

Influence of AI-Powered Assistant Tools on Students' Engagement and Critical Thinking in Curriculum Learning in University of Port Harcourt

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Abstract

The rapid integration of Artificial Intelligence (AI)-powered assistant tools into higher education has generated significant scholarly interest, particularly regarding their influence on student engagement and the development of critical thinking skills. This study investigated the influence of AI-powered assistant tools on students' engagement and critical thinking in curriculum learning within the Faculty of Education, University of Port Harcourt, Nigeria. The study adopted a descriptive survey research design; the study targeted a population of 1,406 students from the 2022 and 2023 academic sets. A sample of 343 respondents was selected through purposive, simple random, and proportional stratified random sampling techniques. Data were collected using a structured questionnaire titled (IAATSECQ) with eight items each. Also, an AI-assisted quiz was administered via Google Forms. The reliability of the instrument using Cronbach's alpha was 0.751. Descriptive statistics (mean and standard deviation) were used to answer research questions, while independent samples t-tests were employed to test the hypotheses at a 0.05 significance level. Findings revealed that AI-powered tools significantly enhanced students' engagement. Gender was found to significantly influence engagement ($z = 2.985$, $p = 0.003$), with female students demonstrating higher engagement levels. Age significantly influenced critical thinking ($z = 5.365$, $p = 0.000$), with younger students (18–25 years) recording higher critical thinking scores than older students (26–35 years). The study concludes that AI-powered assistant tools are effective instruments for enhancing academic engagement and critical thinking in Nigerian higher education, and recommends the institutionalization of AI literacy programmes and differentiated AI integration strategies that are responsive to students' gender and age characteristics.

Keywords: *AI-powered assistant tools, student engagement, critical thinking, curriculum learning, Higher Education (HE).*

Introduction

The rapid advancement of Artificial Intelligence (AI) is transforming various sectors, and education is no exception. AI plays a significant role in both general and higher education, influencing students' academic development by offering a mix of opportunities and challenges (Edtech, 2020). From personalized learning experiences to intelligent tutoring systems that provide tailored guidance, support, and feedback based on individual learning patterns and knowledge levels (Hwang et al., 2020), AI has the potential to revolutionize education and

address the diverse needs of learners. However, positive educational outcomes are not guaranteed solely by the adoption of advanced AI technologies (Du Boulay, 2000). The integration of AI in academic environments raises critical questions related to equity, accessibility, and the evolving role of traditional teaching methods. Artificial Intelligence (AI) can also be defined as the ability of computer systems to perform tasks that normally require human intelligence, such as reasoning, learning, problem-solving, and language understanding (Russell & Norvig, 2021). AI assistants support cognitive engagement by offering adaptive feedback and personalized learning paths. When a student struggles with a topic, the AI can detect patterns in errors and provide targeted explanations or extra exercises at an appropriate difficulty level (Deng et al., 2023). This individualization keeps students working within their zone of proximal development, where tasks are challenging but achievable, thereby maintaining mental effort and motivation. Conversational AI models, such as ChatGPT, can guide students through complex reasoning, prompting reflection, problem-solving, and self-explanation all essential elements of deep learning. AI technologies are transforming assessment procedures in higher education, providing quick, individualized, and equitable techniques. Key applications include adaptive learning platforms, learning analytics, AI-powered proctoring tools, automated grading systems, intelligent tutoring systems, and NLP tools, enhancing assessment effectiveness. (Agbarakwe & Adedeji, 2022). Student engagement is the emotional, behavioural, and cognitive connection learners have with their educational activities, and it is central to their success. AI-powered assistants, when used thoughtfully, can significantly enhance this engagement by offering personalized feedback, adaptive learning experiences, and motivational support (Adamopoulou et al., 2020). Critical thinking is a fundamental skill that enables students to analyze information, evaluate evidence, and make reasoned decisions (Ali et al., 2023). In today's digital era, AI-powered assistants have become increasingly significant in fostering students' critical thinking skills and improving learning outcomes. These intelligent systems such as chatbots, virtual tutors, and adaptive learning platforms use natural language processing and machine learning to interact with students, guide their reasoning, and provide personalized feedback that promotes deeper understanding (Deng et al., 2023). AI-powered tools such as ChatGPT, Claude AI, and Google's AI Search can contribute to the development of critical thinking by encouraging inquiry, reflection, and problem-solving. Through interactive questioning, these systems challenge students to justify their answers, analyze alternatives, and draw logical conclusions. An AI tutor can provide follow-up questions that prompt learners to explain their reasoning or identify flaws in their arguments, encouraging active engagement with content rather than passive memorization a key component of critical thinking (Facione, 2015). Students who used AI-driven learning platforms demonstrated improved higher-order thinking and reasoning skills, as the systems supported exploration and guided learners toward deeper levels of understanding (Wang et al., 2025). Nevertheless, the impact of AI on critical thinking depends on ethical design and implementation. If systems are not transparent or if they oversimplify tasks, students may adopt surface learning habits rather than critical analysis. It is therefore crucial that AI technologies are developed to stimulate inquiry, encourage reflection, and promote intellectual autonomy. Educators should ensure that students understand both the capabilities and limitations of AI tools so they can use them responsibly and critically (Li & Wong, 2023). The effectiveness of AI in fostering critical thinking relies on maintaining a balance between technological assistance and human guidance, ensuring that education remains centered on reasoning, creativity, and intellectual growth (Ezinne & Saturday, 2022).

Although AI-powered assistants have the potential to enhance learning dimensions by offering

personalized, interactive, and reflective learning experiences, there remains a gap in empirical research examining how effectively these systems contribute to improving learners' outcomes. Many educators lack clear evidence and guidance on the best ways to integrate AI tools into the teaching process to promote meaningful learning rather than passive dependence. Artificial Intelligence (AI) and Large Language Models (LLMs) are revolutionizing educational broadcasting in Nigeria's Higher Education System, transforming content creation, curation, personalization, and engagement. The pedagogical implications include generative multimedia production, adaptive content curation, AI-suggestive algorithms, AI-enabled content localization, and interactive AI/LLM systems (Agbarakwe & Chibueze, 2024).

1.2 Statement of the Problem

The problem this study seeks to address is the insufficient understanding of the influence of AI-powered assistants on students' engagement, satisfaction, and critical thinking as variables influencing enhanced learning outcomes. Without adequate research-based evidence, educators and policymakers may struggle to harness the full potential of AI technologies to improve the quality of education and promote active, critical, and satisfied learners in the digital era.

Aim and Objectives

The aim of this study is to investigate the influence of AI-Powered Assistants on Students' Engagement, Satisfaction, and Critical Thinking in the University of Port Harcourt. Specifically, the objectives of the study sought to:

1. Examine the influence of AI-Powered assistant tools on students' engagement in learning curriculum in the Faculty of Education, University of Port Harcourt.
2. Assess how AI-Powered assistant tools contribute to the development of students' critical thinking in learning curriculum in the Faculty of Education, University of Port Harcourt.
3. Examine the influence of AI-Powered assistant tools on students' engagement in learning curriculum based on gender in the Faculty of Education, University of Port Harcourt.
4. Assess how AI-Powered assistant tools contribute to the development of students' critical thinking in learning curriculum based on age in the Faculty of Education, University of Port Harcourt.

Research Questions

The following research questions were raised to guide the study:

1. How does an AI-powered assistant tool influence students' engagement in learning curriculum in the Faculty of Education, University of Port Harcourt?
2. How do AI-powered assistant tools contribute to the development of students' critical thinking in learning curriculum in the Faculty of Education, University of Port Harcourt?
3. How do AI-Powered assistant tools influence students' engagement in learning curriculum based on gender in the Faculty of Education, University of Port Harcourt?
4. How do AI-Powered assistant tools contribute to the development of students' critical thinking in learning curriculum based on age in the Faculty of Education, University of Port Harcourt?

Hypotheses

1. **H0₁:** There is no significant difference in the influence of AI-Powered assistant tools on students' engagement between male and female students in learning curriculum in the Faculty of

Education, University of Port Harcourt.

2. **H0₂:** AI-Powered assistant tools do not significantly contribute to the development of students' critical thinking in curriculum-based learning based on age in the Faculty of Education, University of Port Harcourt.

Literature Review

The rapid proliferation of Artificial Intelligence (AI)-powered assistant tools in higher education has prompted extensive scholarly inquiry into their effects on student learning outcomes. This literature review examines the influence of AI-powered tools on students' engagement and critical thinking within curriculum studies. Grounded in theoretical frameworks including Constructivism, Connectivism, and Social Cognitive Theory (SCT), and supported by a growing body of empirical evidence, the review critically synthesizes existing knowledge on the nature of AI tools in education, the mechanisms through which they foster or hinder engagement and higher-order thinking, and the moderating role of demographic factors.

The Role of AI in Enhancing Students' Engagement

Engagement is recognized as a multidimensional construct encompassing behavioral, emotional, and cognitive dimensions. AI tools enhance student engagement by creating dynamic and responsive learning experiences that support real-time interaction, personalization, and collaboration. Oyebola et al. (2024) demonstrated that AI tools enhance student engagement through personalized content that resonates with each learner's style and preferences, encouraging students to take charge of their educational journeys. AI-powered platforms often incorporate gamification elements points, badges, and leaderboards that motivate students and foster a sense of community. AI also supports collaborative learning by facilitating group discussions and ensuring that all voices are heard, thereby enhancing teamwork skills and collective engagement (Järvelä et al., 2023).

AI and the Development of Critical Thinking Skills

Critical thinking the ability to analyze, evaluate, and synthesize information — is widely recognized as a core competency for academic success and lifelong learning. Assessment of how AI-powered assistant tools promote critical thinking reveals both significant opportunities and important risks. Gaglo (2021) emphasized that AI facilitates inquiry-based learning, encouraging students to ask questions, explore topics deeply, and engage in research. AI tools provide access to vast databases of information, enabling thorough investigations and the formation of well-rounded arguments. Essel (2021) highlighted that collaborative AI tools such as virtual discussion platforms promote critical thinking by fostering peer-to-peer dialogue, where students must articulate viewpoints, challenge assumptions, and defend ideas.

Gender-Based Differences in AI Tool Engagement

Gender also emerges as a meaningful moderator of how students engage with AI tools and develop critical thinking skills. Chen and Xu (2021) found that female students demonstrated significantly higher levels of behavioral and emotional engagement when using AI tools, being more likely to revisit AI-generated feedback and apply it reflectively behaviors closely linked to critical thinking. Okonkwo and Adekunle (2022) found that male students engaged more frequently with AI tools for task completion and speed, while female students reported deeper, comprehension-oriented engagement

Age-Based Differences in AI Tool Use and Critical Thinking

Demographic factors, particularly age, significantly moderate how students utilize AI tools for critical thinking development. Rashid and Bhatti (2021) found that older students (22 years and above) demonstrated greater improvement in critical thinking skills following AI tool integration, as they were more likely to question, evaluate, and reflect on AI-generated content rather than accept it uncritically. Younger students tended to accept AI outputs without significant interrogation. Fernandez and Reyes (2022) similarly found that mature students (aged 25 and above) engaged more analytically with AI tools, often cross-checking AI responses with other sources and identifying limitations in AI-generated information. Adeyemi and Olawale (2023) found that students aged 22–25 recorded the highest critical thinking improvement scores, attributing this to a combination of digital fluency and academic maturity. Liu and Wang (2022) confirmed that older students benefited most from AI tool integration in terms of critical thinking development, while the youngest group showed the least improvement.

Material and Methods

This study adopted a descriptive survey research design. It was carried out in the University of Port Harcourt, Rivers State, Nigeria. The independent variable was AI-powered assistant tools; the dependent variables were engagement, satisfaction, and critical thinking; and the moderating variables were age and gender. The population of the study comprised 1,406 students from the 2022 and 2023 sets in the Faculty of Education, University of Port Harcourt (Source: Faculty of Education, University of Port Harcourt, 2022). The sample size was determined at 343 students using the Taro Yamane formula. The sampling procedure was carried out in stages. The first stage purposively selected the Faculty of Education because of its emphasis on student-centred learning, pedagogy, critical thinking, and creativity. In the second stage, four departments were selected from eight using simple random sampling, ensuring equal probability of selection. Within each selected department, stratified random sampling was used to select 43 students from each of the two academic sets, ensuring proportional and balanced representation. This multi-stage approach minimized bias and ensured adequate representativeness.

The research instrument was a structured questionnaire divided into five sections (A–E). Section A captured demographic data; Sections B and C addressed students' engagement and critical thinking with AI tools, respectively; Section D examined engagement based on gender; and Section E addressed critical thinking based on age. Responses were structured on a four-point modified Likert scale of Strongly Agree (SA = 4), Agree (A = 3), Disagree (D = 2), and Strongly Disagree (SD = 1). Content validity of the instrument was established by the researcher's supervisor and two experts in measurement and evaluation, who reviewed items for relevance and clarity. The reliability of the instrument was established using Cronbach's alpha, yielding a coefficient of 0.751, which was considered acceptable. In addition, a structured AI-assisted quiz was administered via Google Forms to all 343 respondents. The quiz comprised 20 multiple-choice items evaluated using the AI Quiz Evaluation Rubric, assessing respondents across five dimensions: Engagement, Satisfaction, Critical Thinking, Time Used, and Score Achieved, each rated on a 1–5 Likert-type scale. Performance was categorized into five tiers: Very High ($\geq 90\%$), High (80–89%), Moderate (60–79%), Low (40–59%), and Very Low ($< 40\%$).

Descriptive statistics (mean and standard deviation) were used to answer the research questions. A criterion mean of 2.50 was adopted; items with a mean of 2.50 and above were accepted, while those below 2.50 were rejected. Inferential statistics using the independent samples t-test were used to test the hypotheses at a significance level of 0.05. All analyses were performed using

SPSS Version 25.

Results**Demographic Characteristics of Respondents****Table 1: Demographic Information of Respondents**

S/N	Demographic Variable	N	Categories	Frequency	Percentage
1	Gender	343	Male	110	32.07%
			Female	233	67.90%
2	Age	343	18–25 (Younger)	210	61.22%
			26–35 (Older)	133	38.78%
			35–45	0	0%
3	Matriculation Number	343	U2022/U2023	175	51.02%
			U2023/U2024	168	48.98%
4	Utilization of AI Tools	343	ChatGPT	179	52.19%
			Meta AI	80	23.32%
			Claude AI	60	17.49%
			Grammarly	10	2.91%
			Google Bard	8	2.33%
			Quizlet	6	1.75%
5	Frequency of Utilization	343	Daily	225	65.59%
			Occasionally	110	32.07%
			Weekly	6	1.75%
			Rarely	2	0.58%

Table 1 presents the demographic characteristics of the 343 respondents. Female respondents (233; 67.9%) constituted the majority compared to males (110; 32.1%). In terms of age, most respondents were within the 18–25 years bracket (210; 61.22%), followed by those in the 26–35 years category (133; 38.78%). No respondent fell within the 35–45 years age group, indicating a predominantly young adult sample. Regarding academic set, 175 students (51.02%) were from the 2022/2023 session and 168 (48.98%) from the 2023/2024 session. ChatGPT was the most frequently used AI tool (179; 52.19%), followed by Meta AI (80; 23.32%) and Claude AI (60; 17.49%). Regarding frequency of use, 225 respondents (65.59%) reported using AI tools daily, indicating a high level of integration of AI into students' academic routines.

Research Question One: How does AI-powered assistant tools influence students' engagement in learning curriculum in the faculty of Education University of Port Harcourt?

Table 2: Mean and Standard Deviation of the Influence of AI-Powered Assistant Tools on Students' Engagement in Learning Curriculum

S/N	Items	SA n/%	A n/%	D n/%	SD n/%	Mean	Std. Dev	Decision
1	AI-powered assistants make my learning more interactive.	102 (29.7%)	158 (46.1%)	53 (15.5%)	30 (8.7%)	2.97	0.89	Accepted
2	I feel motivated to participate in class activities after using AI tools.	89 (25.9%)	163 (47.5%)	62 (18.1%)	29 (8.5%)	2.91	0.88	Accepted
3	AI tools distract me from focusing on real academic discussions.	38 (11.1%)	71 (20.7%)	142 (41.4%)	92 (26.8%)	2.16	0.94	Rejected
4	I often explore more learning materials after interacting with AI-powered platforms.	95 (27.7%)	162 (47.2%)	58 (16.9%)	28 (8.2%)	2.94	0.88	Accepted
5	Using AI tools reduces my interest in group discussions.	32 (9.3%)	64 (18.7%)	147 (42.9%)	100 (29.2%)	2.08	0.92	Rejected
6	AI assistants encourage me to take more responsibility for my learning.	97 (28.3%)	159 (46.4%)	59 (17.2%)	28 (8.2%)	2.95	0.88	Accepted
7	I struggle to stay focused when using AI tools for academic tasks.	36 (10.5%)	68 (19.8%)	148 (43.1%)	91 (26.5%)	2.14	0.93	Rejected
8	AI platforms make learning tasks more enjoyable and less stressful.	101 (29.4%)	160 (46.6%)	52 (15.2%)	30 (8.7%)	2.96	0.89	Accepted
Aggregate Mean						2.64	0.90	Accepted

Table 2 reveals that AI-powered assistant tools positively influence students' engagement in the Faculty of Education, University of Port Harcourt. Mean scores ranged from 2.08 to 2.97, with an aggregate mean of 2.64 (SD = 0.90), which exceeds the criterion mean of 2.50. The highest-rated item indicated that AI-powered assistants make learning more interactive (M = 2.97), followed by making learning more enjoyable and less stressful (M = 2.96). Items suggesting

distraction, reduced interest in group discussions, and difficulty in focus were rejected ($M < 2.50$), indicating that AI tools are not perceived as academic barriers.

Research Question Two: How do AI-powered assistant tools contribute to the development of students' critical thinking in learning curriculum in the faculty of Education University of Port Harcourt?

Table 3: Mean and Standard Deviation of How AI-Powered Assistant Tools Contribute to Students' Critical Thinking in Learning Curriculum

S/N	Items	SA n/%	A n/%	D n/%	SD n/%	Mean	Std. Dev	Decision
1	AI-powered tools help me analyze academic problems from different perspectives.	96 (28.0%)	162 (47.2%)	57 (16.6%)	28 (8.2%)	2.96	0.88	Accepted
2	I depend too much on AI tools instead of thinking independently.	42 (12.2%)	78 (22.7%)	139 (40.5%)	84 (24.5%)	2.23	0.95	Rejected
3	AI assistants stimulate my curiosity and reasoning skills.	99 (28.9%)	158 (46.1%)	57 (16.6%)	29 (8.5%)	2.94	0.89	Accepted
4	I rarely question AI-generated answers.	36 (10.5%)	70 (20.4%)	144 (42.0%)	93 (27.1%)	2.14	0.94	Rejected
5	AI platforms encourage me to compare ideas before drawing conclusions.	93 (27.1%)	163 (47.5%)	58 (16.9%)	29 (8.5%)	2.93	0.88	Accepted
6	Overreliance on AI reduces my creativity in problem-solving.	40 (11.7%)	74 (21.6%)	143 (41.7%)	86 (25.1%)	2.20	0.95	Rejected
7	AI tools promote logical and reflective thinking in my studies.	97 (28.3%)	160 (46.6%)	57 (16.6%)	29 (8.5%)	2.95	0.89	Accepted
8	I use AI to verify the accuracy and relevance of information before applying it.	91 (26.5%)	159 (46.4%)	63 (18.4%)	30 (8.7%)	2.91	0.89	Accepted
Aggregate Mean						2.68	0.91	Accepted

Table 3 shows that AI-powered tools meaningfully contribute to the development of students' critical thinking in the Faculty of Education. Mean scores ranged from 2.14 to 2.96, with an aggregate mean of 2.68 (SD = 0.91), surpassing the 2.50 criterion. The highest-rated item confirmed that AI tools help students analyze problems from different perspectives ($M = 2.96$), followed by stimulating curiosity and reasoning ($M = 2.94$) and promoting logical and reflective thinking ($M = 2.95$). Items reflecting over-reliance on AI and uncritical acceptance of AI outputs were rejected, indicating a generally critical and discerning posture among respondents.

Research Question Three: How do AI-Powered assistant tools influence students' engagement in learning curriculum base on gender in faculty of Education University of Port- Harcourt?

Table 4: Mean and Standard Deviation of the Influence of AI-Powered Assistant Tools on Students' Engagement Based on Gender

S/N	Item Statement	Male Mean	Male Std	Female Mean	Female Std	$\bar{x}_1\bar{x}_2$	Remarks
1	AI-powered assistant tools make learning activities more interactive and engaging for me regardless of my gender.	2.98	0.89	3.30	0.83	3.14	Agree
2	Male and female students benefit equally from AI-powered tools in sustaining attention during curriculum learning activities.	2.92	0.91	3.18	0.86	3.05	Agree
3	The use of AI-powered tools increases my participation in class discussions and curriculum-related tasks.	2.99	0.91	3.29	0.86	3.14	Agree
4	AI-powered assistant tools help me stay motivated throughout the learning process in the Faculty of Education.	2.96	0.88	3.28	0.85	3.12	Agree
5	Gender does not affect how AI-powered tools influence my level of engagement with learning materials.	2.83	0.98	3.08	0.90	2.95	Agree
6	AI-powered tools encourage both male and female students to explore curriculum content beyond classroom instruction.	2.90	0.92	3.21	0.89	3.06	Agree
7	The use of AI-powered assistant tools has significantly improved my overall engagement with the curriculum.	2.96	0.88	3.30	0.84	3.13	Agree
8	AI-powered assistant tools create an inclusive learning environment that equally engages students of all genders.	2.95	0.89	3.21	0.87	3.08	Agree
Aggregate Mean		2.94	0.91	3.23	0.86	3.08	Agree

Table 4 reveals that both male and female students reported positive engagement with AI tools, with all mean scores exceeding the 2.50 benchmark. Female students, however, recorded a higher aggregate mean ($\bar{x} = 3.23$, $SD = 0.86$) compared to male students ($\bar{x} = 2.94$, $SD = 0.91$), indicating a stronger perceived influence of AI tools on female students' engagement.

Research Question Four: How do AI-Powered assistant tools contribute to the development of students' critical thinking in learning curriculum in faculty of Education University of Port-Harcourt.

Table 5: Mean and Standard Deviation of How AI-Powered Assistant Tools Contribute to Students' Critical Thinking Based on Age

S/N	Item Statement	18–25 Mean	18–25 Std	26–35 Mean	26–35 Std	$\bar{x}$ $\bar{s}$	Remarks
1	Older students tend to apply AI tools more discerningly than younger ones.	3.39	0.74	2.88	0.95	3.13	Agree
2	My age affects how I evaluate information generated by AI systems.	3.35	0.75	2.86	0.96	3.11	Agree
3	Younger students are more likely to depend completely on AI answers.	3.41	0.75	2.89	0.97	3.15	Agree
4	I find that maturity helps me question AI-generated responses.	3.33	0.78	2.84	0.96	3.09	Agree
5	Age has no significant influence on how I use AI for analytical reasoning.	3.31	0.76	2.84	0.95	3.08	Agree
6	Older learners tend to verify AI suggestions before accepting them.	3.36	0.76	2.86	0.97	3.11	Agree
7	Younger users often use AI without analyzing its accuracy.	3.32	0.76	2.83	0.96	3.08	Agree
8	My age group benefits differently from AI tools in developing reasoning skills.	3.39	0.75	2.88	0.97	3.13	Agree
	Aggregate Mean	3.36	0.76	2.86	0.96	3.11	Agree

Table 5 shows that younger students (18–25 years) recorded a higher aggregate mean ($\bar{x} = 3.36$, $SD = 0.76$) compared to older students (26–35 years) ($\bar{x} = 2.86$, $SD = 0.96$), indicating that younger students perceive AI-powered tools as contributing more significantly to their critical thinking development.

Hypothesis Testing

Table 6: Independent Samples t-test of Students' Engagement Based on Gender

Gender	N	Mean	SD	z-value	p-value	Level of Sig.	Remark
Males	110	2.94	0.89	2.985	0.003	0.05	Significant
Females	233	3.23	0.84				

Table 6 shows that male ($M = 2.94$, $SD = 0.89$) and female students ($M = 3.23$, $SD = 0.84$) reported statistically significant differences in engagement ($z = 2.985$, $p = 0.003 < 0.05$). The null hypothesis H_0 is therefore rejected. Gender has a significant influence on students' engagement with AI-powered tools, with female students demonstrating higher engagement.

Table 7: Independent Samples t-test of Students' Critical Thinking Based on Age

Age Group	N	Mean	SD	z-value	p-value	Level of Sig.	Remark
18–25 (Younger)	210	3.36	0.74	5.365	0.000	0.05	Significant
26–35 (Older)	133	2.86	0.96				

Table 7 shows that younger students ($M = 3.36$, $SD = 0.74$) and older students ($M = 2.86$, $SD = 0.96$) differed significantly in critical thinking ($z = 5.365$, $p = 0.000 < 0.05$). The null hypothesis H_{02} is therefore rejected. Age significantly influences the development of critical thinking through AI tool use, with younger students demonstrating higher outcomes.

Discussion of Findings

Influence of AI-Powered Tools on Students' Engagement

The findings reveal that students in the Faculty of Education generally perceive AI-powered assistant tools as positively influencing their academic engagement. The aggregate mean of 2.64 ($SD = 0.90$) exceeded the criterion mean of 2.50, indicating partial agreement that these tools enhance involvement in the learning curriculum. The highest mean for interactivity ($M = 2.97$) aligns with existing literature describing how AI tools facilitate real-time interactions and personalized learning pathways that sustain student interest (Zawacki-Richter et al., 2019). Regarding motivation and exploration, students expressed agreement with enhanced motivation ($M = 2.91$) and encouragement to explore additional learning materials ($M = 2.94$), consistent with findings that AI can boost motivation through adaptive learning systems responding to individual needs (Alqahtani & Rajkhan, 2020). Conversely, students significantly disagreed that AI tools distract them from academic discussions ($M = 2.16$), reduce interest in group work ($M = 2.08$), or hinder focus ($M = 2.14$). This stands in contrast to concerns in the literature about digital fatigue and techno-stress (Selwyn, 2019), suggesting that students in this context are utilizing AI tools effectively without significant disruption to their academic routines. The findings confirm that AI-powered assistant tools enhance behavioural, emotional, and cognitive engagement by providing immediate feedback, interactive dialogue, and personalized learning support, consistent with Engagement Theory (Kearsley & Shneiderman, 1998) and the work of Oyebola et al. (2024) and Järvelä et al. (2023).

Contribution of AI-Powered Tools to Critical Thinking

The aggregate mean of 2.68 ($SD = 0.91$) confirmed that AI tools foster higher-order cognitive processes within the learning curriculum. The highest-rated items analyzing problems from multiple perspectives ($M = 2.96$), stimulating curiosity and reasoning ($M = 2.94$), and promoting logical thinking ($M = 2.95$) describe a student body actively engaging with AI content as a reasoning tool. These results align with Bloom's Revised Taxonomy (Anderson & Krathwohl, 2001) at the higher cognitive levels of analysis, evaluation, and synthesis.

The rejection of over-reliance items is particularly encouraging, suggesting that students maintain an interrogative posture when using AI tools. This aligns with Ouyang and Jiao (2021), who found that AI-assisted learning environments encourage metacognitive activity characteristic of critical thinking. The variability in responses regarding over-reliance ($SD = 0.94$ – 0.95) indicates that a subset of students may still be susceptible to uncritical AI consumption, underscoring the need for explicit AI literacy instruction embedded in curriculum design (Zawacki-Richter et al., 2019; Selwyn, 2019).

Influence of AI Tools on Engagement Based on Gender

The significant difference in engagement ($z = 2.985$, $p = 0.003$) between male and female students, with females recording a higher aggregate mean, aligns with Chen and Xu (2021), who reported higher behavioural and emotional engagement among female students using AI tools. Pham and Le (2023) similarly found that female students exhibited stronger cognitive

engagement with AI learning assistants, particularly when tools provided explanatory feedback. Within the Nigerian educational context, Alabi and Musa (2023) reported similar findings in federal universities, confirming that female education students tend to demonstrate stronger engagement with AI-powered tools than male students.

The difference may be attributed to the learning orientations of male and female students. Okonkwo and Adekunle (2022) found that male students typically used AI for task completion and speed, while female students engaged more deeply for understanding and comprehension—a pattern that may explain the higher engagement levels observed among females in the present study.

Contribution of AI Tools to Critical Thinking Based on Age

The significant difference in critical thinking ($z = 5.365$, $p = 0.000$) with younger students recording higher scores contrasts with several previous studies that reported stronger critical thinking outcomes among older students (Rashid & Bhatti, 2021; Fernandez & Reyes, 2022; Liu & Wang, 2022). The present finding may be attributed to the greater digital fluency and technological familiarity of younger students, who interact more frequently with AI-powered tools and benefit more from their interactive and inquiry-based features.

The finding partially aligns with Adeyemi and Olawale (2023), who reported stronger critical thinking improvement among younger students after AI tool use, attributing this to digital fluency and active technology engagement. The relationship between age and AI-supported critical thinking may depend on contextual factors including technological exposure, frequency of AI use, digital literacy, and learning orientation. Institutions should therefore adopt age-responsive strategies that strengthen critical evaluation across all learner categories.

Conclusion

Based on the findings of this study, AI-powered assistant tools play a significant and positive role in enhancing students' engagement and critical thinking in the Faculty of Education, University of Port Harcourt. The evidence consistently demonstrates that these tools positively influence student engagement and critical thinking in the learning curriculum, affirming their growing relevance in contemporary higher education. The study further concludes that gender and age are significant demographic variables that shape how students interact with and benefit from AI-powered tools. Female students demonstrated stronger levels of engagement than their male counterparts, while younger students showed higher critical thinking outcomes than older students. These findings underscore the importance of adopting differentiated and inclusive AI integration strategies responsive to the diverse learning characteristics of students. Overall, AI-powered assistant tools represent a valuable resource for improving the quality of learning experiences in Nigerian higher education when thoughtfully integrated into curriculum delivery. The result of the structured AI-assisted quiz administered via Google Forms to all 343 respondents supported the result above.

Recommendations

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

1. The University of Port Harcourt should introduce a compulsory course on AI literacy and digital ethics, equipping students with the skills to use AI-powered tools responsibly, evaluate AI-generated content critically, and adhere to standards of academic integrity and proper citation of AI-assisted work.

2. Lecturers and curriculum planners should deliberately design AI-integrated learning tasks that require students to evaluate, critique, and synthesize AI-generated content, embedding higher-order thinking expectations into AI-mediated assignments.
3. The Faculty of Education should implement AI literacy programmes addressing how to interrogate, cross-reference, and evaluate AI-generated information, particularly to ensure that younger students do not substitute technological convenience for critical reasoning.
4. Since female students demonstrated significantly higher engagement, universities should investigate and document female learners' specific interaction preferences to design pedagogical strategies and AI platforms that also improve engagement among male students.
5. Given that older students (26–35 years) demonstrated lower critical thinking scores, educators should develop targeted instructional interventions including workshops, seminars, and guided inquiry activities that train mature learners to question AI outputs and integrate AI responses with prior knowledge.
6. University administrators should invest in reliable and academically robust AI platforms aligned with curriculum content and academic standards, and ensure adequate technical infrastructure, including stable internet access and institutional subscriptions, for equitable student access.

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