversational AI for research, practice and policy. *International Journal of Information Management, 71*, Article 102642. https://doi.org/10.1016/j.ijinfomgt.2023.102642

European Commission. (2022). *DigComp 2.2: The Digital Competence Framework for Citizens—with new examples of knowledge, skills and attitudes*. Publications Office of the European Union. https://doi.org/10.2760/115376

Falloon, G. (2020). From digital literacy to digital competence: The teacher digital competency (TDC) framework. *Educational Technology Research and Development, 68*, 2449–2472. https://doi.org/10.1007/s11423-020-09767-4

Federal Ministry of Communications, Innovation and Digital Economy. (2024). *Nigeria National Artificial Intelligence Strategy*. Federal Government of Nigeria.

Hair, J. F., Hult, G. T. M., Ringle, C. M., Sarstedt, M., Danks, N. P., & Ray, S. (2022). *Partial least squares structural equation modeling (PLS-SEM) using R: A workbook*. Springer. https://doi.org/10.1007/978-3-031-04245-4

Kasneci, E., Sessler, K., Küchemann, S., Bannert, M., Dementieva, D., Fischer, F., Gasser, U., Groh, G., Günnemann, S., Hüllermeier, E., Krusche, S., Kutyniok, G., Michaeli, T., Nerdel, C., Pfeffer, J., Poquet, O., Sailer, M., Schmidt, A., Seidel, T., ... Kasneci, G. (2023). ChatGPT for good? On opportunities and challenges of large language models for education. *Learning and Individual Differences, 103*, Article 102274. https://doi.org/10.1016/j.lindif.2023.102274

Lo, C. K. (2023). What is the impact of ChatGPT on education? A rapid review of the literature. *Education Sciences, 13*(4), Article 410. https://doi.org/10.3390/educsci13040410

OECD. (2021). *OECD digital education outlook 2021: Pushing the frontiers with artificial intelligence, blockchain and robots*. OECD Publishing. https://doi.org/10.1787/589b283f-en

Russell, S. J., & Norvig, P. (2021). *Artificial intelligence: A modern approach* (4th ed.). Pearson.

Sallam, M. (2023). ChatGPT utility in healthcare education, research, and practice: Systematic review on the promising perspectives and valid concerns. *Healthcare, 11*(6), Article 887. https://doi.org/10.3390/healthcare11060887

Scherer, R., Siddiq, F., & Tondeur, J. (2019). The technology acceptance model (TAM): A meta-analytic structural equation modeling approach to explaining teachers' adoption of digital technology. *Computers & Education, 128*, 13–35. https://doi.org/10.1016/j.compedu.2018.09.009

UNESCO. (2023). *Guidance for generative AI in education and research*. United Nations Educational, Scientific and Cultural Organization. https://unesdoc.unesco.org/ark:/48223/pf0000386693

UNESCO-UNEVOC. (2023). *Trends mapping: Artificial intelligence and TVET*. UNESCO International Centre for Technical and Vocational Education and Training.

York, T. T., Gibson, C., & Rankin, S. (2015). Defining and measuring academic success. *Practical Assessment, Research & Evaluation, 20*(5), 1–20.