

The Effect of Artificial Intelligence on Students' Academic Performance in Tertiary Institutions in Nigeria

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Abstract

Artificial Intelligence (AI) has become an important technological innovation influencing different sectors, including education. In Nigeria, tertiary institutions are gradually integrating AI technologies such as intelligent tutoring systems, plagiarism detection tools, chatbots, and generative AI applications to enhance teaching and learning processes. This study examines the effect of artificial intelligence on students' academic performance in tertiary institutions in Nigeria. The research adopted a quantitative approach and reviewed the existing literature and empirical studies related to AI adoption in Nigerian higher education. However, the misuse and overreliance on AI tools may negatively affect critical thinking skills, academic integrity, and independent learning. The study concludes that while AI contributes positively to educational development and academic performance, its effective use requires proper regulation, digital literacy training, and institutional policies to maximize benefits and minimize risks.

1. Introduction

The rapid advancement of digital technology has significantly transformed educational systems worldwide. One of the most influential technologies reshaping higher education is Artificial Intelligence (AI). Artificial Intelligence refers to computer systems capable of performing tasks that normally require human intelligence, such as learning, reasoning, decision-making, and problem-solving. In recent years, AI tools such as chatbots, automated grading systems, intelligent tutoring systems, and generative AI platforms have become increasingly integrated into the educational process. These technologies are designed to support teaching and learning activities by providing personalized learning experiences, improving access to information, and enhancing academic productivity. In Nigeria, tertiary institutions such as universities, polytechnics, and colleges of education are gradually adopting AI-based technologies to improve academic outcomes and institutional efficiency. AI-driven platforms help students access learning materials, conduct research, receive feedback, and improve academic writing.

Research has shown that AI technologies can enhance students' engagement and learning outcomes. For example, studies conducted in Nigerian universities found a positive relationship between AI tool usage and improved academic performance among students, particularly when AI tools are used for research, comprehension, and project completion. Despite these benefits, there are concerns regarding the excessive reliance on AI tools. Some scholars argue that the misuse of AI may encourage academic dishonesty, reduce critical thinking abilities, and undermine authentic learning processes. This research therefore examines the effect of artificial intelligence on students' academic performance in tertiary institutions in Nigeria, highlighting both the benefits and the challenges associated with its use.

2. Problem statement

The rapid expansion of Artificial Intelligence (AI) technologies has led to unprecedented transformations in higher education, particularly in how students access information, complete coursework, and engage in academic activities. AI-powered tools, including intelligent tutoring systems, virtual assistants, chatbots, and generative models such as large language models, are increasingly used by students in tertiary institutions to support learning, research, writing, and study tasks (Vieriu & Petrea, 2025). These technologies are praised for offering personalized learning experiences, enhancing engagement, and potentially improving academic outcomes by simplifying complex concepts and providing real-time feedback (Zakaria, Ahmad, Zainal & Ahmad Alhady, 2024; Ngonso et al., 2025). Empirical evidence from recent educational research suggests that AI tool usage is positively associated with higher academic achievement in some contexts, with students reporting improved performance in assignments, research activities, and examinations when AI tools are integrated into learning processes (Khan, Mehmood & Irshadullah, 2025; Ngonso et al., 2025).

Despite these reported benefits, there is growing concern among educators, scholars, and policymakers about the broader implications of AI integration for academic performance and educational quality. Some studies indicate that improper or excessive reliance on AI may impair students' underlying cognitive processes, diminish critical thinking, and encourage shortcuts that circumvent deep engagement with academic material (Ododo, Orji & Ikpe, 2025). For instance, misuse of AI for tasks such as generating essays or solving assessment questions has been linked to reduced study effort and a decline in foundational learning skills, with students bypassing

intellectual work in favor of AI-generated outputs (Ododo et al., 2025). Moreover, educators have noted rising instances of AI-assisted academic dishonesty, with academic integrity violations attributed to students' unregulated use of generative AI technologies, prompting concerns about the authenticity and validity of student performance outcomes.

The ongoing debate is complicated by differences in AI literacy, access to digital infrastructure, and institutional AI policies, all of which can have unequal effects on student performance within and across tertiary institutions. While some students use AI sensibly to improve comprehension and productivity, others might become overly reliant on these tools, which could jeopardize the development of critical abilities such as data analysis, problem-solving, and independent learning. Few studies provide a comprehensive understanding of AI's overall impact on academic performance across various educational settings, and the current body of research remains fragmented and context-specific. Thus, it is imperative to thoroughly examine how the use of AI affects students' academic achievement in Nigerian higher education institutions. This study aims to investigate the benefits and possible disadvantages of integrating AI in Nigerian higher education, specifically in Bauchi State, evaluate the degree of students' reliance on AI, and ascertain the relationship between these technologies and quantifiable academic results. Closing this gap will yield data that will guide effective policy, pedagogical approaches, and guidelines for using AI in ways that promote real student learning and academic success while reducing related risks.

3. Objectives of the study

- I. To identify the AI tools that affect students' academic performance among higher Institutions in Bauchi State.
- II. To examine the effect of those AI tools on students' academic performance among higher Institutions in Bauchi State.
- III. To propose a framework for an AI tool that can be used to improve students' academic performance among higher Institutions in Bauchi State.

4. Literature review

The integration of artificial intelligence (AI) tools such as ChatGPT, AI Nova, and DeepSeek into education has significantly transformed teaching and learning processes. These tools, powered by machine learning and natural language processing, provide students with instant access to information, personalized tutoring, and academic support. As their adoption increases, researchers

have begun to investigate their effects on students' academic performance, cognitive development, and learning outcomes.

4.1 Concept of Artificial Intelligence in Education

Artificial Intelligence (AI) refers to computer systems capable of performing tasks that typically require human intelligence, such as reasoning, problem-solving, and language understanding. In education, AI tools like ChatGPT enable interactive learning, automated feedback, and content generation. Recent studies show that AI is reshaping educational practices by supporting individualized learning and enhancing student engagement. For example, AI systems provide realtime assistance, enabling students to better understand complex concepts and complete tasks efficiently.

4.2 ChatGPT and Students' Academic Performance

4.2.1 Positive Effects of ChatGPT

Several empirical studies highlight the positive impact of ChatGPT on students' academic performance: A meta-analysis of 51 studies found that ChatGPT significantly improves learning performance, learning perception, and higher-order thinking skills. Research on polytechnic students revealed that ChatGPT enhances academic engagement and performance by supporting self-directed learning and curiosity. In programming education, ChatGPT improved students' learning outcomes and problem-solving abilities by offering instant explanations and coding assistance. Additionally, experimental studies show that students who used ChatGPT in projectbased learning achieved higher completion rates and better scores, suggesting that AI tools can enhance productivity and academic success.

4.3 Negative Effects of ChatGPT

Despite its benefits, several studies identify potential drawbacks: Some findings indicate that excessive use of ChatGPT may lead to lower exam performance, with users scoring lower than non-users in certain contexts. Research also suggests that reliance on AI tools can reduce cognitive engagement, critical thinking, and independent learning. Concerns about academic dishonesty and

over-dependence have been widely reported, particularly in assessment practices. These mixed findings indicate that the effectiveness of ChatGPT depends largely on how it is used by students.

4.4 AI Tools (AI Nova and DeepSeek) in Education

While ChatGPT has been extensively studied, emerging AI tools such as AI Nova and DeepSeek are gaining popularity. These tools function similarly by providing automated responses, research assistance, and academic writing support. Although empirical studies specifically focused on AI Nova and DeepSeek are still limited, literature on AI systems suggests that: AI-powered tools generally improve learning efficiency and access to information.

They facilitate personalized learning experiences, adapting to students' needs. They may also introduce risks such as over-reliance, reduced originality, and ethical concerns. Given their functional similarities to ChatGPT, it is reasonable to infer that AI Nova and DeepSeek may produce comparable academic outcomes, both positive and negative.

5. Research Design

This study adopts a quantitative research approach using a descriptive survey design. The quantitative method is appropriate because it allows for the collection of numerical data to examine the relationship between the use of artificial intelligence tools (ChatGPT, AI Nova, and DeepSeek) and students' academic performance. A survey design enables the researcher to gather data from a large population and analyze patterns and effects statistically. Previous studies on AI in education have also employed quantitative designs to assess behavioral intentions and academic outcomes. Statistical Package for Social Sciences (SPSS) was used for data coding and preliminary analysis. While the structural models were assessed using SmartPLS. Various researchers applied the used of regression analysis techniques, but due to the complexity of the business need, the application of structural equation modeling is suitable. The structural equation modeling techniques presented a suitable approach to the nature of a theoretical model that contains variables and constructs hypothesized to be dynamic in a data collection (Smith et al., 2001). A structural equation modeling technique defines the preliminary design among a set of latent constructs that include more than one variable, and indicators can be measured.

6. Results and discussion

The population of this study comprises the students in Abubakar Tatari Ali Polytechnic; the sample size of the study is 380. Nunnally (1978) argued that reliability and validity are critical aspects of any psychometric assessment. Cronbach's alpha is used to measure the recommended scale's general reliability. According to Sarstedt et al. (2021), the benchmark for a Cronbach's alpha coefficient in exploratory research is a value of 0.70 or higher indicates that the instruments have a high reliability standard (Awang et al., 2016; Sarstedt et al., 2021). The variation values from 0.915 to 0.780 on the Cronbach's alpha and from 0.936 to 0.830 on the composite reliability and the AVE of 0.745 to 0.496 in Table 1) which indicate that the scales are considered reliable.

Table 1. Validity Construct and reliability

Constructs	Items	Loading	CA	CR	AVE
CHARTGPT (CG)	CG1	0.775	0.780	0.830	0.496
	CG2	0.657			
	CG3	0.591			
	CG4	0.718			
	CG5	0.764			
AI NOVA(AIN)	AIN1	0.828	0.915	0.936	0.745
	AIN2	0.840			
	AIN3	0.894			
	AIN4	0.878			
	AIN5	0.873			
DEEPSEEK (DSK)	DSK1	0.724	0.802	0.860	0.552
	DSK2	0.721			
	DSK3	0.809			
	DSK4	0.787			
	DSK5	0.663			
ACADEMIC PERFORMANCE (ACP)	ACP1	0.849	0.909	0.932	0.735
	ACP2	0.903			
	ACP3	0.837			
	ACP4	0.894			
	ACP5	0.799			

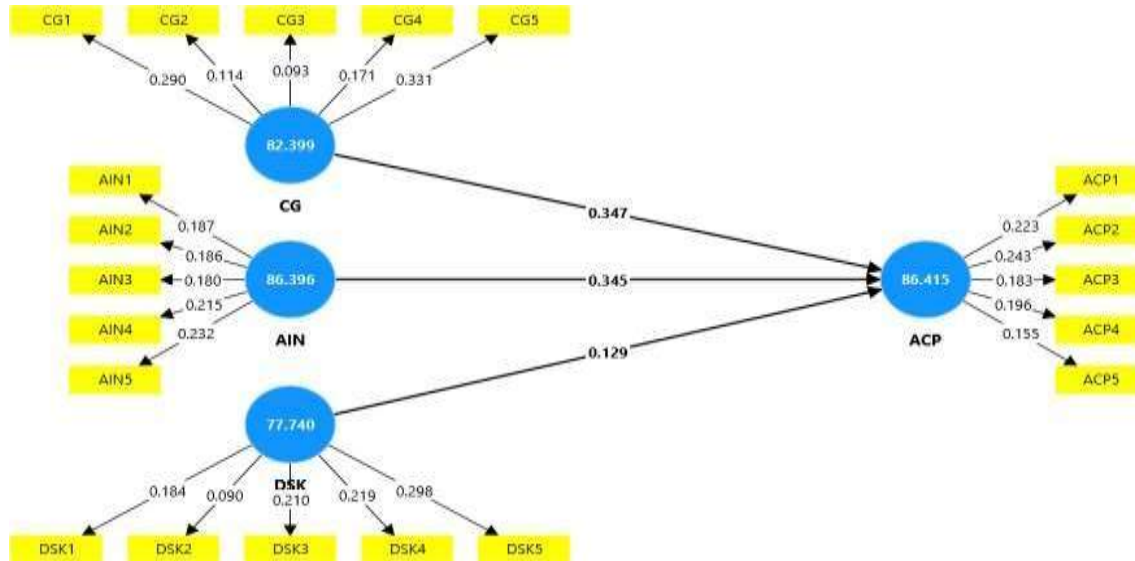


Fig. 1. Structural Model

6.1 Individual Item Reliability

By examining the outer loading of every construct's measurement, as indicated in Figure 1, and Table 1, the distinct item reliability was assessed (Hair et al., 2012; Hair et al., 2014). Based on Hair et al. (2014) rule of thumb, any item that has a loading between 0.40 and 0.70, the analysis of the outer loading of each distinct construct, subject to the increase of average variance extracted (AVE) and composite reliability (CR). Therefore, no item was deleted because they met the threshold and their loading was higher than the threshold of 0.40. (Hair et al., 2014). Therefore, 20 items were retained in the model, and because their loadings fall between 0.090 and 0.591, they are considered appropriate for further study.

Table 2. Path coefficients

Items	Beta Value (β)	T-Statistics	P-Value	R ²
ChatGPT → ACP	0.347	4.924	0.000	0.386
AI Nova → ACP	0.344	5.970	0.000	
DeepSeek → ACP	0.129	2.075	0.038	

The degree to which a single predicting variable affects a directly related or linked dependent variable is indicated by the effect size (F^2). It displays the extent to which each exogenous variable affects an endogenous construct. It also shows how a predictive variable in the model was directly eliminated, resulting in a discrepancy in the R^2 value. As a result, the significance of each variable in the model is measured using the effect size (F^2). Therefore, it can be concluded that a predicting variable's significant association with the endogenous construct increases with its effect size in the model. Furthermore, effect size values (F^2) of 0.154, 0.174, and 0.022 are recommended by Cohen (1988) as small, moderate, and large effect sizes, respectively. Any predictive construct is deemed to not affect the associated endogenous construct in the model if its effect size (F^2) value is less than 0.02. The outcome shown in Table 3. shows the degree of effect size (F^2) for each direct effect between the model's constructs. The results indicate that the ChatGPT has an effect size of $F^2 = 0.174$ (CG) AI Nova (AIN) has an effect size value of $F^2 = 0.154$, and DeepSeek (DSK) has an effect size value of $F^2 = 0.022$ have a slight effect on academic performance.

Table 3. Effect Size (F^2)

Constructs	ACP	Effect size
ChatGPT → ACP	0.174	Medium Effect
AI Nova → ACP	0.154	Medium Effect
DeepSeek → ACP	0.022	Small Effect

Table 4. Important performance map analysis (IPMA)

Constructs	Importance	Performance
ChatGPT → ACP	0.347	82
AI Nova → ACP	0.345	86
DeepSeek → ACP	0.129	77

Table 4 shows the axes plotting, which denotes the importance of different characteristics or factors and their importance; the table shows that CG and AIN have high importance and high performance, while DSK has high performance and low importance.

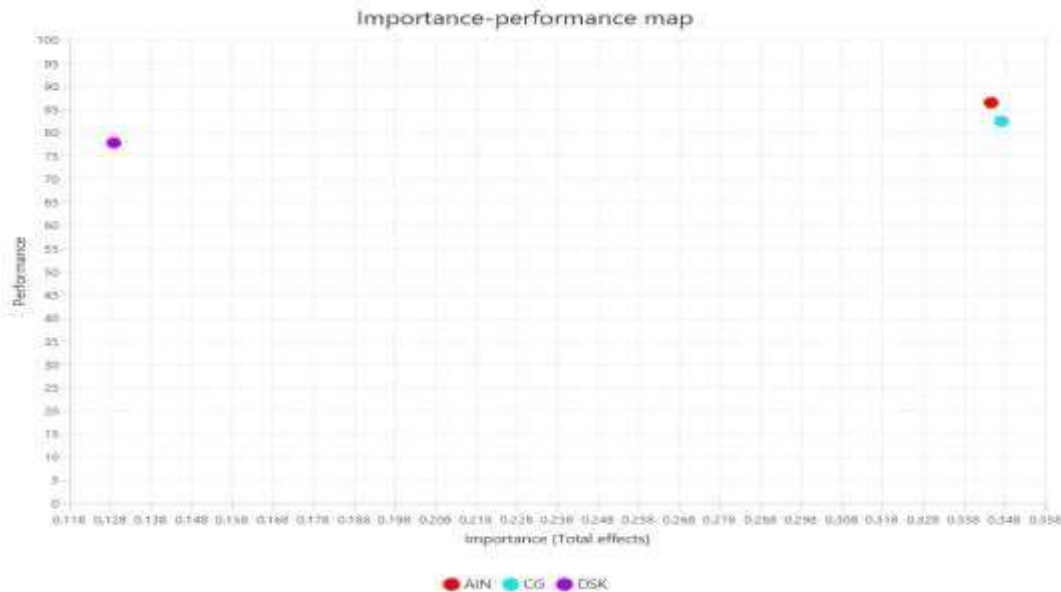


Fig. 2. Importance Performance

7. Results and Discussion

The structural model was evaluated to examine the effect of ChatGPT, AI Nova, and DeepSeek on students' academic performance in tertiary institutions. Figure 1 presents the path coefficients and factor loadings; Figure 2 represents the importance-performance analysis, while Table 3 indicates the f^2 effect size. The path coefficients assess the structural model's effects between the endogenous latent construct (ACP) and the exogenous latent constructs (CG, AIN, DSK). The degree and implications of the assessments show the strength of the effect. A significant and positive effect is shown in the path coefficients that are close to +1, and strong negative relations are typically shown by path coefficients that go toward -1. (Hair et al., 2014). Using the critical t-value for significance testing at the 5% level of significance, the bootstrapping procedure in the Smart PLS SEM program determines the significance of the path coefficients. The path coefficients were shown in Table 2 together with their corresponding t-values and p-values. As revealed in Table 2, all the paths indicated a positive effect on ACP. The value of $R^2 = 0.386$. It was discovered that the IVs may account for 39% of the difference in the students' ACP. Then other variables outside the scope of this study account for the remaining 61% of the variance. The path coefficient, as offered in Table 2, shows that the coefficient value for ChatGPT → ACP ChatGPT on Academic Performance (CG) (H1) is ($t=4.924$, $p<.0.000$), indicating that students have relevant knowledge on AI, which has a

significant effect on their Academic Performance. The coefficient value of AI Nova on Academic Performance (AIN) on Academic Performance (H2) is ($t=5.970$, $p<0.000$), which signifies that AIN has a positive effect on ACP; likewise, the coefficient value of DeepSeek on Academic Performance (H3) is ($t=2.075$, $p<0.038$), which shows a significant effect on ACP. Generally, the results support that generative AI tools serve best as accompaniments to instruction. The findings line up with the Technology Acceptance Model, where perceived usefulness drives academic performance.

8. Importance-Performance Map Analysis (IPMA)

To provide managerial insights, IPMA was conducted with Academic Performance as the target construct. IPMA assesses both the importance total effect and performance average latent variable score of each predictor. Figure 2 shows the IPMA results. AI Nova and ChatGPT are indicated in the high importance-high performance quadrant. AI Nova had the highest importance (0.347) and performance ~ 87 , followed closely by ChatGPT with importance (0.345) and performance (83). DeepSeek falls in the low importance-moderate performance quadrant with importance (0.129) and performance (78). This implies that AI Nova and ChatGPT are the main predictors of academic performance and are already being applied efficiently by students. Consequently, they signify the polytechnic's significant strengths. DeepSeek, while performing sufficiently, contributes less to overall academic outcomes at present.

9. Overall Contribution and Implications

When combined, ChatGPT, AI Nova, and DeepSeek account for 38.6% of the variation in academic performance. This lends credence to the more general claim that AI works best when combined with education rather than in place of it. The results also support studies that demonstrate how instructor support and self-efficacy mediate the relationship between AI use and achievement.

Theoretical Implication: The results support the Technology Acceptance Model — perceived practicality and consistency of AI tools improve academic performance.

Practical Implication: To avoid "never skilling" or "cognitive surrender," tertiary institutions should provide AI literacy education that teaches ethical, reflective, and Socratic use of AI tools. DeepSeek should be used for technical and research tasks, whereas ChatGPT and AI Nova should be promoted for general learning support.

This study focuses on self-reported use and performance. Future research should combine with actual GPA data and look into moderators such as digital literacy, discipline, and instructor

guidance. More research is also needed on AI Nova specifically, as academic literature on it is sparse when compared to ChatGPT and DeepSeek.

In conclusion, the results show that generative AI tools have a positive impact on academic performance; the strength of the effect varies depending on the tool. While DeepSeek shows promise but needs more integration and familiarity, ChatGPT and AI Nova are currently the most influential for general academic work.

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