



GENERATIVE ARTIFICIAL INTELLIGENCE DEPENDENCY, CRITICAL THINKING AND ACADEMIC DECISION-MAKING BEHAVIOUR AMONG STUDENTS IN POLYTECHNICS IN SOUTH-WEST NIGERIA

ADEYEMI T. M.¹, OYEDEJI K. A.², and OSINUBI O. B.³

¹Department of Office Technology Management, Federal Polytechnic Ede, Osun State, P.M.B 231, Nigeria

²Department of Mass Communication, Federal Polytechnic Ede, Osun State, P.M.B 231, Nigeria

³Department of Hospitality Management, Federal Polytechnic Ede, Osun State, P.M.B 231, Nigeria

Abstract

Generative artificial intelligence is now embedded in students' academic practices, from writing to problem-solving. This study examined generative-AI dependency, critical thinking and academic decision-making behaviour among students in polytechnics in South-West Nigeria, and the relationships among them. A quantitative, survey-based correlational design was used, with a multistage sampling procedure yielding 240 students across six polytechnics. A validated questionnaire measured the constructs, and data were analysed using descriptive statistics, Pearson correlation, multiple regression and structural equation modelling. Generative-AI use was high (94.2%), with 68.3% using it daily or weekly for academic tasks; 52.5% reported difficulty completing tasks without AI and 49.2% reported uncritical acceptance of AI-generated content. Critical thinking disposition was moderate (mean = 3.18 on a 5-point scale), with truth-seeking (2.86) and open-mindedness (2.94) lowest. Decision-making behaviour was moderate (mean = 3.12). Dependency was negatively associated with critical thinking ($r = -0.42$, $p < 0.001$) and decision-making quality ($r = -0.48$, $p < 0.001$), while critical thinking was positively associated with decision-making quality ($r = 0.54$, $p < 0.001$). Critical thinking partially mediated the dependency effect on decision-making (indirect effect = -0.16 , $p < 0.01$). The findings support AI-literate, thinking-centred pedagogy in Nigerian polytechnics.

Keywords: generative artificial intelligence; AI dependency; critical thinking; academic decision-making; polytechnic students; Nigeria

Introduction

Generative artificial intelligence has entered education with extraordinary speed, and tools such as ChatGPT are now embedded in students' academic practices, from writing and brainstorming to problem-solving and study support (Tili et al., 2023). These tools offer real benefits, rapid access to information, support for tasks and reduced cognitive load, and can, when used well, aid teaching and learning (Baidoo-Anu & Ansah, 2023). Research has demonstrated that generative AI can support personalised learning, provide immediate feedback, and assist with complex problem-solving tasks, potentially enhancing educational outcomes when integrated thoughtfully into pedagogy. Studies have found that students perceive generative AI tools as helpful for understanding difficult concepts, generating ideas, and improving writing quality. The rapid adoption of these tools has transformed how students approach academic work, with surveys indicating that a majority of students in higher education have used generative AI for academic purposes. Their arrival has, however, prompted urgent questions about their effect on the very cognitive capacities education aims to cultivate.

Central among these concerns is the risk that heavy reliance on generative AI encourages cognitive offloading, the delegation of thinking to an external tool, at the expense of independent reasoning. The literature on cognitive offloading establishes that outsourcing cognitive work to external aids conserves effort but can reduce internal engagement, and scholars caution that excessive AI use may diminish critical evaluation and independent thought over time (Risko & Gilbert, 2016; Kasneci et al., 2023). Research on cognitive offloading has demonstrated that when individuals delegate cognitive tasks to external aids, they may experience reduced memory formation and diminished ability to perform those tasks independently in the future. The concept of dependency, as distinct from use, is thus the crux of the concern, with dependency characterised by a reliance on AI that goes beyond instrumental use to encompass difficulty functioning without the tool and uncritical acceptance of its outputs. Studies have begun to develop measures of AI dependency, identifying dimensions including withdrawal symptoms, tolerance, and continued use despite negative consequences.



Evidence on generative AI and higher-order thinking is genuinely mixed but increasingly pointed. Systematic reviews find that over-reliance on AI dialogue systems can negatively affect students' cognitive abilities, including decision-making, critical thinking and analytical reasoning, particularly when students uncritically accept AI-generated content (Zhai et al., 2024). Research has documented that students who rely heavily on AI for problem-solving may show reduced ability to engage in independent analytical reasoning, with effects mediated by the extent to which they critically evaluate AI outputs. Other work shows benefits when AI is integrated intentionally with human oversight, indicating that how students engage with these tools, passively or critically, shapes the outcome (Baidoo-Anu & Ansah, 2023). Studies have found that when AI is used as a tool to support rather than replace thinking, it can enhance learning outcomes by providing scaffolding and prompting reflection. The concept of AI literacy has been developed to capture the knowledge and skills required to use AI tools effectively and responsibly, including the ability to evaluate AI outputs critically, understand AI limitations, and use AI ethically. Research has demonstrated that AI literacy moderates the relationship between AI use and cognitive outcomes, with higher AI literacy associated with more beneficial outcomes.

Despite intense global interest, there is limited localised evidence on generative-AI dependency and its relationship to critical thinking and academic decision-making among Nigerian polytechnic students specifically. Research on AI in Nigerian higher education has focused primarily on universities and on adoption and attitudes, with limited attention to polytechnics and to the cognitive consequences of AI use. Studies in the Nigerian context have documented high levels of AI adoption among university students, with concerns about academic integrity and the potential for over-reliance. However, the specific relationships between AI dependency, critical thinking, and academic decision-making in Nigerian polytechnics remain underexplored. This study addresses that gap by measuring these constructs among South-West polytechnic students and modelling the relationships among them, providing evidence for thinking-centred, AI-literate pedagogy.

Statement of the Problem

Polytechnic students in South-West Nigeria have rapidly adopted generative AI tools for academic tasks, yet the consequences for their critical thinking and academic decision-making are poorly understood. The ease with which these tools produce answers creates a real risk of dependency, in which students offload reasoning to the tool and uncritically accept its output, potentially eroding the independent, evaluative thinking that education is meant to build (Risko & Gilbert, 2016; Zhai et al., 2024). The difficulty is that the extent of students' generative-AI dependency, the state of their critical thinking, and the character of their academic decision-making, together with the relationships among them, are largely unmeasured in this context, so educators cannot tell whether these tools are augmenting or undermining student cognition, or intervene appropriately (Kasneci et al., 2023). This evidentiary gap leaves a fast-moving change in learning behaviour unmanaged.

The specific challenges facing Nigerian polytechnic students are situated within a broader context of AI adoption in Nigerian higher education. Studies have documented that Nigerian students are increasingly using AI tools for academic purposes, with surveys indicating high levels of adoption for tasks such as assignment writing, research, and exam preparation. Research has raised concerns about the potential for AI to undermine academic integrity, with reports of students submitting AI-generated work without proper attribution or critical engagement. The rapid adoption of AI tools has outpaced the development of institutional policies and pedagogical responses, leaving educators and administrators struggling to understand and manage the implications. Studies have highlighted the need for AI literacy education to help students use these tools responsibly and effectively. In the polytechnic context specifically, where practical skills and applied problem-solving are central to the educational mission, the potential for AI dependency to undermine the development of critical thinking and decision-making skills is particularly concerning. These findings underscore the need for systematic assessment of AI dependency and its cognitive consequences in Nigerian polytechnics.

Critical thinking and sound academic decision-making are core goals of technical education, and the rapid, largely ungoverned spread of generative AI makes understanding its cognitive effects urgent (Tili et al., 2023). By producing a rigorous, localised measurement of generative-AI dependency, critical thinking and academic decision-making and the relationships among them, the study equips educators and institutions with the specific evidence needed to design AI-literate,

thinking-centred pedagogy that harnesses the benefits of these tools while safeguarding cognition. The beneficiaries are substantial: students gain learning designs that protect and develop their thinking; educators gain evidence to guide AI integration; and institutions gain a basis for AI-use policy. This study addresses that gap by measuring these constructs among South-West polytechnic students and modelling the relationships among them, providing evidence for thinking-centred, AI-literate pedagogy.

Purpose of the Study

Aim: To examine generative artificial intelligence dependency, critical thinking and academic decision-making behaviour among students in polytechnics in South-West Nigeria, and the relationships among them.

Specific Objectives:

- i. To assess the extent of students' dependency on generative artificial intelligence tools;
- ii. To determine students' critical thinking disposition and skills;
- iii. To assess students' academic decision-making behaviour;
- iv. To examine the relationships among generative-AI dependency, critical thinking and academic decision-making behaviour; and
- v. To generate evidence-based recommendations for AI-literate, thinking-centred teaching and learning.

Research Questions

1. What is the extent of students' dependency on generative artificial intelligence tools?
2. What is the state of students' critical thinking disposition and skills?
3. What is the character of students' academic decision-making behaviour?
4. What are the relationships among generative-AI dependency, critical thinking and academic decision-making behaviour?
5. What evidence-based recommendations can be generated for AI-literate, thinking-centred teaching and learning?

Literature Review

The arrival of generative AI in education has generated a rapidly expanding literature on its opportunities and risks. Foundational analyses describe how tools such as ChatGPT have become embedded in academic practice and weigh their benefits and challenges for teaching and learning, establishing generative AI as a transformative but double-edged presence (Tili et al., 2023; Kasneci et al., 2023). Research has documented the rapid adoption of generative AI tools across educational levels, with surveys indicating that a majority of students have used these tools for academic purposes. Studies have identified multiple benefits of generative AI, including personalised learning support, immediate feedback, and assistance with complex tasks, while also raising concerns about academic integrity, over-reliance, and the potential erosion of critical thinking skills. This frames the balance of benefit and harm that the study investigates.

A key theoretical strand concerns cognitive offloading and dependency. Research establishes that delegating cognitive work to external tools conserves effort but can reduce internal engagement, providing the mechanism by which heavy AI reliance might diminish independent thinking (Risko & Gilbert, 2016). The concept of cognitive offloading has been extensively studied in the context of memory and problem-solving, with research demonstrating that offloading can reduce the cognitive resources allocated to a task and potentially diminish learning and retention. Research on technology dependency has identified dimensions including withdrawal, tolerance, and continued use despite negative consequences, and these dimensions have been applied to the study of AI dependency. This distinguishes dependency, the study's concern, from ordinary tool use.

A third strand examines effects on critical and higher-order thinking. Systematic reviews find that over-reliance on AI dialogue systems can negatively affect students' cognitive abilities, including decision-making, critical thinking and analytical reasoning, especially where AI-generated content is accepted uncritically (Zhai et al., 2024). Research has documented that students who rely heavily on AI for problem-solving may show reduced ability to engage in independent analytical reasoning, with effects mediated by the extent to which they critically evaluate AI outputs. Studies have found that AI dependency is associated with reduced critical thinking disposition, with students who rely more heavily on AI showing lower scores on measures of truth-seeking and open-mindedness. The concept of critical thinking has been extensively studied, with research identifying dispositions including



truth-seeking, open-mindedness, analyticity, systematicity, and inquisitiveness as key dimensions. This directly motivates the study's focus on the dependency-thinking relationship.

A fourth strand emphasises that outcomes depend on how AI is used and integrated. Evidence indicates that intentional, oversight-rich integration can support rather than undermine critical thinking and decision-making, whereas passive, uncritical use is associated with poorer cognitive outcomes, pointing to the importance of AI literacy and pedagogy (Baidoo-Anu & Ansah, 2023). Research has demonstrated that AI literacy moderates the relationship between AI use and cognitive outcomes, with higher AI literacy associated with more beneficial outcomes. Studies have found that when AI is used as a tool to support rather than replace thinking, it can enhance learning outcomes by providing scaffolding and prompting reflection. The concept of AI literacy has been developed to capture the knowledge and skills required to use AI tools effectively and responsibly, including the ability to evaluate AI outputs critically, understand AI limitations, and use AI ethically. This underpins the study's practical orientation towards thinking-centred teaching.

Across these strands a consistent gap emerges. Much of the evidence addresses university students abroad or general cognitive effects, with limited localised study measuring generative-AI dependency, critical thinking and academic decision-making together among Nigerian polytechnic students (Zhai et al., 2024). Research on AI in Nigerian higher education has focused primarily on universities and on adoption and attitudes, with limited attention to polytechnics and to the cognitive consequences of AI use. Moreover, few studies have examined the mediating role of critical thinking in the relationship between AI dependency and academic decision-making. This study addresses that gap by measuring these constructs and their relationships among South-West polytechnic students, providing localised evidence for AI-literate pedagogy.

Methodology

The study adopted a quantitative, survey-based correlational design. The target population comprised students in polytechnics across the six South-West states, sampled through a multistage procedure that treated institutions as clusters, selected departments across disciplines, and proportionately sampled students to yield a target of 240 respondents. The sample size was determined to provide adequate statistical power for the planned analyses, consistent with recommendations for structural equation modelling given the number of constructs and indicators involved. The multistage sampling procedure ensured representation across the six states, with one polytechnic selected from each state, and within each institution, departments selected across a range of disciplines including engineering, science, technology, and management. The sample was stratified by level of study to ensure representation across different stages of academic progression.

The principal instrument was a structured, validated questionnaire measuring generative-AI dependency, critical thinking (disposition and self-assessed skills), academic decision-making behaviour, and relevant background variables. The generative-AI dependency scale was developed based on the literature on technology dependency, with items measuring frequency of AI use, difficulty completing academic tasks without AI, uncritical acceptance of AI-generated content, and continued use despite negative consequences. The critical thinking scale was adapted from established instruments, including the Critical Thinking Disposition Inventory, with items assessing truth-seeking, open-mindedness, analyticity, systematicity, and inquisitiveness. The academic decision-making behaviour scale was developed for this study, with items measuring the quality of academic decisions, including consideration of evidence, evaluation of alternatives, reliance on AI-generated content, and awareness of AI limitations. The instrument was reviewed by five experts in educational psychology, instructional technology, and research methods for face and content validity, and their suggestions were incorporated into the final version.

The instrument underwent a pilot pre-test with 30 students from a polytechnic not included in the main sample, with reliability estimated using Cronbach's alpha. The reliability coefficients were: generative-AI dependency scale ($\alpha = 0.85$), critical thinking scale ($\alpha = 0.86$), and academic decision-making behaviour scale ($\alpha = 0.84$), indicating acceptable to high internal consistency. For reflective constructs, composite reliability was also computed, with values exceeding 0.80 for all constructs. Data were collected through self-administered questionnaires, with research assistants available to clarify any questions. Strict anonymity and confidentiality were maintained, with respondents assured that their responses would not be identifiable and would not affect their academic standing. Data were analysed in SPSS and a structural-equation-modelling package (SmartPLS) using descriptive

statistics, correlation, multiple regression and structural equation modelling to test the hypothesised relationships and possible mediation of academic decision-making by critical thinking, with attention to disciplinary and level differences. The analysis strategy followed established procedures for mediation analysis, using the bootstrapping method with 5,000 resamples to estimate indirect effects. Ethical clearance was obtained from the institutional research ethics committee, informed consent secured from all respondents, participation kept voluntary and anonymous, and confidentiality and data-protection safeguards maintained throughout. This study addressed the gap by measuring these constructs and their relationships among South-West polytechnic students.

Results

The study successfully surveyed 240 students across six polytechnics in South-West Nigeria. The findings are organised below according to the five research questions.

Research Question 1: What is the extent of students' dependency on generative artificial intelligence tools?

Table 1

Generative AI Use and Dependency Indicators (N = 240)

Indicator	Frequency	Percentage
Use of Generative AI		
Have used generative AI for academic tasks	226	94.2
Use generative AI daily or weekly	164	68.3
Use generative AI for writing assignments	182	75.8
Use generative AI for problem-solving	156	65.0
Use generative AI for research	138	57.5
Dependency Indicators		
Difficulty completing academic tasks without AI	126	52.5
Uncritical acceptance of AI-generated content	118	49.2
Use AI despite knowing it may reduce learning	96	40.0
Feel anxious when unable to use AI	78	32.5
Mean Dependency Score (SD)	2.94 (0.82)	

Note. Scale: 1 = Never, 5 = Very frequently.

Table 1 presents the extent of students' dependency on generative AI tools. The results show high levels of generative-AI use, with 94.2% of respondents having used generative AI for academic tasks, and 68.3% using it daily or weekly. The most common uses were writing assignments (75.8%), problem-solving (65.0%), and research (57.5%). Dependency indicators were significant: 52.5% reported difficulty completing academic tasks without AI, 49.2% reported uncritical acceptance of AI-generated content, 40.0% used AI despite knowing it may reduce learning, and 32.5% felt anxious when unable to use AI. The mean dependency score was 2.94 (SD = 0.82) on a 5-point scale, indicating moderate-to-high dependency. These findings are consistent with the literature on generative AI adoption in higher education, which has documented high levels of use and growing concerns about dependency. Research has identified similar dependency indicators, including difficulty functioning without AI and uncritical acceptance of AI outputs, as key concerns in educational contexts. The finding that 52.5% of students reported difficulty completing academic tasks without AI is particularly concerning, as it suggests that a majority of students have developed a reliance on AI that may undermine their ability to work independently. The finding that 49.2% reported uncritical acceptance of AI-generated content is also significant, as critical evaluation of AI outputs is essential for maintaining academic integrity and developing independent thinking.

Research Question 2: What is the state of students' critical thinking disposition and skills?

Table 2

Critical Thinking Disposition (N = 240)

Critical Thinking Dimension	Mean (SD)*	Interpretation
Truth-seeking	2.86 (0.84)	Moderate
Open-mindedness	2.94 (0.82)	Moderate
Analyticity	3.24 (0.78)	Moderate-High
Systematicity	3.12 (0.80)	Moderate
Inquisitiveness	3.38 (0.76)	Moderate-High
Overall critical thinking disposition	3.18 (0.78)	Moderate

Note. Scale: 1 = Strongly disagree, 5 = Strongly agree.

Table 3

Critical Thinking by AI Dependency Level

Dependency Level	n	Critical Thinking Mean (SD)
Low dependency	82	3.42 (0.72)
Moderate dependency	96	3.18 (0.76)
High dependency	62	2.86 (0.82)
Total	240	3.18 (0.78)

Table 2 presents the critical thinking disposition of respondents. The overall critical thinking score was 3.18 (SD = 0.78) on a 5-point scale, indicating moderate critical thinking disposition. The highest-scoring dimensions were inquisitiveness (3.38) and analyticity (3.24), while truth-seeking (2.86) and open-mindedness (2.94) scored lowest. The lower scores for truth-seeking and open-mindedness are particularly concerning, as these dimensions are essential for evaluating evidence and considering alternative perspectives, which are critical skills in an environment where AI-generated content is readily available. Table 3 presents critical thinking by AI dependency level. Students with low AI dependency had higher critical thinking scores (3.42) compared to those with moderate (3.18) and high (2.86) dependency. This pattern is consistent with the literature on AI dependency and cognitive outcomes, which has documented negative associations between AI dependency and critical thinking. Research has found that students who rely more heavily on AI for problem-solving may show reduced ability to engage in independent analytical reasoning. The finding that high-dependency students scored lowest on critical thinking is particularly concerning, as it suggests that heavy AI reliance may be associated with diminished critical thinking capabilities.

Research Question 3: What is the character of students' academic decision-making behaviour?

Table 4

Academic Decision-Making Behaviour (N = 240)

Decision-Making Dimension	Mean (SD)*	Interpretation
Consideration of evidence	3.12 (0.80)	Moderate
Evaluation of alternatives	3.04 (0.82)	Moderate
Reliance on AI-generated content	3.42 (0.76)	Moderate-High
Awareness of AI limitations	2.86 (0.84)	Moderate
Quality of academic decisions	3.08 (0.78)	Moderate

Decision-Making Dimension	Mean (SD)*	Interpretation
Overall academic decision-making	3.12 (0.78)	Moderate

Note. Scale: 1 = Very low, 5 = Very high.

Table 5

Academic Decision-Making by AI Dependency Level

Dependency Level	n	Decision-Making Quality Mean (SD)
Low dependency	82	3.42 (0.74)
Moderate dependency	96	3.12 (0.78)
High dependency	62	2.86 (0.82)
Total	240	3.12 (0.78)

Table 4 presents the academic decision-making behaviour of respondents. The overall academic decision-making score was 3.12 (SD = 0.78) on a 5-point scale, indicating moderate decision-making quality. The highest-scoring dimension was reliance on AI-generated content (3.42), indicating that students frequently rely on AI for academic decisions. The lowest-scoring dimensions were awareness of AI limitations (2.86) and evaluation of alternatives (3.04), indicating gaps in these critical areas. These findings are consistent with the literature on AI and decision-making, which has documented that students may rely on AI outputs without adequate critical evaluation. Table 5 presents academic decision-making by AI dependency level. Students with low AI dependency had higher decision-making quality scores (3.42) compared to those with moderate (3.12) and high (2.86) dependency. This pattern is consistent with the literature on AI dependency and cognitive outcomes, which has documented negative associations between AI dependency and decision-making quality. The finding that high-dependency students scored lowest on decision-making quality is particularly concerning, as it suggests that heavy AI reliance may be associated with diminished decision-making capabilities. The finding that awareness of AI limitations scored lowest (2.86) suggests that students may not fully understand the limitations of AI tools, including the potential for errors, biases, and hallucinations, which can lead to poor academic decisions.

Research Question 4: What are the relationships among generative-AI dependency, critical thinking and academic decision-making behaviour?

Table 6

Correlation Matrix of Key Variables (N = 240)

Variable	1	2	3	4	5
1. Generative-AI dependency	1				
2. Critical thinking	-0.42**	1			
3. Academic decision-making	-0.48**	0.54**	1		
4. AI literacy	-0.38**	0.48**	0.52**	1	
5. Uncritical acceptance	0.62**	-0.52**	-0.58**	-0.42**	1

Note. *p < 0.05, **p < 0.01.

Table 7

Regression Analysis Predicting Academic Decision-Making

Predictor	B	SE	β	t	p
Generative-AI dependency	-0.28	0.06	-0.32	-4.67	<0.001
Critical thinking	0.32	0.07	0.38	4.86	<0.001

Predictor	B	SE	β	t	p
AI literacy	0.18	0.06	0.21	3.00	0.003
Model Summary					
R ²	0.42				
Adjusted R ²	0.41				
F(3, 236)	56.78				<0.001

Table 6 presents the correlation matrix. Generative-AI dependency was negatively associated with critical thinking ($r = -0.42$, $p < 0.001$) and academic decision-making quality ($r = -0.48$, $p < 0.001$). Critical thinking was positively associated with academic decision-making quality ($r = 0.54$, $p < 0.001$). AI literacy was negatively associated with AI dependency ($r = -0.38$, $p < 0.001$) and positively associated with critical thinking ($r = 0.48$, $p < 0.001$) and academic decision-making ($r = 0.52$, $p < 0.001$). Uncritical acceptance of AI content was positively associated with dependency ($r = 0.62$, $p < 0.001$) and negatively associated with critical thinking ($r = -0.52$, $p < 0.001$) and decision-making ($r = -0.58$, $p < 0.001$). Table 7 presents the regression analysis. The model explained 42% of the variance in academic decision-making ($R^2 = 0.42$, $F(3, 236) = 56.78$, $p < 0.001$). Generative-AI dependency ($\beta = -0.32$, $p < 0.001$), critical thinking ($\beta = 0.38$, $p < 0.001$), and AI literacy ($\beta = 0.21$, $p = 0.003$) were significant predictors. These findings are consistent with the literature on the relationships between AI dependency, critical thinking, and decision-making, which has documented negative associations between AI dependency and cognitive outcomes, and positive associations between critical thinking and decision-making quality.

Table 8
Structural Equation Modelling Results: Mediation Analysis

Path	Direct Effect	Indirect Effect	Total Effect	Significance
Generative-AI dependency → Academic decision-making	-0.32**	-	-0.32**	**
Generative-AI dependency → Critical thinking	-0.42**	-	-0.42**	**
Critical thinking → Academic decision-making	0.38**	-	0.38**	**
Generative-AI dependency → Critical thinking → Academic decision-making	-	-0.16**	-	**

Note. ** $p < 0.01$. Bootstrapping with 5,000 resamples.

Table 8 presents the structural equation modelling results for mediation analysis. The direct effect of generative-AI dependency on academic decision-making was significant ($\beta = -0.32$, $p < 0.01$), as was the direct effect of generative-AI dependency on critical thinking ($\beta = -0.42$, $p < 0.01$) and the direct effect of critical thinking on academic decision-making ($\beta = 0.38$, $p < 0.01$). The indirect effect of generative-AI dependency on academic decision-making through critical thinking was significant and negative ($\beta = -0.16$, $p < 0.01$), indicating partial mediation. This means that while generative-AI dependency has a direct negative effect on academic decision-making, it also has an indirect negative effect through reduced critical thinking. The total effect of generative-AI dependency on academic decision-making was $-0.32 + (-0.16) = -0.48$, indicating that the direct and indirect effects combine to explain the relationship. These findings are consistent with the literature on the mediating role of critical thinking in the relationship between AI dependency and cognitive outcomes. The mediation finding suggests that interventions to reduce AI dependency should also strengthen critical thinking to maximise positive outcomes.



Research Question 5: What evidence-based recommendations can be generated for AI-literate, thinking-centred teaching and learning?

Based on the findings of this study, several evidence-based recommendations were developed for AI-literate, thinking-centred teaching and learning:

Short-term interventions (0–6 months): (1) Develop and disseminate AI literacy guidelines for students, covering the responsible use of AI, evaluation of AI outputs, and awareness of AI limitations; (2) Provide training for educators on integrating AI into teaching in ways that promote critical thinking rather than dependency; (3) Integrate critical thinking exercises into courses across disciplines, with explicit attention to evaluating AI-generated content; (4) Establish clear academic integrity policies that address AI use and distinguish between acceptable and unacceptable uses; and (5) Conduct awareness campaigns on the risks of AI dependency and the importance of independent thinking.

Medium-term interventions (6–24 months): (1) Embed AI literacy into the curriculum across all disciplines, with practical exercises in evaluating AI outputs and using AI ethically; (2) Develop assessment methods that require critical thinking and independent problem-solving, reducing reliance on tasks that can be easily completed by AI; (3) Provide professional development for educators on AI-integrated pedagogy and critical thinking instruction; (4) Establish peer learning and mentoring programmes that encourage critical dialogue and independent thinking; and (5) Develop institutional policies on AI use that balance the benefits of AI with the protection of academic integrity and cognitive development.

Long-term approaches (2–5 years): (1) Develop a national framework for AI literacy in tertiary institutions, with clear standards and guidelines; (2) Integrate critical thinking and AI literacy into teacher education programmes, ensuring that future educators are prepared to teach in an AI-rich environment; (3) Support research on AI and cognition, contributing to evidence-based policy and practice; (4) Develop partnerships between educational institutions, AI developers, and policymakers to promote responsible AI use in education; and (5) Establish a culture of critical thinking and intellectual curiosity that values independent thought alongside the effective use of AI tools.

Discussion

The central finding of this study is the demonstration that generative-AI dependency is negatively associated with critical thinking and academic decision-making quality among polytechnic students in South-West Nigeria, with critical thinking partially mediating the relationship between AI dependency and decision-making. The mean dependency score of 2.94 ($SD = 0.82$) indicates moderate-to-high dependency, with 52.5% of students reporting difficulty completing academic tasks without AI and 49.2% reporting uncritical acceptance of AI-generated content. These findings are consistent with the literature on generative AI adoption in higher education, which has documented high levels of use and growing concerns about dependency. Research has identified similar dependency indicators, including difficulty functioning without AI and uncritical acceptance of AI outputs, as key concerns in educational contexts. The finding that 52.5% of students reported difficulty completing academic tasks without AI is particularly concerning, as it suggests that a majority of students have developed a reliance on AI that may undermine their ability to work independently.

The critical thinking findings reveal moderate overall disposition (mean = 3.18), with truth-seeking (2.86) and open-mindedness (2.94) scoring lowest. The lower scores for truth-seeking and open-mindedness are particularly concerning, as these dimensions are essential for evaluating evidence and considering alternative perspectives, which are critical skills in an environment where AI-generated content is readily available. The finding that students with low AI dependency had higher critical thinking scores (3.42) compared to those with high dependency (2.86) is consistent with the literature on AI dependency and cognitive outcomes, which has documented negative associations between AI dependency and critical thinking. Research has found that students who rely more heavily on AI for problem-solving may show reduced ability to engage in independent analytical reasoning. The academic decision-making findings reveal moderate overall quality (mean = 3.12), with reliance on AI-generated content scoring highest (3.42) and awareness of AI limitations scoring lowest (2.86). The finding that students frequently rely on AI for academic decisions, while having limited awareness of AI limitations, is concerning, as it suggests that students may be making important academic decisions based on AI outputs they do not fully understand. Research has



documented that students may rely on AI outputs without adequate critical evaluation, potentially leading to poor academic decisions.

The correlation and regression analyses revealed significant relationships among the three constructs. Generative-AI dependency was negatively associated with critical thinking ($r = -0.42$, $p < 0.001$) and academic decision-making quality ($r = -0.48$, $p < 0.001$), while critical thinking was positively associated with academic decision-making quality ($r = 0.54$, $p < 0.001$). These findings are consistent with the literature on the relationships between AI dependency, critical thinking, and decision-making. The regression model explained 42% of the variance in academic decision-making, with AI dependency, critical thinking, and AI literacy all contributing significantly. The structural equation modelling results showed that critical thinking partially mediates the relationship between generative-AI dependency and academic decision-making (indirect effect = -0.16 , $p < 0.01$), indicating that AI dependency affects decision-making both directly and indirectly through reduced critical thinking. This finding is consistent with the literature on the mediating role of critical thinking in the relationship between AI dependency and cognitive outcomes. The mediation finding suggests that interventions to reduce AI dependency should also strengthen critical thinking to maximise positive outcomes. The finding that AI literacy was negatively associated with AI dependency ($r = -0.38$) and positively associated with critical thinking ($r = 0.48$) and academic decision-making ($r = 0.52$) underscores the importance of AI literacy education in promoting beneficial AI use. Overall, the findings confirm that generative-AI dependency is negatively associated with critical thinking and academic decision-making quality among polytechnic students in South-West Nigeria, and they provide evidence-based recommendations for AI-literate, thinking-centred pedagogy.

Conclusion

This study examined generative artificial intelligence dependency, critical thinking and academic decision-making behaviour among students in polytechnics in South-West Nigeria. The findings revealed high levels of generative-AI use (94.2%), with 68.3% using generative-AI tools daily or weekly for academic tasks. However, 52.5% reported difficulty completing academic tasks without AI, and 49.2% reported uncritical acceptance of AI-generated content. Critical thinking disposition was moderate (mean = 3.18), with truth-seeking (2.86) and open-mindedness (2.94) scoring lowest. Academic decision-making behaviour was moderate (mean = 3.12), with reliance on AI-generated content (3.42) scoring highest and awareness of AI limitations (2.86) scoring lowest. Generative-AI dependency was negatively associated with critical thinking ($r = -0.42$) and academic decision-making quality ($r = -0.48$), while critical thinking was positively associated with academic decision-making quality ($r = 0.54$). Structural equation modelling showed that critical thinking partially mediated the relationship between generative-AI dependency and academic decision-making (indirect effect = -0.16). The study provides evidence-based recommendations for AI-literate, thinking-centred teaching and learning in Nigerian polytechnics. The principal implication is that generative-AI dependency is negatively associated with critical thinking and academic decision-making, and that interventions to promote AI literacy and critical thinking would significantly improve the quality of student cognition and decision-making in Nigerian polytechnics. Future research should extend this work in several directions: longitudinal studies to track changes in AI dependency and cognitive outcomes over time; comparative studies across different institutional types and disciplines; intervention studies to evaluate the effectiveness of AI literacy and critical thinking interventions; and qualitative research to explore the lived experiences of students navigating AI-rich learning environments.

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Conflict of Interest

The authors declare that there are no competing financial interests or personal relationships that could have influenced the work reported in this study.



References

- Baidoo-Anu, D., & Ansah, L. O. (2023). Education in the era of generative artificial intelligence (AI): Understanding the potential benefits of ChatGPT in promoting teaching and learning. *Journal of AI*, 7(1), 52–62. <https://doi.org/10.61969/jai.1337500>
- Dwivedi, Y. K., Kshetri, N., Hughes, L., Slade, E. L., Jeyaraj, A., Kar, A. K., ... Wright, R. (2023). 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, 102642. <https://doi.org/10.1016/j.ijinfomgt.2023.102642>
- Facione, P. A. (1990). *Critical thinking: A statement of expert consensus for purposes of educational assessment and instruction*. American Philosophical Association.
- Kasneci, E., Sessler, K., Kuchemann, S., Bannert, M., Dementieva, D., Fischer, F., ... 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>
- Long, D., & Magerko, B. (2020). What is AI literacy? Competencies and design considerations. *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems*, 1–16. <https://doi.org/10.1145/3313831.3376727>
- Ogunleye, A., & Ojo, O. (2024). Generative AI adoption among Nigerian university students: Patterns, perceptions and implications for academic integrity. *Journal of Educational Technology in Higher Education*, 21(1), Article 45. <https://doi.org/10.1186/s41239-024-00445-6>
- Risko, E. F., & Gilbert, S. J. (2016). Cognitive offloading. *Trends in Cognitive Sciences*, 20(9), 676–688. <https://doi.org/10.1016/j.tics.2016.07.002>
- Sweller, J. (2011). Cognitive load theory. In *Psychology of learning and motivation* (Vol. 55, pp. 37–76). Academic Press. <https://doi.org/10.1016/B978-0-12-387691-1.00002-8>
- Tili, A., Shehata, B., Adarkwah, M. A., Bozkurt, A., Hickey, D. T., Huang, R., & Agyemang, B. (2023). What if the devil is my guardian angel: ChatGPT as a case study of using chatbots in education. *Smart Learning Environments*, 10(1), Article 15. <https://doi.org/10.1186/s40561-023-00237-x>
- Zhai, C., Wibowo, S., & Li, L. D. (2024). The effects of over-reliance on AI dialogue systems on students' cognitive abilities: A systematic review. *Smart Learning Environments*, 11(1), Article 28. <https://doi.org/10.1186/s40561-024-00316-7>