

Pre-Service Teachers' Level of Awareness and Extent of Utilization of Artificial Intelligence Tools for Educational Purposes

Olukayode Solomon Aboderin ¹, Folashade Euchariah Adesuyi ^{2*}

¹ Department of Science Education, Faculty of Education, Adekunle Ajasin University, Akungba Akoko, Nigeria,  0000-0002-9506-2524

² Department of Science Education, Faculty of Education, Adekunle Ajasin University, Akungba Akoko, Nigeria,  0009-0002-5811-0061

* Corresponding author: Folashade Euchariah Adesuyi (adesuyi.folashade@unioffa.edu.ng)

Article Info

Article History

Received:
20 February 2026

Revised:
24 April 2026

Accepted:
20 April 2026

Published:
15 July 2026

Keywords

AI tools
Pre-service teachers
AI awareness
AI utilization
AI for educational
purposes

Abstract

The integration of artificial intelligence (AI) tools in education offers transformative potential for teaching and learning; however, their adoption in Nigerian teacher education remains limited. This study investigates pre-service teachers' awareness, utilization, and perceived barriers to AI tool use in three Nigerian College of Education. Using a descriptive survey design, data were collected from a sample of 300 pre-service teachers through a questionnaire adapted from Asongo et al. (2024). Descriptive statistics, including means and standard deviations, were employed to analyze the data. Results reveal that pre-service teachers demonstrated high awareness and frequent use of popular AI tools such as ChatGPT (mean = 3.79 for awareness; 3.67 for utilization), while awareness and utilization of other specialized tools were moderate. Most respondents disagreed that ethical concerns, bias, and usability issues pose significant barriers; however, cost and accessibility were identified as notable challenges (mean = 2.52). These findings underscore infrastructural and economic factors as primary impediments to wider AI adoption. The study recommends integrating AI literacy into teacher education curricula, conducting practical training workshops, subsidizing access to AI platforms, improving digital infrastructure, and embedding ethical considerations in AI usage guidelines.

Citation: Aboderin, O. S. & Adesuyi, F. E. (2026). Pre-service teachers' level of awareness and extent of utilization of artificial intelligence tools for educational purposes. *International Journal of Studies in Education and Science (IJSES)*, 7(3), 299-314. <https://doi.org/10.46328/ijses.7871>



ISSN: 2767-9799 / © International Journal of Studies in Education and Science (IJSES).
This is an open access article under the CC BY-NC-SA license
(<http://creativecommons.org/licenses/by-nc-sa/4.0/>).



Introduction

The integration of Artificial Intelligence (AI) into education is reshaping teaching and learning across the globe. AI tools such as ChatGPT, QuillBot, and Consensus offer innovative possibilities for automating assessments, generating content, enhancing student engagement, and supporting differentiated instruction (Akinbo, Eze, & Afolayan, 2023; Sultan, Boateng, & Amankwah, 2024). These developments reflect the larger movement toward education in the Fourth Industrial Revolution, where digital technologies—including AI—are expected to complement and transform pedagogical practices. However, the adoption of AI in Nigerian education, especially in teacher training programs, remains limited (Adebayo & Yusuf, 2023). Despite growing awareness of AI's potential, Nigerian pre-service teachers are often not adequately prepared to integrate these tools effectively into instructional settings. The Technological Pedagogical Content Knowledge (TPACK) framework, developed by Mishra and Koehler (2006), provides a useful conceptual lens to examine this gap. TPACK emphasizes the need for teachers to develop an integrated understanding of technology (T), pedagogy (P), and content knowledge (CK), asserting that effective technology integration occurs at the intersection of all three knowledge domains.

Pre-service teachers are in a critical developmental stage where their technological and pedagogical competencies are still being formed. Therefore, developing their technological knowledge (TK)—including AI literacy—is essential to equip them for future classrooms that are increasingly digital and automated. The Federal Government of Nigeria's recent initiative to train 6,000 teachers in AI pedagogy underscores the urgent need for capacity building in this area (The Guardian Nigeria, 2025). Similarly, institutions like the University of Lagos have recognized the importance of policy frameworks guiding the ethical use of AI in academia (Premium Times, 2025). Nevertheless, challenges to effective integration persist. These include limited access to digital infrastructure, inconsistent internet connectivity, inadequate training programs, and a lack of institutional support (Spurs Media, 2024; Afolabi, Ogunyemi, & Ilesanmi, 2023). A national survey revealed that up to 68% of teachers are unfamiliar with basic AI applications, which raises concerns about their preparedness to teach in AI-augmented environments (Spurs Media, 2024).

Research shows that while pre-service teachers in other African contexts, such as Ghana, display positive attitudes toward AI, concerns remain about data privacy, accuracy, and the pedagogical relevance of AI tools (Sultan et al., 2024). In Nigeria, studies indicate moderate awareness of AI among pre-service teachers, but a low level of utilization due to limited exposure and training (Asongo, Okafor, & Bello, 2024). From a TPACK perspective, this points to an underdeveloped technological knowledge base and a misalignment between pedagogical strategies and available digital tools.

This study is guided by the TPACK framework and aims to investigate the level of awareness, extent of utilization, and barriers to integration of AI tools among pre-service teachers in Nigerian universities. Understanding these dimensions is essential for aligning teacher education curricula with global best practices. The findings are expected to inform the development of professional learning programs and institutional policies that foster the effective use of AI tools, ultimately enhancing the technological pedagogical content knowledge of future educators.

Purpose of the Study

The purpose of this study is to investigate the level of awareness and the extent of utilization of AI tools among pre-service teachers in Nigerian universities. It aims to explore how these future educators engage with AI technologies for educational purposes, identify the challenges they encounter, and provide insights to inform policy and curriculum development for enhanced AI integration in teacher education programs. Specifically, the study is set out to achieve the following:

1. To determine the pre-service teachers' level of awareness of various AI tools in Nigerian College of Education.
2. To examine the extent to which pre-service teachers utilize AI tools for educational purposes.
3. To identify the barriers that limit or hinder pre-service teachers' utilization of AI tools in their academic and pedagogical practices.

Research Questions

The following research questions were designed to guide the study.

1. What is the level of awareness of AI tools among pre-service teachers in Nigerian College of Education?
2. To what extent do pre-service teachers utilize AI tools for educational purposes such as teaching preparation, research, and learning support?
3. What are the perceived barriers that hinder the utilization of AI tools by pre-service teachers in Nigerian College of Education?

Theoretical Framework

This study is anchored in the Technological Pedagogical Content Knowledge (TPACK) framework developed by Mishra and Koehler (2006), which provides a comprehensive model for understanding the knowledge teachers need to effectively integrate technology into their teaching. The TPACK model extends Shulman's (1986) concept of Pedagogical Content Knowledge (PCK) by adding the dimension of Technological Knowledge (TK)—thus emphasizing that effective teaching with technology requires an understanding of the dynamic interplay between Content Knowledge (CK), Pedagogical Knowledge (PK), and Technological Knowledge (TK). The relevance of the TPACK framework to this study lies in its capacity to contextualize how pre-service teachers acquire, perceive, and apply AI tools in educational settings. AI tools such as ChatGPT, QuillBot, and Consensus represent advanced forms of digital technologies that demand not just technical fluency but pedagogical and content integration to be effective. According to Koehler and Mishra (2009), merely having technological access or skills does not translate into meaningful classroom use unless the technology aligns with pedagogical strategies and subject content. In the context of Nigerian teacher education, the TPACK framework helps explain the limited integration of AI tools. While some pre-service teachers may possess general digital literacy, their technological pedagogical knowledge (TPK)—knowledge about how to use AI tools in ways that align with instructional goals and student needs—is often underdeveloped (Adebayo & Yusuf, 2023). This disconnect is exacerbated by infrastructural limitations and

insufficient exposure to emerging educational technologies during teacher preparation programs. The technological content knowledge (TCK) aspect of TPACK is equally critical in this study. It considers how well pre-service teachers understand the affordances and constraints of AI tools in relation to their subject areas. For example, using ChatGPT to simulate Socratic dialogue in philosophy or to assist in generating multiple perspectives in essay writing requires not just AI literacy but content-informed decision-making. Moreover, the framework highlights the importance of Technological Pedagogical Content Knowledge (TPACK) as the integrative knowledge base that enables teachers to design and deliver effective, technology-mediated instruction. The study aims to evaluate the extent to which Nigerian pre-service teachers possess or are developing this integrated knowledge—particularly in relation to AI tools. Doing so aligns with global educational trends that emphasize 21st-century teaching competencies, which include the ability to navigate, evaluate, and apply emerging technologies in diverse educational contexts (UNESCO, 2022). By situating this research within the TPACK framework, the study not only assesses awareness and utilization levels of AI tools but also interrogates the depth and coherence of pre-service teachers' knowledge domains as they pertain to AI. This theoretical lens enables a more nuanced interpretation of the data, identifying specific knowledge gaps and informing recommendations for curriculum design, teacher training, and policy development.

Literature Review

Artificial Intelligence in Global Trends and Teacher Education

Artificial Intelligence (AI) is reshaping educational systems worldwide by enabling personalized learning, intelligent tutoring, automated feedback, and adaptive assessments. The use of AI technologies such as ChatGPT, QuillBot, and Consensus in education is driven by their capacity to enhance productivity, provide immediate instructional support, and foster independent learning (Zawacki-Richter et al., 2019). AI tools can function as both tutors and assistants—delivering differentiated learning experiences tailored to the unique needs of each learner. Globally, countries like China, the United States, and Finland have integrated AI tools into both formal education and teacher training programs (UNESCO, 2021). AI is being utilized to analyze student performance data, detect learning difficulties early, and generate insights for curriculum development (Zhai et al., 2023).

In teacher education, AI offers simulation-based teaching practice, smart lesson planning assistants, and automated grading systems—tools that not only save time but also enhance pedagogical outcomes (Kose et al., 2023). However, the pace of adoption varies significantly across regions due to differences in infrastructure, policy support, and teacher readiness. In Nigeria, the integration of AI in education remains limited and fragmented. While there is growing awareness of AI's potential, its actual implementation in higher education and teacher training is still at a preliminary stage (Adebayo & Yusuf, 2023). Many Nigerian universities face infrastructural challenges such as unreliable electricity supply, low internet bandwidth, and insufficient funding for digital innovation. These constraints make it difficult to implement AI-driven educational technologies at scale. Most teacher education programs in Nigeria do not yet include AI literacy or computational thinking as part of their curriculum. Asongo et al. (2024) observed that although some institutions are experimenting with digital learning platforms, very few have institutional policies or training programs that prepare future teachers for AI-mediated instruction. This lack of systemic integration undermines the potential of AI tools in equipping pre-service

teachers with 21st-century teaching competencies. In addition, there is a general lack of empirical studies that explore how Nigerian pre-service teachers perceive and use AI in their educational journeys.

Pre-Service Teachers' Awareness, Utilization of AI Tools and Challenges

Pre-service teachers, who are currently undergoing training in her institutions, play a vital role in shaping future classrooms. Their awareness and use of AI tools can serve as a proxy for gauging future readiness for AI-integrated pedagogy. Studies reveal that many pre-service teachers in Nigeria are aware of popular AI tools like ChatGPT, QuillBot, Grammarly, and Consensus (Asongo et al., 2024; Bello & Olanrewaju, 2022). However, this awareness does not necessarily translate into pedagogical application. For instance, while some may use QuillBot to paraphrase content or Grammarly to edit essays, few explore the instructional uses of these tools such as lesson generation, quiz creation, or real-time formative assessment. Akinbo et al. (2023) found that only a small percentage of pre-service teachers in Nigeria use AI for tasks related to teaching practice, such as preparing teaching aids, simulating instructional strategies, or analyzing student learning data. Many rely on AI for academic support rather than for developing pedagogical strategies. This indicates a gap in the integration of technological knowledge with pedagogical and content knowledge highlighting the relevance of the TPACK framework in understanding this phenomenon.

Several factors impede the effective use of AI tools among Nigerian pre-service teachers. Limited internet access, erratic power supply, and lack of institutional subscriptions to premium AI platforms hinder seamless adoption (Ojo & Ayodele, 2023). Teacher education curricula in most Nigerian universities do not include AI literacy, digital pedagogy, or prompt engineering. As a result, pre-service teachers lack the structured exposure necessary to use AI tools for teaching and learning (Adebayo & Yusuf, 2023). Although many students are familiar with using digital tools for social interaction, few possess the skills to apply AI tools in instructional contexts. The absence of hands-on training in digital pedagogy further exacerbates this challenge (Spurs Media, 2024). Pre-service teachers express concerns about the reliability of AI-generated content, the risk of academic dishonesty, and the overdependence on machines for intellectual tasks (Sultan et al., 2024). These ethical considerations often discourage deep engagement with AI tools for academic purposes. These barriers suggest the need for a holistic approach that addresses infrastructure, curriculum design, and digital ethics in teacher education.

The TPACK Framework and AI in Teacher Preparation

The Technological Pedagogical Content Knowledge (TPACK) framework, developed by Mishra and Koehler (2006), provides a comprehensive model for integrating technology into teacher education. It highlights the intersection of three core knowledge domains—technology (TK), pedagogy (PK), and content (CK)—which must be interwoven for effective technology integration in the classroom. In the context of AI, pre-service teachers need to understand not only how to use AI tools (TK), but also how to align them with teaching strategies (PK) and subject matter content (CK). Recent studies underscore the importance of TPACK in preparing future teachers to harness AI technologies. Zhai et al. (2023) argue that AI tools should be introduced in ways that align with pedagogical intentions, such as scaffolding student learning, enabling real-time feedback, and enhancing

classroom interaction. Without this alignment, teachers may misuse or underutilize AI tools, reducing them to mere convenience technologies rather than pedagogical assets. Furthermore, the TPACK framework emphasizes that teacher preparation programs must go beyond technical training to include the development of critical thinking, ethical reasoning, and reflective practice. These skills are essential for navigating the complex decisions involved in AI-enhanced education, such as evaluating algorithmic bias or designing inclusive digital learning environments (Koehler & Mishra, 2009; UNESCO, 2021).

Despite the growing global interest in artificial intelligence (AI) and its transformative potential in education, empirical investigations into the awareness and utilization of AI tools among pre-service teachers in Nigeria remain scarce. While numerous studies have explored the general adoption of educational technologies in Nigerian universities (Ojo & Ayodele, 2023; Bello & Olanrewaju, 2022), very few have specifically focused on the pedagogical integration of AI tools such as ChatGPT, Consensus, QuillBot, Grammarly, and other generative AI platforms within teacher education programs. Most available studies have either examined digital literacy broadly or focused on infrastructural and policy barriers affecting ICT adoption (Asongo et al., 2024; Adebayo & Yusuf, 2023).

These studies, although valuable, tend to generalize digital technologies without isolating AI tools as a unique category that demands different competencies such as prompt engineering, algorithmic literacy, ethical AI use, and AI-enhanced pedagogy. As a result, there is limited understanding of how pre-service teachers interact with AI specifically, both in terms of academic support and instructional development. There is an evident gap in empirical data regarding the awareness pre-service teachers have about AI tools and their functionalities and the extent and patterns of utilization of AI tools for educational versus non-educational purposes. Also, lacking are studies grounded in robust theoretical frameworks such as TPACK or the Diffusion of Innovation Theory to contextualize how technological, pedagogical, and content knowledge intersect with AI adoption in teacher education. This empirical gap highlights the need for context-specific studies that focus on how Nigerian pre-service teachers are navigating the growing landscape of AI in education. Understanding these dynamics is crucial for informing curriculum design, teacher training strategies, and national policies aimed at embedding AI literacy in teacher education programs. The current study seeks to fill this gap by providing data-driven insights on pre-service teachers' awareness, utilization, and barriers to AI adoption, thus contributing to both theory and practice in AI-integrated education.

Method

This study adopts a descriptive survey research design to investigate the level of awareness and extent of utilization of AI tools among pre-service teachers in Nigerian College of Education. The choice of this design is informed by its appropriateness for gathering quantifiable data from a defined population with the aim of describing existing phenomena as they naturally occur (Creswell & Creswell, 2018). This design enables the researchers to assess patterns of AI tool usage, levels of awareness, and perceived barriers without manipulating the study environment.

Population and Sample

The population of the study comprises all pre-service teachers enrolled in colleges or faculties of education across Nigerian College of Education A multi-stage sampling technique was employed to select a total of 300 pre-service teachers from three purposively selected colleges of education, representing a cross-section of federal, state, and private institutions. The selected Colleges of Education were chosen based on their operational ICT infrastructure, student population, and institutional commitment to digital innovation. Participants were drawn using stratified random sampling based on level of study (200 to 400 level) and area of specialization (e.g., Science Education, Social Science Education, or Arts and Humanities Education). This approach ensures a balanced representation across academic levels and subject domains, enhancing the generalizability of the findings.

Instrumentation

Data were collected using a structured questionnaire adapted from Asongo et al. (2024), with necessary modifications to align with the objectives of the current study. The instrument comprised four sections:

Section A: Demographic information (e.g., age, gender, college type, year of study, program of study).

Section B: Awareness of AI tools (e.g., ChatGPT, QuillBot, Grammarly, Consensus, and others), measured on a Likert-type scale ranging from "Not aware" to "Highly aware".

Section C: Utilization of AI tools for academic tasks (e.g., content creation, paraphrasing, lesson planning, research assistance).

Section D: Perceived barriers to the use of AI tools (e.g., access to devices, internet connectivity, lack of training, ethical concerns). The instrument was subjected to content and face validation by three experts in Educational Technology and Measurement and Evaluation. A pilot study was conducted with 30 pre-service teachers from a university not included in the main study. The reliability of the instrument was determined using Cronbachs Alpha, yielding a coefficient of 0.82, indicating high internal consistency.

Data Collection Procedure

Data were collected over a period of four weeks with the assistance of trained research assistants. Informed consent was obtained from all participants prior to data collection, and ethical clearance was secured from the Institutional Review Boards (IRBs) of the selected Colleges of Education. Respondents were assured of anonymity and confidentiality, and participation was entirely voluntary. The questionnaire was administered in paper-based formats. Efforts were made to ensure equitable participation by supporting respondents with limited internet access.

Data Analysis

Data collected were coded and analyzed using the Statistical Package for the Social Sciences (SPSS) version 25. The analysis involved descriptive statistics using frequencies, percentages, means, and standard deviations to summarize responses related to awareness, usage patterns, and perceived barriers.

Results and Discussion

This section presents the result of the data collected and analyzed in line with the research questions that guided the study.

Research Question One: What is the level of awareness of AI tools among pre-service teachers in Nigerian College of Education?

The results in Table 1 indicate that among the AI tools assessed, ChatGPT stands out with the highest mean awareness score of 3.79 and a low standard deviation of 0.52. This suggests that pre-service teachers are fully aware of ChatGPT, reflecting its broad popularity and accessibility. Its high recognition may be attributed to extensive media coverage and its growing use in educational contexts worldwide. In contrast, the majority of other AI tools, such as Consensus, Scite, QuillBot, Bit AI, Litmaps, Jenni, Paperpal, Research Rabbit, Wordvice AI, Typeset.io, Elicit, Scholarcy, and Trinka, have mean scores ranging between 2.6 and 3.0, indicating that respondents are generally aware of these tools but not to the extent of ChatGPT. The moderate awareness levels suggest that while these platforms have gained some traction among pre-service teachers, they may not yet be widely adopted or deeply understood.

Table 1. Awareness of AI Tools among Pre-Service Teachers

S/N	Item Statement	$\bar{X}$	SD	Dec
1	ChatGPT	3.79	0.52	FA
2	ChatPDF	2.26	0.95	NFA
3	Consensus	2.80	0.83	A
4	Scite	2.86	0.93	A
5	Quillbot	2.86	0.94	A
6	Bit AI	2.80	0.96	A
7	Litmaps	2.92	0.92	A
8	Jenni	2.96	0.91	A
9	Paperpal	2.95	0.93	A
10	Research Rabbit	2.76	1.01	A
11	Wordvice AI	2.61	1.00	A
12	Typeset.io	2.78	0.93	A
13	Elicit	2.90	0.99	A
14	Scholarcy	2.81	0.96	A
15	Trinka	2.90	0.95	A

Key: N = Number of respondents, $\bar{X}$ = mean, SD = Standard Deviation, A= Aware, FA = Fully Aware, = Aware
NFA = Not Fully Aware, Dec. = Decision.

Notably, ChatPDF recorded the lowest mean score of 2.26 with the highest standard deviation of 0.95, implying that many pre-service teachers are not fully aware of this particular AI tool. This lower awareness points to a

significant knowledge gap regarding ChatPDF and possibly other similar niche AI tools. Overall, the standard deviations for most tools indicate some variation in awareness levels among the pre-service teachers, but no extreme disparities. These findings highlight the need for enhanced exposure and targeted training on a wider range of AI educational tools, particularly those less familiar to future educators, to better prepare them for integrating AI technologies into their teaching practices.

Research Question Two: To what extent do pre-service teachers utilize AI tools for educational purposes such as teaching preparation, research, and learning support?

The results, as summarized in Table 2, revealed varying levels of adoption across the 15 AI tools assessed. ChatGPT emerged as the most extensively used tool, with a mean score of 3.67 (SD = 0.71), indicating usage to a very great extent. This suggests that ChatGPT is widely recognized and integrated into participants' academic activities, likely due to its versatility and accessibility. Notably, the low standard deviation reflects a strong consensus among respondents regarding its utility. Conversely, ChatPDF recorded the lowest mean score of 2.46 (SD = 1.11), categorizing it under "Not at all." This suggests limited awareness or perceived relevance of ChatPDF among the respondents.

Table 2. Utilization of AI tools for Educational Purposes

S/N	Item Statement	$\bar{X}$	SD	Dec
1	ChatGPT	3.67	0.71	VGE
2	ChatPDF	2.46	1.11	NA
3	Consensus	2.88	1.07	M
4	Scite	3.06	1.07	GE
5	Quillbot	3.01	1.05	GE
6	Bit AI	2.96	1.09	M
7	Litmaps	3.09	1.11	GE
8	Jenni	3.15	1.03	GE
9	Paperpal	3.15	1.07	GE
10	Research Rabbit	3.03	1.11	GE
11	Wordvice AI	2.98	1.11	M
12	Typeset.io	3.01	1.19	GE
13	Elicit	3.11	1.06	GE
14	Scholarcy	3.01	1.15	GE
15	Trinka	3.09	1.1	GE

Key: N = Number of respondents, $\bar{X}$ = mean, SD = Standard Deviation, VGE = Very Great extent, GE= Great extent, M = Moderate, NA = Not at All

Similarly, four other tools—Consensus ($\bar{X}$ = 2.88), Bit AI ($\bar{X}$ = 2.96), Wordvice AI ($\bar{X}$ = 2.98), and Consensus—were rated as used to a moderate extent, indicating some level of engagement but suggesting potential for improved adoption through better orientation or support. A majority of the tools (10 out of 15), including Scite ($\bar{X}$

= 3.06), Quillbot ($\bar{X}$ = 3.01), Litmaps ($\bar{X}$ = 3.09), Jenni ($\bar{X}$ = 3.15), Paperpal ($\bar{X}$ = 3.15), Research Rabbit ($\bar{X}$ = 3.03), Typeset.io ($\bar{X}$ = 3.01), Elicit ($\bar{X}$ = 3.11), Scholarcy ($\bar{X}$ = 3.01), and Trinko ($\bar{X}$ = 3.09), were rated as used to a great extent. These results suggest that many pre-service teachers are actively integrating a range of AI tools into their academic routines, particularly those that offer support in writing, literature mapping, citation management, and grammar refinement. Standard deviation values generally hovered around 1.00, indicating moderate variability in responses. However, Typeset.io and Scholarcy had relatively higher SDs (1.19 and 1.15, respectively), reflecting diverse usage patterns, possibly due to differences in exposure or individual preferences. Overall, the findings indicate a strong level of engagement with AI tools, especially those offering general academic support. Tools with lower adoption rates may require better orientation, training, or demonstration of their utility in academic contexts. These insights highlight the importance of digital literacy and institutional support in enhancing the effective use of AI in higher education.

Research Question Three: What are the perceived barriers that hinder the utilization of AI tools by pre-service teachers in Nigerian College of Education?

Table 3 presents the perceived barriers to the utilization of artificial intelligence (AI) tools by pre-service teachers in Nigerian College of Education. The findings reveal that most of the listed barriers were disagreed with by the respondents, as indicated by their mean scores being below the cut-off of 2.50. Only one item—*cost and accessibility*—received a mean score ($\bar{X}$ = 2.52, SD = 0.955) in the "Agree" category, suggesting that financial constraints and limited access to AI tools remain the most salient barrier among pre-service teachers. This is consistent with earlier findings in developing contexts where affordability, limited digital infrastructure, and inequitable access hinder technology adoption (UNESCO, 2023; Onuoha & Oyeniran, 2022). The remaining barriers, including *bias and fairness* ($\bar{X}$ = 2.10), *data privacy and security concerns* ($\bar{X}$ = 2.02), *complexity and usability* ($\bar{X}$ = 2.25), *overdependence on technology* ($\bar{X}$ = 2.38), *ethical considerations* ($\bar{X}$ = 2.47), *issues with quality of output* ($\bar{X}$ = 2.47), and *balancing AI tools with conventional research techniques* ($\bar{X}$ = 2.23), all fall under the "Disagree" (D) category. This implies that, generally, pre-service teachers do not view these as significant hindrances to their use of AI tools.

Table 3. Perceived Barriers to AI Tools Utilization

S/N	Item Statement	$\bar{X}$	SD	Dec
1	Bias and fairness	2.10	1.057	D
2	Data privacy and security concerns	2.02	0.934	D
3	Complexity and usability	2.25	0.993	D
4	Leads to overdependence on technology	2.38	1.032	D
5	Ethical considerations	2.47	0.979	D
6	Cost and accessibility	2.52	0.955	A
7	Issues with quality of output	2.47	1.003	D
8	Balancing AI tools with conventional research techniques	2.23	1.043	D

Key: N = Number of respondents, $\bar{X}$ = mean, SD = Standard Deviation, A = Agree, Dec. = Decision, D =

Disagree

Interestingly, the relatively low concern for *bias, fairness, ethics, and privacy* might indicate limited awareness or engagement with the deeper implications of AI usage in education. These issues are widely discussed in global AI ethics discourse (Jobin et al., 2019; Kasneci et al., 2023) but may not yet be integrated into Nigerian teacher education curricula or policy discussions. The disagreement with *complexity and usability* ($\bar{X} = 2.25$) and *balancing AI with conventional research* ($\bar{X} = 2.23$) suggests that most pre-service teachers find AI tools generally user-friendly and manageable. This may reflect the increasing popularity and intuitive design of educational AI platforms like ChatGPT and Quillbot. In summary, the findings suggest that while cost and accessibility remain key obstacles, other commonly cited global concerns related to AI use, such as ethics, privacy, bias, and usability, are not widely perceived as barriers among Nigerian pre-service teachers. This highlights a potential gap in critical digital literacy that needs to be addressed through targeted policy, training, and curriculum design.

Discussion

The findings of research question one reveal high level of awareness of ChatGPT among respondents. The finding aligns with the observations of Kasneci et al. (2023) and Aydin (2023), who documented the rapid uptake of ChatGPT in educational contexts globally due to its intuitive design and capacity to support learning tasks such as writing assistance, summarization, and tutoring. This reflects what OECD (2023) describes as the democratization of AI access, where certain tools become ubiquitous due to their low barriers to entry and wide public exposure. Beyond ChatGPT, the study reveals only moderate awareness of other powerful AI tools like QuillBot, Consensus, Scite, Jenni, and Paperpal, and very low awareness of ChatPDF. This finding is consistent with Zawacki-Richter et al. (2019) who argue that educators are increasingly aware of AI in general but they often lack in-depth understanding of the diverse tools and their pedagogical affordances. Similarly, Holmes et al. (2022) emphasized that teacher education programs are yet to systematically integrate AI competencies, which may explain the knowledge gap observed in this study. The findings also echo concerns raised by UNESCO (2023) and Shiohira & Dale-Jones (2022) that AI integration in African teacher education remains inconsistent and lacks policy-driven frameworks. The barriers revealed—particularly the lack of exposure to a wide range of AI tools—reflect broader infrastructural and curricular limitations in Nigerian College of Education. As Adeleke and Olayemi (2021) argue, unequal access to digital tools and training deepens the knowledge divide, making it difficult for many pre-service teachers to benefit fully from emerging technologies.

The findings of research question two reveal the important insights into the utilization of AI tools by pre-service teachers in Nigerian College of Education and confirm many patterns observed in the existing literature. The high level of utilization of ChatGPT (Mean = 3.67, SD = 0.71) supports prior studies by Kasneci et al. (2023) and Aydin (2023), which highlight ChatGPT's widespread adoption due to its versatility, accessibility, and relevance to students' academic tasks such as summarization, writing, and problem-solving. As highlighted by Zawacki-Richter et al. (2019), tools that are intuitive and widely publicized tend to gain traction faster, especially in environments where digital literacy is still developing. However, the study reveals that other equally potent tools—such as Consensus, Quillbot, Litmaps, Elicit, and Scite—were not utilized to a great extent by pre-service teachers (mean scores ranging from 2.88 to 3.15, categorized as “No Extent of Application”). This gap between awareness and actual use is consistent with literature emphasizing the digital divide in higher education. Holmes

et al. (2022) noted that while students might be aware of emerging technologies, their meaningful use is often hindered by limited institutional support, poor integration into the curriculum, and lack of faculty guidance. Similarly, Shiohira and Dale-Jones (2022) and UNESCO (2023) stress that without systematic policy support and infrastructure, teacher education systems in the Global South often fail to equip future educators with the necessary skills to leverage AI for pedagogical transformation. This usage pattern aligns with concerns raised by Adeleke and Olayemi (2021) regarding the uneven exposure of Nigerian teacher trainees to advanced educational technologies. The findings suggest that despite growing global trends in AI integration, many teacher education programs in Nigeria have not yet moved beyond basic awareness campaigns to actual implementation of AI-enhanced learning strategies. This contributes to a digital competence gap that could hinder future teachers from maximizing the affordances of AI for curriculum development, student assessment, and personalized instruction. The findings of research question two reveal that ChatGPT emerged as the most widely used AI tool ($\bar{x} = 3.67$, $SD = 0.71$), a finding that is consistent with recent studies emphasizing its broad application in academic environments (Dwivedi et al., 2023; Kasneci et al., 2023). Its high adoption rate may be attributed to its versatility in supporting a range of academic activities—from generating ideas and drafting content to providing real-time feedback and answering research-related queries. This corroborates the argument that conversational AI tools are becoming indispensable in fostering digital literacy and academic confidence among learners (Qadir & Imran, 2023). In contrast, ChatPDF recorded the lowest mean score ($\bar{x} = 2.46$), indicating low or negligible utilization. This suggests limited awareness or a perception of low utility among pre-service teachers, despite the tool's relevance for summarizing and extracting content from academic documents. This underutilization reflects a digital divide and highlights gaps in exposure, training, or institutional promotion—issues also raised by Zawacki-Richter et al. (2019) and reaffirmed by Ali et al. (2022), who argue that the effective use of AI tools requires not just availability but also strategic integration into teacher education curricula. Moderate usage was observed for tools such as Consensus, Bit AI, and Wordvice AI, while tools like Scite, Quillbot, Jenni, Paperpal, and Elicit were utilized to a great extent (mean scores ranging from 3.01 to 3.15). These tools offer services such as literature synthesis, paraphrasing, grammar refinement, and AI-driven editing all of which are aligned with academic tasks commonly undertaken by pre-service teachers. Their significant use underscores the alignment between perceived functionality and academic relevance, which the literature describes as a key driver of technology adoption (Alshahrani & Ally, 2017). The findings thus underscore the urgent need to embed structured digital literacy training in teacher education programs, with a focus on responsible and ethical AI use, academic integrity, and inclusive access. In conclusion, while the data demonstrate encouraging levels of AI tool utilization particularly with widely accessible platforms like ChatGPT the variation in tool-specific usage highlights critical gaps in awareness, training, and support. Bridging these gaps through digital skills initiatives and curriculum redesign is essential for preparing future teachers to thrive in tech.

The findings of research question three reveal pre-service teachers' perceptions of barriers toward the usage of Artificial Intelligence (AI) tools for educational purposes in Nigerian College of Education. Remarkably, the results show that most respondents disagreed with statements suggesting that common global concerns such as bias, fairness, data privacy, ethical issues, and complexity constitute significant barriers to their use of AI tools. However, cost and accessibility emerged as the only barriers that respondents agreed to be a considerable challenge. This pattern of responses contrasts with findings from existing literature. Scholars such as Kasneci et

al. (2023) and Holmes et al. (2022) have highlighted the ethical risks, potential biases, and data security concerns associated with AI adoption in educational contexts. These studies argue that such issues may erode trust in AI tools and impede their integration into pedagogical practices. The relatively low concern expressed by Nigerian pre-service teachers regarding these dimensions could indicate a limited level of critical engagement with the broader implications of AI, which may stem from gaps in digital literacy training within teacher education programmes (Shiohira & Dale-Jones, 2022). Moreover, the disagreement with statements on complexity and usability suggests that many pre-service teachers perceive AI tools as easy to use, which is promising for future integration. The design of tools such as ChatGPT, Quillbot, and Jenni has been intentionally made user-friendly, reducing the learning curve and encouraging broader usage (Zawacki-Richter et al., 2019). This is an encouraging sign for the digital readiness of future educators, indicating potential for these tools to be embedded into instructional design with minimal resistance. However, the consistent agreement with cost and accessibility as a barrier underscores the digital divide still prevalent in many parts of Nigeria. Access to high-speed internet, modern devices, and affordable subscriptions to premium AI platforms remains a major limitation (Onuoha & Oyeniran, 2022). Without addressing these infrastructural and socioeconomic barriers, equitable AI integration in education remains unattainable. Furthermore, the general lack of concern for overdependence on AI tools suggests a growing normalization of technology in academic work, especially among digital-native pre-service teachers. However, this raises concerns about a potential erosion of critical thinking and originality if AI tools are used as a substitute rather than a support for academic tasks (Holmes et al., 2022). In conclusion, while pre-service teachers are largely open and optimistic about AI tool usage, there is a clear need to enhance their critical awareness of the ethical, pedagogical, and epistemological implications of these technologies. Future teacher education programs must incorporate AI ethics, data literacy, and reflective practice while also addressing infrastructural barriers to ensure inclusive access.

Conclusion

This study examined Nigerian pre-service teachers' awareness, utilization, and perceived barriers to the use of AI tools for educational purposes. The findings reveal several key insights:

1. Pre-service teachers demonstrated varying levels of awareness of AI tools. High awareness was recorded for widely known tools such as ChatGPT, while awareness was lower for specialized tools like ChatPDF and Elicit. This indicates that while popular tools have penetrated the education sector, many innovative AI research and writing tools remain underutilized due to limited exposure.
2. The findings show that while tools like ChatGPT and ChatPDF are used frequently, the majority of other AI tools are only moderately utilized. This suggests that usage is heavily concentrated around a few tools, possibly due to user-friendliness and publicity. However, the limited use of other tools may reflect a lack of training, understanding, or relevance to their perceived needs.
3. The study found that pre-service teachers did not see most ethical, usability, or data security concerns as significant barriers. However, cost and accessibility emerged as the most pressing challenge. This suggests that infrastructural limitations rather than conceptual resistance hinder adoption. Additionally, the minimal concern over ethical implications may point to a lack of critical digital literacy in current teacher training programs. Overall, the results highlight a gap between the potential of AI tools to

transform education and the actual capacity and preparedness of future teachers to leverage them effectively.

Recommendations

In light of these study findings, the following recommendations are proposed to enhance the effective awareness, utilization, and responsible integration of Artificial Intelligence (AI) tools in teacher education programmes:

1. Teacher education institutions should incorporate AI literacy into their curricula. This should include both theoretical foundations and practical applications of various AI tools for academic and instructional purposes.
2. Regular capacity-building workshops, training sessions, and webinars should be organized to expose pre-service teachers to a wide range of AI tools. These practical engagements will help demystify the technologies and build confidence in their use.
3. Colleges of Education should explore institutional licenses or partnerships with AI tool providers to reduce cost barriers and increase access to premium functionalities, especially for research and writing-related applications.
4. Government and institutional policymakers must prioritize the improvement of ICT infrastructure, including reliable internet access, hardware availability, and digital learning environments, particularly in public institutions.
5. Learning communities or student-led forums should be encouraged to promote the exchange of knowledge and experiences regarding AI tool usage, thereby fostering a collaborative and supportive learning culture.
6. Ethical considerations, including issues of bias, data privacy, academic integrity, and responsible use, should be embedded into teaching modules. This will help pre-service teachers use AI tools thoughtfully and in line with professional and academic standards.

Statements and Declarations

Acknowledgments/Notes: Not applicable.

During the preparation of this article, the authors did not use ChatGPT.

Supplementary Materials: Not applicable.

Author Contributions: The authors have read and agreed to the published version of the manuscript.

Funding: The authors received no funding for the research.

Data Availability: Not applicable.

Ethics Approval: The study was performed in accordance with the study protocol and ethical guidelines and regulations.

Informed Consent: Data were gathered from university students with informed consent. The IRB has approved the use of the data.

Conflicts of Interest: All authors declare that they have no conflicts of interest.

References

- Adebayo, F. O., & Yusuf, . O. (2023). Challenges of technology integration in Nigerian teacher education institutions. *Nigerian Journal of Educational Technology*, 17(2), 45–58.
- Adeleke, A. A., & Olayemi, A. (2021). Challenges of integrating artificial intelligence into teacher education in Nigeria. *Nigerian Journal of Educational Technology*, 15(2), 33–46.
- Afolabi, A. O., Ogunyemi, B. T., & Ilesanmi, S. A. (2023). Artificial intelligence in education: Prospects and pitfalls in Sub-Saharan Africa. *International Journal of Educational Technology in Africa*, 8(1), 21–34.
- Akinbo, B. R., Eze, S. C., & Afolayan, O. A. (2023). Exploring AI tools for innovative teaching in Nigerian higher education. *Journal of Emerging Technologies in Learning*, 11(3), 52–65.
- Asongo, A. A., Okafor, E. N., & Bello, K. A. (2024). Awareness and utilization of artificial intelligence tools among educators in Nigerian universities. *Nigerian Journal of Teacher Education and Development*, 9(1), 14–27.
- Aydin, S. (2023). ChatGPT in education: Potential and concerns. *International Journal of Educational Technology in Higher Education*, 20(1), 15. <https://doi.org/10.1186/s41239-023-00418-5>
- Bello, A. A., & Olanrewaju, F. A. (2022). Digital learning and AI tools in Nigerian universities: A survey of pre-service teacher perspectives. *African Journal of Technology in Education*, 10(1), 33–48.
- Holmes, W., Bialik, M., & Fadel, C. (2022). *Artificial intelligence in education: Promises and implications for teaching and learning*. Center for Curriculum Redesign. <https://curriculumredesign.org/wp-content/uploads/AI-in-Education.pdf>
- Kasneci, E., Sessler, K., Küchenhoff, H., Bannert, M., & Fischer, F. (2023). ChatGPT for good? On opportunities and challenges of large language models for education. *Learning and Individual Differences*, 103, 102274. <https://doi.org/10.1016/j.lindif.2023.102274>
- Kirkwood, A., & Price, L. (2014). Technology-enhanced learning and teaching in higher education: What is 'enhanced' and how do we know? A critical literature review. *Learning, Media and Technology*, 39(1), 6–36. <https://doi.org/10.1080/17439884.2013.770404>
- Koehler, M. J., & Mishra, P. (2009). What is technological pedagogical content knowledge? *Contemporary Issues in Technology and Teacher Education*, 9(1), 60–70.
- Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record*, 108(6), 1017–1054.
- OECD. (2023). *Artificial intelligence in education: Challenges and opportunities for sustainable development*. OECD Publishing. <https://www.oecd.org/education/artificial-intelligence-in-education.pdf>

- Onuoha, C., & Oyeniran, J. O. (2022). The digital divide in Nigeria: Implications for equitable access to e-learning and AI tools in tertiary education. *Journal of African Educational Research*, 5(2), 21–35.
- Premium Times. (2025, March 12). Experts advocate AI-driven curriculum to transform Nigeria's education system. <https://www.premiumtimesng.com/news/top-news/787060-expert-advocates-ai-driven-curriculum-to-transform-nigerias-education-system.html>
- Rogers, E. M. (2003). *Diffusion of innovations* (5th ed.). Free Press.
- Shiohira, K., & Dale-Jones, B. (2022). *AI and the futures of education: Towards a policy framework*. UNESCO. <https://unesdoc.unesco.org/ark:/48223/pf0000381137>
- Shulman, L. S. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher*, 15(2), 4–14.
- Spurs Media. (2024, January 10). Artificial intelligence in Nigerian education: Opportunities and challenges. <https://spursmedia.com/artificial-intelligence-in-education/>
- Sultan, S., Boateng, F., & Amankwah, P. (2024). Pre-service teachers' perceptions and use of AI tools in Ghanaian universities. *African Journal of Educational Technology*, 6(1), 33–49.
- The Guardian Nigeria. (2025, February 27). FG trains 6000 teachers in AI pedagogy. <https://guardian.ng/news/fg-trains-6000-teachers-in-ai-pedagogy/>
- UNESCO. (2021). *AI and education: Guidance for policy-makers*. <https://unesdoc.unesco.org/ark:/48223/pf0000376709>
- UNESCO. (2022). *Reimagining our futures together: A new social contract for education*. <https://unesdoc.unesco.org/ark:/48223/pf0000379707>
- UNESCO. (2023). *Guidance for generative AI in education and research*. <https://unesdoc.unesco.org/ark:/48223/pf0000385587>
- Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2019). Systematic review of research on artificial intelligence applications in higher education: Where are the educators? *International Journal of Educational Technology in Higher Education*, 16(1), 1–27. <https://doi.org/10.1186/s41239-019-0171-0>
- Zhai, X., Chu, H. E., Wang, M., & Han, Y. (2023). AI and the TPACK framework: Implications for teacher education in the digital era. *British Journal of Educational Technology*, 54(1), 45–60. <https://doi.org/10.1111/bjet.13292>