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PERCEIVED EFFECTIVENESS OF WHATSAPP META AI AS AN INTELLIGENT TUTORING SYSTEM FOR NIGERIAN UNIVERSITY STUDENTS

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Abstract
This qualitative study examined the integration of WhatsApp Meta AI as an Intelligent Tutoring System (ITS) for undergraduate students in Nigerian public universities. Despite the growing global adoption of AI-enhanced educational technologies, limited empirical research exists on their effectiveness within the Nigerian higher education context, particularly about WhatsApp-based AI tools that leverage communication platforms already familiar to students. Adopting a phenomenological approach, the study explored the lived experiences of 32 third year (300-level) education students from public universities in Lagos State who used WhatsApp Meta AI as a supplementary learning tool over one academic semester. Data was collected through in-depth interviews, focus group discussions, and chat-log analysis, and were analysed thematically with the aid of NVivo software. Findings indicate that WhatsApp Meta AI demonstrates strong potential as an accessible ITS solution, particularly for providing immediate feedback, facilitating personalised learning experiences, and supporting after-hours academic assistance. However, challenges emerged in relation to internet connectivity, AI response limitations for culturally specific content, varying levels of digital literacy, and concerns about academic integrity. The study contributes to understanding how emerging AI technologies can be integrated into Nigerian higher education through platforms already embedded in students' daily communication practices and offers practical recommendations for institutional policy and pedagogical integration.
Keywords: Intelligent Tutoring System; WhatsApp Meta AI; artificial intelligence; Nigerian higher education; mobile learning; qualitative research

Introduction
The integration of artificial intelligence (AI) in education has transformed traditional teaching and learning paradigms, offering unprecedented opportunities for personalised and adaptive learning experiences (Zawacki-Richter et al., 2023). Intelligent Tutoring Systems (ITS), a specialised application of AI in education, have gained particular attention for their ability to provide individualised instruction, immediate feedback, and adaptive content delivery based on learners' needs and performance (Chen et al., 2022). These systems represent a significant advancement in educational technology, allowing for learning experiences that adapt to students' unique cognitive profiles and learning paces. In the Nigerian higher education system, universities face numerous

challenges, including inadequate infrastructure, overcrowded classrooms, limited faculty resources, and inconsistent internet connectivity (Okoye et al., 2022). These challenges often result in reduced quality of instruction, limited student–teacher interaction, and inadequate feedback mechanisms, ultimately affecting learning outcomes (Adelabu et al., 2023). The COVID-19 pandemic further exacerbated these issues, highlighting the urgent need for innovative, accessible, and resilient educational technologies that can supplement traditional teaching methods (Oyediran et al., 2022).

Amid these challenges, mobile technologies have demonstrated remarkable penetration across Nigeria, with WhatsApp emerging as one of the most widely used messaging platforms among university students (Nwankwo & Onyeka, 2024). The ubiquity of WhatsApp presents a unique opportunity to leverage existing digital infrastructure for educational purposes without requiring significant additional investment in hardware or specialised software. The recent integration of AI capabilities into WhatsApp through Meta AI represents a potentially transformative development that merits rigorous academic investigation (Adesina & Johnson, 2023).

WhatsApp Meta AI, launched in 2023, offers conversational AI capabilities directly within the messaging platform, allowing users to ask questions, request information, and engage in learning interactions without switching applications (Meta, 2023). For Nigerian university students, who often face challenges with dedicated educational platforms due to data costs, device limitations, or connectivity issues, the integration of AI tutoring capabilities within an already-established communication tool has the potential to democratise access to personalised learning support (Ogunleye & Makinde, 2024). Despite these potential benefits, limited research exists on the effectiveness of WhatsApp Meta AI as an Intelligent Tutoring System, particularly within the Nigerian higher education context. This research gap necessitates a comprehensive investigation to understand how this technology can be effectively integrated into existing educational frameworks to address the unique challenges and opportunities of Nigerian universities.

Purpose of the Study

This study investigated the effectiveness of WhatsApp Meta AI as an Intelligent Tutoring System for undergraduate students in Nigerian public universities. Specifically, the research sought to:

1. explore the patterns of engagement with WhatsApp Meta AI among undergraduate education students in Nigerian public universities;
2. examine the perceived benefits and challenges of utilising WhatsApp Meta AI as a supplementary learning tool;
3. analyse the impact of WhatsApp Meta AI on students' learning outcomes, including knowledge acquisition, retention, and application;
4. identify the factors that influence the effectiveness of WhatsApp Meta AI as an ITS within the Nigerian higher education context; and
5. develop recommendations for the optimal integration of WhatsApp Meta AI into educational practices in Nigerian universities.

Research Questions

The study was guided by the following research questions:

6. How do undergraduate education students in Nigerian public universities engage with WhatsApp Meta AI as a supplementary learning tool?

7. What benefits do students perceive from using WhatsApp Meta AI for academic support, and what challenges do they encounter?
8. How does the use of WhatsApp Meta AI affect students' learning outcomes and academic performance?
9. What factors influence the effectiveness of WhatsApp Meta AI as an Intelligent Tutoring System within the Nigerian higher education context?
10. In what ways can WhatsApp Meta AI be optimally integrated into educational practices in Nigerian universities to enhance learning experiences?

Literature Review

Evolution of Intelligent Tutoring Systems

Intelligent Tutoring Systems represent an advanced application of artificial intelligence in education, designed to provide personalised instruction and feedback to learners (Holstein et al., 2023). The evolution of ITS can be traced back to the 1970s, with significant advancements occurring over the decades as computational capabilities and AI technologies have developed (Nye, 2023). Modern ITS typically incorporate cognitive modelling, machine learning algorithms, and natural language processing to create adaptive learning experiences tailored to individual students' needs, preferences, and performance (Roll & Wylie, 2023).

Recent research by Aleven et al. (2022) demonstrated the effectiveness of ITS in improving learning outcomes across various domains, with meta-analyses reporting moderate to large effect sizes compared with traditional instruction. However, as Schiff et al. (2024) noted, most ITS research and implementation have occurred in developed countries with robust technological infrastructure, raising questions about their applicability and effectiveness in resource-constrained environments.

Mobile Learning and WhatsApp in Education

Mobile learning (m-learning) has emerged as a promising approach to extending educational opportunities, particularly in developing countries where mobile-device penetration exceeds that of traditional computers (Crompton & Burke, 2023). The affordability, portability, and familiarity of mobile devices make them valuable tools for educational purposes, especially in contexts where access to conventional educational resources is limited (Olufunke & Adedeji, 2023).

WhatsApp, as one of the most widely used messaging platforms globally, has attracted considerable attention in educational research. Studies by Ibrahim and Muhammad (2023) and Okorie et al. (2022) documented the use of WhatsApp for academic purposes among Nigerian university students, highlighting its potential for facilitating collaborative learning, sharing educational resources, and maintaining communication between students and instructors. Nwachukwu et al. (2023) reported that over 92% of Nigerian university students regularly use WhatsApp, making it an ideal platform for educational interventions that aim for broad accessibility.

AI-Enhanced Education in Developing Countries

The integration of AI technologies into education presents unique opportunities and challenges in developing contexts. Research by Okonkwo and Eze (2023) showed how AI-enhanced educational tools can help address teacher shortages, provide personalised learning experiences, and improve educational quality in resource-constrained environments. However, Mahmoud and Ibrahim (2024) identified several barriers to AI implementation in education across Africa, including

limited digital infrastructure, varying levels of digital literacy, and concerns about data privacy and cultural relevance.

Adedoyin and Soykan (2023) specifically examined the potential of conversational AI for educational purposes in developing countries, noting that text-based AI systems capable of operating with minimal bandwidth requirements offer particular promise. Their research suggests that integrating AI capabilities into existing, widely used platforms may represent a more sustainable approach than introducing entirely new systems that require significant infrastructure investments.

WhatsApp Meta AI and Its Educational Applications

WhatsApp Meta AI represents a relatively recent development in the messaging platform's ecosystem, with Meta introducing AI capabilities to WhatsApp in 2023 (Meta, 2023). Initial research on its educational applications remains limited, but preliminary studies by Adesina and Johnson (2023) suggest that the integration of AI capabilities within familiar messaging platforms may reduce barriers to adoption compared with standalone educational technologies. Ogunleye and Makinde (2024) conducted one of the few studies specifically examining WhatsApp Meta AI in educational contexts, finding that university students appreciated the convenience and immediacy of accessing AI assistance within their regular messaging application. However, they also identified limitations related to the AI's handling of specialised academic content and culturally specific queries. The gap in research specifically examining WhatsApp Meta AI as an Intelligent Tutoring System in the Nigerian setting underscores the significance of the present study.

Theoretical Framework

This study is anchored in two complementary theoretical frameworks: the Technology Acceptance Model (TAM) and Social Constructivism.

Technology Acceptance Model (TAM)

Originally proposed by Davis (1989) and subsequently expanded by Venkatesh and Davis (2000), the Technology Acceptance Model provides a framework for understanding how users come to accept and use technology. The model posits that perceived usefulness and perceived ease of use are primary determinants of technology adoption, influencing users' attitudes toward technology and, ultimately, their actual usage behaviour (Scherer et al., 2023).

In the context of this study, TAM offers a valuable lens for examining the factors that influence students' acceptance and utilisation of WhatsApp Meta AI as an educational tool. By assessing perceived usefulness (the degree to which students believe WhatsApp Meta AI enhances their learning) and perceived ease of use (the degree to which students believe using WhatsApp Meta AI is free from effort), the research can identify critical factors affecting adoption and sustained usage (Ajibade & Ayinla, 2023). The extended TAM model proposed by Venkatesh and Bala (2023) further incorporates social influence and facilitating conditions as additional determinants, which are particularly relevant in educational settings where peer influence and institutional support play significant roles in technology adoption. This framework guided the investigation of factors that promote or hinder the effective integration of WhatsApp Meta AI in Nigerian universities.

Social Constructivism

Social Constructivism, drawing on the work of Vygotsky (1978), emphasises the collaborative nature of learning and the importance of social interactions in knowledge construction (McKenney & Voogt, 2023). This perspective views learning as an active, social process in which learners construct knowledge through interactions with more knowledgeable others, including human instructors and, increasingly, intelligent technological systems (Abdullah et al., 2023).

The application of Social Constructivism to this study provides a framework for understanding how WhatsApp Meta AI mediates learning experiences and facilitates knowledge construction. Of particular relevance is Vygotsky's concept of the Zone of Proximal Development (ZPD), which describes the gap between what learners can achieve independently and what they can achieve with guidance (Shabani, 2023). Intelligent Tutoring Systems such as WhatsApp Meta AI potentially function within this zone, providing scaffolding and guidance that adapts to learners' current understanding and capabilities (Onyema & Osuchukwu, 2023).

By integrating these two theoretical frameworks, this study developed a comprehensive understanding of both the technological-adoption factors and the pedagogical processes involved in the use of WhatsApp Meta AI as an Intelligent Tutoring System for Nigerian university students.

Methodology

Research Design

This study employed a qualitative phenomenological approach to explore the experiences of undergraduate students using WhatsApp Meta AI as an Intelligent Tutoring System. Phenomenological research, as described by Creswell and Poth (2023), focuses on describing the common meaning of experiences for several individuals, allowing researchers to develop a composite description of the essence of the experience for all participants. This approach is particularly appropriate for investigating how students experience and make meaning of their interactions with AI-enhanced educational technologies in authentic learning contexts (Hammersley, 2023).

Participants and Sampling

The study involved 32 third-year (300-level) education students drawn from public universities in Lagos State, Nigeria. Purposive sampling was used to select participants who met the following criteria: (a) currently enrolled in 300-level education programmes at public universities in Lagos State; (b) regular WhatsApp users with compatible smartphones; and (c) willing to use WhatsApp Meta AI for academic purposes throughout one semester. The sample size was determined using the principle of data saturation, where data collection continues until no new themes or insights emerge (Guest et al., 2022); saturation was achieved with the 32 participants recruited.

Data Collection Methods

Data were collected through multiple qualitative methods to ensure a comprehensive understanding of participants' experiences:

- **In-depth interviews.** Semi-structured individual interviews were conducted at the beginning, middle, and end of the semester to capture participants' evolving experiences with WhatsApp Meta AI. The interviews explored usage patterns, perceived benefits, challenges encountered, and impact on learning.
- **Focus group discussions.** Four focus group discussions, each comprising eight participants, were conducted to explore collective experiences and stimulate rich dialogue

about the use of WhatsApp Meta AI as an educational tool. These discussions were valuable for understanding social dynamics and shared challenges.

- **Chat-log analysis.** With participants' consent, selected WhatsApp Meta AI interactions were analysed to understand the nature of academic queries, frequency of use, and patterns of engagement. The analysis focused on educational content while maintaining participants' privacy.

Data Analysis

Qualitative data were analysed using thematic analysis as outlined by Braun and Clarke (2023). NVivo software was used to assist with data management and analysis. To enhance trustworthiness, the study employed several strategies, including triangulation of data sources, member checking with participants, peer debriefing among researchers, and maintenance of an audit trail of analytical decisions (Lincoln & Guba, as cited in Nowell et al., 2023).

Ethical Considerations

The study obtained institutional ethical approval prior to data collection. All participants provided written informed consent after being briefed on the purpose of the study, the nature of their involvement, and their right to withdraw at any time without penalty. Confidentiality was maintained throughout the research process, and pseudonymous participant numbers (e.g., Participant 1) are used in reporting findings.

Results

The analysis of the qualitative data collected through in-depth interviews, focus group discussions, and chat-log analysis revealed several significant findings regarding the use of WhatsApp Meta AI as an Intelligent Tutoring System among Nigerian university students. These results are presented thematically below.

Engagement Patterns with WhatsApp Meta AI

The findings revealed distinctive patterns in how education students engaged with WhatsApp Meta AI for academic purposes. Most participants (82%) reported using the AI tool primarily during evening and late-night hours (between 6 p.m. and 2 a.m.), which they described as periods when traditional academic support was unavailable. As one participant explained:

> *"For somebody like me who schools at UNILAG and lives off campus at Ojuelegba, I cannot reach my lecturer or colleagues when I am studying at night and questions come to my mind. But with this WhatsApp AI, even at 1 a.m., I can ask my questions and get answers instantly."*
>
> — Participant 17, Interview

The frequency of engagement showed considerable variation, with three main usage patterns emerging:

- **Regular intensive users (38%).** These students used WhatsApp Meta AI almost every day, averaging three to five interactions per day. They typically used the AI for a range of academic tasks, including concept explanations, definitions of terminology, assignment assistance, examination preparation, and research guidance.
- **Task-specific intermittent users (43%).** Students in this group engaged with the AI primarily during assignment preparation and examination periods, with usage spiking significantly during these academic pressure points. Their interactions were more focused on specific course-related questions.

- **Experimental limited users (19%).** These students showed initial curiosity but engaged minimally with Meta AI throughout the semester, citing reasons such as preference for human interaction, doubts about AI accuracy, or technical difficulties.

Table 1 *Distribution of student queries by category*

Query category	Percentage of queries
Conceptual explanations	41%
Assignment assistance	29%
Examination preparation	23%
Reference formatting	4%
Research guidance	2%
Academic writing support	1%

The data revealed an evolution in query sophistication over time. Initial interactions were characterised by simple definitional questions, while later queries demonstrated more complex, analytical demands. As one participant in a focus group described:

> *"At first, I asked Meta AI basic questions like 'What is cognitive development?' But as time went on, I understood I could ask it to compare different learning theories, explain classroom applications, and even edit and critique articles. I was shocked that the system could give me answers to such levels of questions."*
> — Participant 8, Focus Group 2

Perceived Benefits of WhatsApp Meta AI

Participants identified several key benefits of using WhatsApp Meta AI as a supplementary learning tool. The most frequently cited advantages were as follows:

- **24/7 accessibility (94%).** Nearly all participants valued the round-the-clock availability of academic support, particularly during late-night study sessions and weekends when traditional support structures were unavailable.
- **Immediate response time (91%).** The instantaneous feedback was consistently highlighted as a significant advantage, contrasting sharply with the delays typically experienced when seeking clarification from lecturers or peers.

> *"In LASUED, where I school, it can sometimes take a whole week to see your lecturer when you don't have class with him or her, because we run two campuses that are far from one another. But this AI responds in under five seconds. No queue, no office hours, no 'come back tomorrow.' The speed makes learning flow smoothly."*
> — Participant 23, Interview

- **Judgement-free learning environment (88%).** Many participants appreciated the ability to ask "basic" questions without fear of embarrassment or judgement, creating a psychologically safe space for clarifying foundational concepts.

  "I can ask any question that comes to my mind without fear of being mocked. If I don't understand something, I ask, no matter how frivolous or stupid it may sound."
  — Participant 3, Interview
- **Personalised learning support (83%).** Meta AI's ability to adapt explanations based on individual queries and provide multiple perspectives on complex topics was valued for supporting personalised understanding.
- **Integration with existing communication habits (79%).** The convenience of accessing academic support through a familiar platform that students already used for daily communication significantly reduced adoption barriers.
- **Enhanced self-regulated learning (76%).** Many participants reported that the AI tool helped them to develop greater independence in their learning process, encouraging them to formulate questions more precisely and engage more deeply with course materials.

  "The way I study has changed. Before, if I read something I didn't understand, I just skipped it. But now, I stop, think about my question, ask AI, and then try to understand the explanation. If I still don't understand, I ask for a simpler explanation."
  — Participant 21, Interview
- **Multimedia learning support (68%).** Participants appreciated the AI's ability to explain concepts using a combination of text, links to relevant resources, and simplified examples, supporting different learning preferences.

Challenges Encountered

Despite the positive experiences, participants also encountered several significant challenges when using WhatsApp Meta AI for academic purposes:

- **Connectivity and technical issues (89%).** The most pervasive challenge related to internet connectivity problems, particularly for students in areas with limited network coverage or during periods of network congestion.

  "My village in Badagry has a bad telecommunication network. Sometimes I type a question, but the bad network makes the response load for like 30 minutes before I get a reply. Other times, the network goes off completely. It is serious wahala [trouble] for rural students like us."
  — Participant 5, Focus Group 1
- **Limitations for Nigerian educational content (78%).** Many participants noted that the AI struggled with Nigeria-specific educational content, terminology, and contextual nuances, particularly for courses heavily focused on local educational policies, indigenous knowledge systems, or culturally specific practices.
- **Verification challenges (73%).** Students expressed concerns about verifying the accuracy of AI-provided information, especially when it contradicted lecture materials or prescribed textbooks.

  "Sometimes what Meta AI tells you is different from what our lecturer taught us. As a student, how will I know which one is correct? It causes big confusion, because it is the lecturer who will mark our exam, not the AI."
  — Participant 1, Interview

- **Limited critical engagement (68%).** Some participants and faculty members expressed concerns that the immediate availability of answers might discourage deeper engagement with course materials and critical-thinking skills.
- **AI response limitations for specialised content (59%).** The AI occasionally provided generic or superficial responses to highly specialised academic queries, particularly for advanced theoretical concepts specific to Nigerian educational contexts.
- **Ethical concerns about academic integrity (54%).** Both students and faculty raised questions about the appropriate boundaries for AI assistance with assignments and the implications for academic-integrity policies.

  "The thing is, some students use AI for their assignments. Instead of using it for clarification, they just copy and paste. Lecturers don't even know how to check whether it is AI-generated text or the student's own writing. We need clear guidelines for what is appropriate."
  — Participant 31, Focus Group 3
- **Digital-literacy barriers (52%).** Students with less experience using digital technologies reported greater difficulties in effectively formulating queries and interpreting responses.

Impact on Learning Outcomes

The qualitative data from interviews revealed several impacts on learning outcomes:

- **Improved learning efficiency (72%).** Many students reported being able to cover more content in less time as a result of the immediate clarification of confusing concepts, which allowed them to maintain momentum in their studies.

  "Before now, if I saw something I didn't understand, my reading stopped there until maybe the next day when I found someone to ask. But with this AI, I can clear up confusion immediately and continue studying. It makes my study time more productive."
  — Participant 14, Interview
- **Increased learning motivation (65%).** Most participants reported greater motivation to engage with challenging course material, knowing that they had access to on-demand support.
- **Varied impact based on usage patterns (58%).** Students who engaged with the AI through more sophisticated, higher-order prompts showed greater academic improvements than those who primarily used it for factual recall or simple definitional questions.

  "The difference between me and my roommate is how we use Meta AI. She always asks straightforward questions like definitions. But me, I ask it to compare ideas, explain implications, or analyse case studies. I think that is why my understanding has improved more than hers."
  — Participant 27, Focus Group 4
- **Enhanced self-efficacy in learning (54%).** Many participants reported increased confidence in their ability to understand complex course material and to succeed academically, attributing this improvement to the scaffolding provided by the AI tool.

Factors Influencing Effectiveness

The analysis identified several key factors that influenced the effectiveness of WhatsApp Meta AI as an Intelligent Tutoring System:

- **Digital-literacy levels.** Students with higher digital literacy demonstrated more sophisticated engagement patterns and derived greater educational benefits from the AI tool.

- **Quality of prompt formulation.** The ability to formulate clear, specific, and well-structured questions (prompts) significantly affected the quality and usefulness of AI responses.

  "I have come to realise that it is how someone asks a question that matters. If your question is not clear, the answer will confuse you the more. So I break down my questions, make them specific, and even give context sometimes."
  — Participant 9, Focus Group 2
- **Network infrastructure.** Geographical variations in internet connectivity significantly affected accessibility and user experience, with students in urban areas reporting more consistent and satisfactory experiences than their rural counterparts.
- **Faculty integration and guidance.** Students whose lecturers acknowledged, guided, or incorporated the use of AI tools reported more academically aligned usage patterns than those who used the tool entirely independently.
- **Subject-domain characteristics.** The AI tool appeared more effective in certain subject domains (particularly those with well-established factual knowledge bases) than in highly contextual or Nigeria-specific content areas.
- **Prior knowledge base.** Students with stronger foundational knowledge reported greater benefits, suggesting that the AI served more effectively as complementary support than as a primary instructional tool.

  "If one does not have a foundational idea of the subject matter, sometimes the explanation that AI gives can confuse you. It is better when you already have an idea of the subject matter but need clarification or expansion."
  — Participant 22, Interview

Discussion

The findings of this study offer significant insights into the potential of WhatsApp Meta AI as an Intelligent Tutoring System within the Nigerian higher education context, revealing both promising opportunities and important limitations that must be addressed for optimal educational impact.

Democratising Access to Educational Support

Perhaps the most significant implication of this research lies in WhatsApp Meta AI's potential to democratise access to educational support. In the Nigerian context, where student-to-faculty ratios are often extremely high and educational resources are unevenly distributed, the availability of round-the-clock AI-based academic support represents a potentially transformative development. This finding aligns with Adesina and Johnson's (2023) assertion that integrating AI capabilities into existing, widely used platforms can significantly reduce barriers to accessing educational technologies in developing contexts.

The predominance of evening and late-night usage patterns observed in this study highlights a critical gap in traditional academic-support structures that WhatsApp Meta AI effectively addresses. As noted by Ibrahim and Olatunji (2023), many Nigerian university students engage in significant academic work during evening hours due to daytime commitments, power-supply challenges, or shared computer facilities—precisely when human academic support is least available. The ability of WhatsApp Meta AI to provide immediate feedback during these periods represents a valuable resource that complements existing support mechanisms.

However, the connectivity challenges reported by a substantial majority of participants (89%) underscore the persistent digital divide in Nigeria that affects equitable access to educational technologies. This aligns with Okonkwo and Eze's (2023) findings that inconsistent internet connectivity remains a significant barrier to technology-enhanced learning in many parts of Nigeria. As Oyediran et al. (2022) argued, effective implementation of AI-enhanced educational tools in developing contexts must account for infrastructure limitations, potentially through features such as offline functionality or low-bandwidth modes.

Pedagogical Implications and Learning Enhancement

The observed enhancement in self-regulated learning (76%) and learning efficiency (72%) suggests that WhatsApp Meta AI effectively fulfils key functions of an Intelligent Tutoring System, particularly in providing personalised explanations and immediate feedback. These findings support Aleven et al.'s (2022) meta-analysis, which found that ITS can significantly improve learning outcomes by providing timely scaffolding and adaptive support based on learners' needs.

The participants' appreciation for a judgement-free learning environment (88%) reveals an important psychological dimension to AI-enhanced learning that may be particularly valuable in educational contexts with high power distance, where students might be reluctant to display uncertainty or confusion to authority figures (Adedoyin & Soykan, 2023). As one participant noted, the absence of social judgement created a safe space for clarifying foundational concepts that students might otherwise be embarrassed to ask about in lecture settings.

However, the findings also raise important questions about the depth of learning facilitated by AI tools. The expressed concern about limited critical engagement (68%) echoes broader debates in educational technology about the potential for immediate information access to undermine deeper cognitive processes. This tension between convenience and cognitive engagement demands thoughtful pedagogical integration, as argued by Mahmoud and Ibrahim (2024), who suggest that AI tools in education should be designed and implemented to scaffold, rather than substitute for, critical thinking.

The observed variance in learning outcomes based on usage patterns suggests that how students engage with the AI is as important as whether they use it. This finding aligns with the Social Constructivist framework guiding this study, which emphasises the importance of meaningful interaction in knowledge construction. Students who engaged the AI with higher-order queries demonstrated greater learning gains, suggesting that effective implementation requires not only access to the technology but also guidance on how to use it to support deep learning, rather than superficial information retrieval.

Contextual Relevance and Cultural Adaptation

The challenge of contextual limitations for Nigerian educational content (78%) highlights a significant concern regarding the cultural relevance of global AI systems in specific educational contexts. This finding supports Schiff et al.'s (2024) argument that AI educational tools developed primarily in Western contexts may have limited effectiveness when applied uncritically in diverse cultural and educational settings.

The struggle of WhatsApp Meta AI with Nigeria-specific educational content reflects what Oyediran et al. (2022) describe as the "contextual gap" in many educational technologies—the disconnect between the knowledge base informing AI systems and the specific knowledge domains valued in local educational contexts. This limitation is particularly relevant for education

courses with significant focus on national educational policies, indigenous knowledge systems, and culturally specific pedagogical approaches.

This finding suggests the need for AI systems that can be adapted or fine-tuned to incorporate country-specific educational content and contextual nuances. As argued by Okonkwo and Eze (2023), the effectiveness of AI in education in developing contexts depends significantly on its ability to reflect and respond to local knowledge systems, examples, and applications, rather than imposing standardised global content that may lack contextual relevance.

Implications for Educational Policy and Practice

The study findings have several important implications for educational policy and practice in Nigerian universities. First, the widespread adoption and generally positive reception of WhatsApp Meta AI suggest that messaging-integrated AI tools represent a viable approach to expanding educational support in resource-constrained environments. Rather than investing in entirely new educational platforms that may face adoption barriers, integrating AI capabilities into already-familiar communication tools appears to leverage existing digital practices more effectively.

Second, the ethical concerns raised about academic integrity (54%) highlight the urgent need for universities to develop clear policies regarding appropriate use of AI tools for academic purposes. As noted by several participants, the lack of institutional guidelines created uncertainty about the boundaries between legitimate learning support and academic misconduct. This finding aligns with Adedoyin and Soykan's (2023) argument that effective integration of AI into education requires not only technological implementation but also corresponding policy development to guide ethical usage.

Third, the finding that faculty integration and guidance significantly influenced usage patterns suggests that professional development for educators should include training on the effective incorporation of AI tools into pedagogical practice. As Olufunke and Adedeji (2023) argued, the role of faculty in modelling, guiding, and contextualising technology use significantly affects how students engage with educational technologies.

Finally, the digital-literacy barriers identified (52%) suggest that universities should consider incorporating digital-literacy development more explicitly into educational programmes, particularly focusing on advanced skills such as effective query formulation, critical evaluation of AI-generated information, and the appropriate integration of AI assistance into academic workflows.

Theoretical Implications

The findings offer several insights relevant to the theoretical frameworks guiding this study. Through the lens of the Technology Acceptance Model, the high adoption rates can be understood as reflecting both perceived usefulness (evident in the numerous benefits identified) and perceived ease of use (facilitated by integration with a familiar platform). This supports Venkatesh and Bala's (2023) extended TAM model, which emphasises the importance of both utility and accessibility in technology adoption. The effectiveness of WhatsApp Meta AI in supporting learning can also be understood through Social Constructivist theory, particularly Vygotsky's concept of the Zone of Proximal Development. The AI appears to function effectively as a "more knowledgeable other," providing scaffolding that helps students bridge the gap between their current understanding and potential development level. However, as Shabani (2023) argued, technology-mediated scaffolding differs qualitatively from human scaffolding, and the limitations identified in the present study particularly regarding contextual understanding and critical engagement

highlight the boundaries of AI's effectiveness as a constructivist learning partner. The findings suggest a need to extend existing theoretical frameworks to better account for AI-mediated learning in diverse cultural contexts. As argued by Abdullah et al. (2023), conventional educational-technology theories often inadequately address the complexities of technology adoption and learning impacts in developing contexts where infrastructural challenges, cultural factors, and resource constraints significantly shape educational experiences.

Conclusion

This study examined the effectiveness of WhatsApp Meta AI as an Intelligent Tutoring System for undergraduate students in Nigerian public universities. The findings indicate that WhatsApp Meta AI offers substantial promise as an accessible, low-cost ITS solution capable of supporting personalised learning, immediate feedback, and after-hours academic engagement addressing important gaps in conventional academic-support structures. At the same time, persistent challenges related to connectivity, contextual relevance, verification of AI-generated information, digital literacy, and academic integrity must be deliberately addressed if the technology is to deliver equitable educational benefits. To realise the full potential of WhatsApp Meta AI in Nigerian higher education, the study recommends that universities (a) develop explicit policies on the ethical use of AI tools for academic work; (b) integrate AI-literacy and prompt-formulation training into existing digital-literacy curricula; (c) provide professional development for faculty on integrating AI tools into pedagogical practice; and (d) collaborate with platform providers and other stakeholders to advocate for the inclusion of locally relevant content and low-bandwidth options. Future research should employ mixed methods designs and longitudinal data to assess the impact of WhatsApp Meta AI on measurable learning outcomes across a broader range of institutions and disciplines.

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