

Artificial Intelligence-Powered Virtual Learning Tools and Student Learning Outcome in Private Secondary Schools in Port Harcourt Metropolis, Rivers State

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ARTICLE INFO

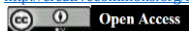
Keywords:
artificial intelligence,
virtual learning tools,
chatgpt, meta ai,
chatbots,
student learning outcome.

Vol. 01, No. 05, 2026

<https://doi.org/10.5281/zenodo.23418571>

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ABSTRACT

This study examined the relationship between artificial intelligence-powered virtual learning tools and student learning outcome in private secondary schools in Port Harcourt metropolis, Rivers State. Three research objectives, three research questions, and three null hypotheses guided the study. The study adopted a correlational research design. The population of the study comprised 6,407 teachers from registered private secondary schools in Port Harcourt and Obio/Akpor Local Government Areas of Rivers State. A sample of 375 teachers was determined using the Taro Yamane formula and drawn using the proportionate stratified sampling technique. The instrument used for data collection was a self-designed questionnaire titled “Artificial Intelligence-Powered Virtual Learning Tools and Student Learning Outcome Questionnaire (AIPVLTSLOQ)”, validated by experts in Educational Management and in Measurement and Evaluation from Rivers State University. The reliability of the instrument was established using the Cronbach Alpha method, yielding coefficients of 0.84, 0.81, and 0.79 for the ChatGPT, Meta AI, and chatbot clusters respectively. The three research questions were answered using Pearson Product Moment Correlation (PPMC), while the three null hypotheses were tested using t-transformation at the 0.05 level of significance. The findings revealed a high and positive relationship between utilization of ChatGPT and student learning outcome ($r = 0.82$), between utilization of Meta AI and student learning outcome ($r = 0.79$), and between chatbot engagement in Question and Answer sessions and student learning outcome ($r = 0.76$), and each relationship was statistically significant. Based on the findings, the study recommended among others that school administrators should formally integrate ChatGPT, Meta AI, and chatbot-based Question and Answer sessions into instructional delivery frameworks, supported by school-wide policies on their purposeful and ethical use and by professional development for teachers.

Introduction

Artificial intelligence (AI) has moved from the margins of computer science to the centre of conversations about how teaching and learning should be organised. In its broad sense, AI refers to computer systems that perform tasks which historically required human intelligence, such as reasoning, understanding language, solving problems, and making recommendations. Scholars and international bodies have increasingly argued that AI can innovate teaching and learning practices and help address some of the most persistent challenges in education (Luckin et al., 2016; Popenici & Kerr, 2017; Holmes et al., 2021; UNESCO, 2025). Closer to home, Taylor et al. (2025) reported that adult educators in Rivers State-owned universities were only moderately aware of artificial intelligence tools and adopted them to a low extent, which shows that the promise of these tools has not yet become part of routine practice in

many Nigerian classrooms. For schools, the practical question is no longer whether such tools exist but whether their use is associated with better learning outcomes for students.

Three categories of AI-powered tools are of particular relevance to secondary school classrooms. ChatGPT, a generative AI chatbot developed by OpenAI, uses natural language processing and a large language model to hold human-like conversations, answer questions, explain concepts, and generate written content. Baidoo-Anu and Ansah (2023) observed that it can provide prompt feedback on student work and personalised guidance, while Ng et al. (2024) reported that it can support learners in flexible and adaptable learning contexts. Meta AI, an AI-driven assistant built on Meta's Llama large language model and embedded in platforms such as Facebook, Instagram, and WhatsApp, answers questions, creates content, and generates images within applications that many teachers and students already use daily (Nikita, 2025). Chatbots more broadly are programs that simulate human conversation and, increasingly, use natural language processing to understand user questions and automate personalised responses (IBM, 2021); they can attend to many users at the same time (Guendalina et al., 2022), which makes them attractive for question-and-answer support beyond the limits of the school timetable.

The aim of secondary education in Nigeria is to prepare learners for useful living and for higher education (Federal Republic of Nigeria, 2013). In private secondary schools in Port Harcourt metropolis, however, there are concerns about declining academic enthusiasm, poor attitudes to study, and consistently unsatisfactory results in the West African Secondary School Certificate Examination (WASSCE), which have been linked to the persistence of traditional, teacher-centred instructional methods. The rise of artificial intelligence and social media has also brought fresh concerns about the integrity of school examinations, as LongJohn and LongJohn (2026) showed in their study of cyber security measures and WAEC question leakages in Port Harcourt, so that schools are now required to manage these tools wisely rather than simply adopt them. Empirical attention to AI in Rivers State has so far focused mainly on public secondary schools, universities, and school administration (Arannilewa et al., 2025; Charles et al., 2025; Ihua-Jonathan & Nwisagbo, 2024; Nwuke & Yellowe, 2025; Sam-Kalagbor, 2026), while related work in private secondary schools has examined virtual learning resources more generally (Wey-Amaewhule & Okoronkwo, 2024). The specific relationship between ChatGPT, Meta AI, chatbot engagement and student learning outcome in private secondary schools has received comparatively little attention.

The study is anchored on Bloom's (1968) Mastery Learning Theory, which holds that learners should master the objectives of one unit before progressing to the next, supported by continuous assessment, corrective feedback, and additional help where mastery has not been achieved. AI-powered tools that respond instantly, adjust explanations to the learner, and allow repeated practice at the learner's own pace are well aligned with this view, and the theory therefore provides a useful lens for interpreting any relationship between the use of such tools and learning outcome. It is against this background that the present study, drawn from a wider Master of Education investigation into AI-powered virtual learning tools, examined the relationship between the utilization of ChatGPT, the utilization of Meta AI, and chatbot engagement in Question and Answer sessions, on one hand, and student learning outcome in private secondary schools in Port Harcourt metropolis, Rivers State, on the other.

Statement of the Problem

The effectiveness of the teaching-learning process in secondary school is important because this stage of education prepares young people for tertiary studies and for diverse careers. Yet private secondary schools in Port Harcourt metropolis are confronted with a troubling trend of declining interest in academic pursuits and poor attitudes to learning, which has been associated with a culture of nonchalance, increased juvenile delinquency, and consistently poor student performance in the West African Secondary School Certificate Examination (WASSCE). These challenges have been traced to a

reliance on traditional, teacher-centred instruction characterised by note memorisation, repetitive drills, and a single mode of lesson delivery for all learners, which fails to accommodate diverse learning needs and leaves students ill-prepared for a digitalised world. While AI offers promising solutions in the form of personalised learning, round-the-clock accessibility, and immediate feedback, its actual relationship with student learning outcome in private secondary schools in Port Harcourt metropolis remains under-explored. There is therefore a gap in understanding how AI-powered tools such as ChatGPT, Meta AI, and chatbots relate to student learning outcome in these schools. It is against this background that the study examined the relationship between AI-powered virtual learning tools and student learning outcome in private secondary schools in Port Harcourt metropolis, Rivers State.

Purpose of the Study

The purpose of the study was to investigate the relationship between artificial intelligence-powered virtual learning tools and student learning outcome in private secondary schools in Port Harcourt metropolis, Rivers State. In specific terms, the study sought to:

1. find out the relationship between utilization of ChatGPT and student learning outcome in private secondary schools in Port Harcourt metropolis, Rivers State.
2. ascertain the relationship between utilization of Meta AI and student learning outcome in private secondary schools in Port Harcourt metropolis, Rivers State.
3. examine the relationship between chatbot engagement in Question and Answer sessions and student learning outcome in private secondary schools in Port Harcourt metropolis, Rivers State.

Research Questions

The following research questions guided the study:

1. What is the relationship between the utilization of ChatGPT and student learning outcome in private secondary schools in Port Harcourt metropolis, Rivers State?
2. What is the relationship between the utilization of Meta AI and student learning outcome in private secondary schools in Port Harcourt metropolis, Rivers State?
3. What is the relationship between chatbot engagement in Question and Answer sessions and student learning outcome in private secondary schools in Port Harcourt metropolis, Rivers State?

Hypotheses

The following null hypotheses were tested at the 0.05 level of significance:

1. There is no significant relationship between the utilization of ChatGPT and student learning outcome in private secondary schools in Port Harcourt metropolis, Rivers State.
2. There is no significant relationship between the utilization of Meta AI and student learning outcome in private secondary schools in Port Harcourt metropolis, Rivers State.
3. There is no significant relationship between chatbot engagement in Question and Answer sessions and student learning outcome in private secondary schools in Port Harcourt metropolis, Rivers State.

Methodology

The study adopted a correlational research design, which is appropriate where the aim is to establish the direction and strength of the relationship between two or more variables as they naturally occur, without manipulating them. The design was suited to the study because it sought to establish the relationship between AI-powered virtual learning tools and student learning outcome in private secondary schools. The study was carried out in Port Harcourt metropolis, which comprises the Port Harcourt and Obio/Akpor Local Government Areas of Rivers State, Nigeria. The population of the study comprised 6,407 teachers from registered private secondary schools in the two Local Government Areas,

made up of 1,577 teachers in Port Harcourt (857 male and 720 female) and 4,830 teachers in Obio/Akpor (2,523 male and 2,307 female) (Rivers State Ministry of Education, 2024).

The sample size was determined using the Taro Yamane formula at a 0.05 margin of error, which gave a sample of 375 teachers. The proportionate stratified sampling technique was adopted to ensure fair representation of both Local Government Areas: ten percent of the registered private secondary schools in each Local Government Area were selected, amounting to 14 of 143 schools in Port Harcourt and 44 of 439 schools in Obio/Akpor, a total of 58 schools. The teachers who constituted the sample were then randomly selected from the staff of these 58 schools.

The instrument used for data collection was a self-designed questionnaire titled “Artificial Intelligence-Powered Virtual Learning Tools and Student Learning Outcome Questionnaire” (AIPVLTSLQ). It comprised a section on the bio-data of respondents and a section of structured items drawn from the research questions, measuring utilization of ChatGPT, utilization of Meta AI, chatbot engagement in Question and Answer sessions, and student learning outcome. The items were rated on a four-point scale of Strongly Agree (4), Agree (3), Disagree (2), and Strongly Disagree (1). The face and content validity of the instrument was established by three experts, two in Measurement and Evaluation and one in Educational Management, all from Rivers State University, who scrutinised the language, adequacy, and relevance of the items in relation to the purpose of the study; their corrections were incorporated into the final draft. The reliability of the instrument was determined through a test of internal consistency using the Cronbach Alpha method, following a pilot administration to 20 teachers in a private secondary school in Emohua Local Government Area, which is outside the area of the study. Reliability coefficients of 0.84, 0.81, and 0.79 were obtained for the ChatGPT, Meta AI, and chatbot clusters of the instrument respectively, indicating that the instrument was reliable for the purposes of the study.

The researcher, assisted by two trained research assistants who were teachers in the sampled schools, administered the questionnaire to the respondents, and data from 375 respondents were used for the analysis. The research questions were answered using the Pearson Product Moment Correlation (PPMC) coefficient, with the strength of relationship interpreted as follows: 0.80–1.00 = very strong relationship; 0.60–0.79 = strong relationship; 0.40–0.59 = moderate relationship; 0.20–0.39 = weak relationship; and 0.00–0.19 = very weak or no relationship. The three null hypotheses were tested at the 0.05 level of significance by transforming the correlation coefficient (r) to t , using $t = r\sqrt{(n - 2) / \sqrt{(1 - r^2)}}$; a null hypothesis was rejected where the calculated t -value exceeded the critical t -value, and retained where it did not.

Results

The results are presented in line with the three research questions and the three null hypotheses that guided the study. Table 1 presents the PPMC analysis answering the research questions, while Table 2 presents the t -transformation tests of the null hypotheses.

Table 1: PPMC Analysis of the Relationship between AI-Powered Virtual Learning Tools (ChatGPT, Meta AI, and Chatbot Engagement in Q&A Sessions) and Student Learning Outcome in Private Secondary Schools in Port Harcourt Metropolis, Rivers State

S/N	Independent Variable (X) against Student Learning Outcome (Y)	N	r	r ²	Strength	Remark
1	Utilization of ChatGPT	375	0.82	0.67	Very strong	High positive
2	Utilization of Meta AI	375	0.79	0.62	Strong	High positive
3	Chatbot Engagement in Q&A Sessions	375	0.76	0.58	Strong	High positive

Note: r = Pearson Product Moment Correlation coefficient; r² = coefficient of determination. All coefficients are significant at the 0.05 level.

Research Question 1: What is the relationship between the utilization of ChatGPT and student learning outcome in private secondary schools in Port Harcourt metropolis, Rivers State?

Table 1 shows that the correlation coefficient (r) between utilization of ChatGPT and student learning outcome is 0.82. This value is high and positive, falling within the very strong band of the classification adopted for the study. It implies that there is a high and positive relationship between the utilization of ChatGPT and student learning outcome in private secondary schools in Port Harcourt metropolis, Rivers State; that is, teachers who reported higher utilization of ChatGPT also reported better student learning outcome. The coefficient of determination (r² = 0.67) indicates that about 67 percent of the variance in student learning outcome is shared with utilization of ChatGPT.

Research Question 2: What is the relationship between the utilization of Meta AI and student learning outcome in private secondary schools in Port Harcourt metropolis, Rivers State?

Table 1 further shows that the correlation coefficient (r) between utilization of Meta AI and student learning outcome is 0.79. This value is high and positive, falling within the strong band of the classification adopted for the study. It implies that there is a high and positive relationship between the utilization of Meta AI and student learning outcome in private secondary schools in Port Harcourt metropolis, Rivers State. The coefficient of determination (r² = 0.62) indicates that about 62 percent of the variance in student learning outcome is shared with utilization of Meta AI.

Research Question 3: What is the relationship between chatbot engagement in Question and Answer sessions and student learning outcome in private secondary schools in Port Harcourt metropolis, Rivers State?

Table 1 also reveals that the correlation coefficient (r) between chatbot engagement in Question and Answer sessions and student learning outcome is 0.76. This value is high and positive, falling within the strong band of the classification adopted for the study. It implies that there is a high and positive relationship between chatbot engagement in Question and Answer sessions and student learning outcome in private secondary schools in Port Harcourt metropolis, Rivers State; teachers who reported more active chatbot engagement also reported better learning outcome. The coefficient of determination (r² = 0.58) indicates that about 58 percent of the variance in student learning outcome is shared with chatbot engagement.

Test of Hypotheses

Ho₁: There is no significant relationship between the utilization of ChatGPT and student learning outcome in private secondary schools in Port Harcourt metropolis, Rivers State.

Ho₂: There is no significant relationship between the utilization of Meta AI and student learning outcome in private secondary schools in Port Harcourt metropolis, Rivers State.

Ho₃: There is no significant relationship between chatbot engagement in Question and Answer sessions and student learning outcome in private secondary schools in Port Harcourt metropolis, Rivers State.

Table 2: t-Transformation Test of the Significance of the Relationship between AI-Powered Virtual Learning Tools and Student Learning Outcome in Private Secondary Schools in Port Harcourt Metropolis, Rivers State

Variable (X) against Student Learning Outcome (Y)	N	r	df	t-cal	t-crit	α	Decision
Utilization of ChatGPT	375	0.82	373	27.67	1.97	0.05	Significant; Ho ₁ rejected
Utilization of Meta AI	375	0.79	373	24.89	1.97	0.05	Significant; Ho ₂ rejected
Chatbot Engagement in Q&A Sessions	375	0.76	373	22.58	1.97	0.05	Significant; Ho ₃ rejected

Note: $t\text{-cal} = r\sqrt{(n-2) / \sqrt{(1-r^2)}}$; t-crit is the two-tailed critical value of t at df = 373.

Hypothesis 1. Table 2 shows that the calculated t-value of 27.67, obtained by transforming $r = 0.82$, is greater than the critical t-value of 1.97 at the 0.05 level of significance with 373 degrees of freedom. The null hypothesis is therefore rejected. This means that there is a significant positive relationship between utilization of ChatGPT and student learning outcome in private secondary schools in Port Harcourt metropolis, Rivers State.

Hypothesis 2. Table 2 shows that the calculated t-value of 24.89, obtained by transforming $r = 0.79$, is greater than the critical t-value of 1.97 at the 0.05 level of significance with 373 degrees of freedom. The null hypothesis is therefore rejected. This means that there is a significant positive relationship between utilization of Meta AI and student learning outcome in private secondary schools in Port Harcourt metropolis, Rivers State.

Hypothesis 3. Table 2 shows that the calculated t-value of 22.58, obtained by transforming $r = 0.76$, is greater than the critical t-value of 1.97 at the 0.05 level of significance with 373 degrees of freedom. The null hypothesis is therefore rejected. This means that there is a significant positive relationship between chatbot engagement in Question and Answer sessions and student learning outcome in private secondary schools in Port Harcourt metropolis, Rivers State.

Discussion of Findings

The finding for research question one indicated a high and positive relationship between utilization of ChatGPT and student learning outcome ($r = 0.82$), the strongest of the three relationships examined in this paper, and the corresponding hypothesis one confirmed that the relationship is statistically significant. This suggests that in schools where ChatGPT is used more extensively as an instructional and learning tool, teachers also perceive stronger student learning outcomes. The result is consistent with Baidoo-Anu and Ansah (2023), who noted that ChatGPT has the potential to provide prompt feedback on student assignments and personalised guidance. It also accords with Rospigliosi (2023), who highlighted that incorporating ChatGPT into classroom settings allows educators to deliver courses with more engaging and current instructional content, and with Ng et al. (2024), who found that, unlike tools built on fixed content, ChatGPT can flexibly handle complex and adaptable learning contexts. At the postgraduate level in Rivers State, Prince et al. (2024) similarly reported that AI tools, including ChatGPT, influenced students' learning outcome to a high extent. The ability of ChatGPT to respond to individual questions at any time, explain content in different ways, and give immediate feedback is what the Mastery Learning Theory would identify as a support for learners who need additional time or help to reach mastery.

The finding for research question two revealed a high and positive relationship between utilization of Meta AI and student learning outcome ($r = 0.79$), with hypothesis two confirming that the relationship is significant. This is in line with Nikita (2025), who described Meta AI as a smart virtual assistant that answers questions, creates content, generates images, and helps with task planning within platforms people already use, thereby making information more accessible and learner-centred. Cirrus (2024) likewise observed that Meta's AI-driven and immersive tools can move students from being passive observers to active participants in learning, stimulating curiosity and improving attention. Because Meta AI is embedded in widely used social media and messaging applications, it may be easier for teachers and students in private secondary schools in Port Harcourt metropolis to adopt, which may partly explain the strength of the relationship observed. Such ease of adoption still depends on the skill of the teacher, and Ikechukwu et al. (2026), who examined teachers' digital competence and effective classroom instructional delivery in senior secondary schools in Port Harcourt Metropolis, showed that the benefit of digital tools in the classroom rests largely on how competently teachers are able to use them.

The finding for research question three showed a high and positive relationship between chatbot engagement in Question and Answer sessions and student learning outcome ($r = 0.76$), and the corresponding hypothesis three confirmed that the relationship is significant. Although this was the lowest of the three coefficients, it remained strong. The result agrees with Guendalina et al. (2022), who noted that chatbots can attend to a large number of users simultaneously while mimicking natural conversation, and with IBM (2021) and Oracle (2021), which describe modern chatbots as systems that use natural language processing to understand questions and deliver increasingly personalised responses. In the context of the present study, chatbot-supported Question and Answer sessions can give students round-the-clock access to academic support, immediate feedback, and opportunities for repeated practice beyond the limits of the classroom. The somewhat lower coefficient may reflect the narrower scope of chatbot engagement in structured Question and Answer sessions compared with the broader range of uses associated with general-purpose tools such as ChatGPT and Meta AI, although this interpretation would need to be tested in further research.

Taken together, the three findings are consistent with the broader evidence from Rivers State that technology-supported instruction is positively related to student learning outcome in private secondary schools. In particular, Wey-Amaewhule and Okoronkwo (2024) found a high and positive relationship between teachers' utilization of virtual learning resources and students' learning outcome in private secondary schools in Port Harcourt metropolis using the same design and analysis. Sam-Kalagbor (2026) likewise found that principals and vice-principals in public senior secondary schools in Port Harcourt Metropolis rated the role of artificial intelligence high in school record management, while Nwuke and Yellowe (2025) examined the utilization of artificial intelligence in school supervision for effective administration in public secondary schools in Rivers State, and both studies suggest that AI is gaining ground in the management of schools as well as in the classroom. Two cautions are, however, necessary. First, the study is correlational, so the results show that higher use of these tools goes together with better learning outcome but cannot by themselves establish that the tools cause the improvement. Second, both the tool-use and learning-outcome variables were rated by teachers, so the findings reflect teachers' perceptions. Experimental or quasi-experimental studies that include students' measured performance would provide stronger evidence.

Conclusion

Based on the findings of the study, it was concluded that the utilization of ChatGPT, the utilization of Meta AI, and chatbot engagement in Question and Answer sessions are each highly and positively related to student learning outcome in private secondary schools in Port Harcourt metropolis, Rivers State. All three null hypotheses were rejected at the 0.05 level of significance, confirming that the

relationships are statistically significant. The strongest relationship was recorded for ChatGPT ($r = 0.82$), followed by Meta AI ($r = 0.79$) and chatbot engagement in Question and Answer sessions ($r = 0.76$). The findings imply that private secondary schools that thoughtfully integrate these tools into their instructional frameworks are likely to experience gains in academic engagement, personalised learning, immediate feedback, and overall student performance, and they point to the inadequacy of sole reliance on traditional teacher-centred methods. Given the correlational design of the study, these implications should be read as associations that merit further experimental testing rather than as proof of cause and effect.

Recommendations

Based on the findings of the study, the following recommendations were made:

1. School administrators of private secondary schools in Port Harcourt metropolis should formally integrate ChatGPT into their instructional delivery frameworks. This can be achieved by developing school-wide policies that guide teachers and students on the purposeful and ethical use of ChatGPT for tasks such as essay feedback, research assistance, question answering, and personalised tutoring, with clear safeguards against over-dependence and academic dishonesty.
2. Private secondary school authorities in Port Harcourt metropolis, in collaboration with the Rivers State Ministry of Education, should facilitate the adoption of Meta AI as an instructional resource. Professional development workshops and teacher training programmes should be organised to equip educators with the competencies required to integrate Meta AI into lesson delivery in order to provide personalised and responsive learning experiences for students.
3. School management and teachers in private secondary schools in Port Harcourt metropolis should encourage and structure chatbot engagement in Question and Answer sessions as a routine pedagogical activity. Schools should install or subscribe to AI-powered chatbot platforms that interact with students in natural language, provide instant feedback, and supplement classroom instruction, particularly in subjects where students need additional practice and clarification beyond normal school hours.

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