

INTEGRATING ARTIFICIAL INTELLIGENCE CHATBOTS TO SUPPORT INDEPENDENT LEARNING AMONG SCIENCE EDUCATION STUDENTS IN RIVERS STATE UNIVERSITY

By

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Abstract

The study investigated integrating artificial intelligence chatbots to support independent learning among Science Education final year students in Rivers State University. The study adopted descriptive survey research design. The study population comprised 73 Science Education final-year students from the Department of Science Education. Given the manageable size of the population, a census sampling technique was adopted; meaning the entire population of 73 Science Education final year students was included in the study. The primary data collection instrument was a self-structured questionnaire titled “Integrating Artificial Intelligence Chatbots to Support Independent Learning Questionnaire (IAICSLQ)”. The questionnaire was designed using a 4-point Likert scale. The questionnaire was validated by two research experts. The reliability of the questionnaire was assessed using Cronbach’s Alpha method, yielding coefficients of 0.88, 0.83, and 0.87. A total of 73 copies of the questionnaire were distributed to final year students, with the assistance of two trained research assistants and 70 completed questionnaires were retrieved within a two-week administration period. Weighted mean and standard deviation addressed the research questions and independent t-test was used to test hypotheses at 0.05 significance level. The study found that there is a statistically significant difference between male and female Science Education final year students regarding AI chatbot support for independent learning; academic

tasks they perform using AI chatbots and Science Education final year students in using AI chatbots to comprehend difficult course material. The recommended among others that schools should provide equal access to AI chatbot training and orientation for both male and female Science Education final year students to ensure that all learners can confidently use technology for independent learning and maximize their educational potential.

Keywords: Integrating, Artificial Intelligence, Chatbots, Support, Independent Learning.

Introduction

Integrating artificial intelligence chatbots to support independent learning among university final year students involves deploying conversational AI systems designed to provide on-demand, personalized academic assistance. These chatbots, powered by natural language processing, act as digital tutors, offering explanations, guiding research, and prompting critical thinking outside formal classroom settings. This integration marks a shift towards more self-directed learning paradigms, where students can seek clarification and explore topics at their own pace. The core objective is to augment traditional educational resources, providing a responsive and interactive layer of support that fosters greater learner autonomy and engagement in higher education environments (Okonkwo & Ade-Ibijola, 2021; Aldosari, 2020).

The benefits of this integration are multifaceted, significantly enhancing the independent learning experience. Chatbots offer 24/7 accessibility, providing instant feedback and reducing waiting times for help, which is crucial for maintaining student momentum. They support personalized learning by adapting responses to individual queries, thereby catering to diverse knowledge levels and learning styles. Furthermore, these tools can build metacognitive skills by asking scaffolded questions that guide students to discover answers independently rather than simply providing them. This constant availability encourages consistent study habits and can reduce anxiety by offering a low-stakes, private space for students to address knowledge gaps (Winkler & Söllner, 2018; Crompton & Burke, 2023).

However, significant challenges accompany these technological advancements. A primary concern is pedagogical; over-reliance on chatbots may undermine the development of deep critical thinking and complex problem-solving skills if interactions remain superficial. Technical limitations, such as generating inaccurate or biased "hallucinations," can actively mislead learners (Ogbonnia, 2017). Furthermore, the impersonal nature of AI interactions cannot replicate the motivational and emotional support provided by human educators, which is vital for student well-being. Ethical issues regarding data privacy, algorithmic transparency, and the digital divide also pose substantial risks, potentially exacerbating educational inequalities if access is uneven (Zawacki-Richter et al., 2019).

While AI chatbots present a powerful tool for scaffolding independent learning through personalized, constant support, their implementation requires careful, critical design. Success depends on integrating these systems as complementary aids within a broader educational ecosystem, not as replacements for human instruction. Universities must establish clear guidelines for ethical use, provide digital literacy training, and ensure ongoing human oversight to mitigate risks. When thoughtfully deployed, chatbots can empower final year students to take greater ownership of their educational journey, potentially leading to more resilient and adaptive lifelong learners (Hwang, Xie, & Wah, 2020).

Artificial intelligence chatbots serve as versatile academic companions, fundamentally transforming how final year students manage their learning. These tools provide immediate, 24/7 access to information and instructional support, allowing students to clarify doubts, explore topics beyond lecture materials, and learn at their own pace outside the traditional classroom (Pan, Roussanaly & Boyer, 2022). This constant availability fosters self-regulation and metacognitive skills, as students must formulate questions and critically assess the AI's responses to guide their study sessions. By offering a personalized, on-demand interaction, chatbots empower learners to take greater ownership of their educational journey, moving from passive reception to active knowledge construction. This shift is crucial for developing the lifelong learning competencies

required in modern academia and professional fields (Chiu et al., 2023; Hwang, Xie, Wah & Gašević, 2020).

Nguyen (2023) found that chatbots increased students' sense of learning autonomy. The tool's constant availability helped them overcome initial hurdles with complex tasks, fostering confidence in independent problem-solving. Porter & Kessler (2024) observed that chatbots act as a "first respondent." This encourages students to explore foundational concepts on their own before seeking human help, effectively building their metacognitive and self-regulation skills. Final year students strategically integrate AI chatbots into their independent study for a variety of complex academic tasks (Woolf, 2020). A primary use is the drafting and refinement of written assignments, where students employ chatbots to generate initial outlines, propose thesis statements, or suggest improvements to sentence structure and clarity. Furthermore, these tools are extensively used for brainstorming research ideas, summarizing lengthy academic papers, and preparing for examinations by generating practice questions and quizzes. Students also leverage chatbots for coding assistance in computer science courses, debugging scripts, and explaining algorithmic concepts. This multifaceted application turns the chatbot into a multi-subject tutor and productivity tool, streamlining the research and composition process (Rudolph et al., 2023). Dawson (2024) reported that final year students primarily use chatbots for brainstorming assignment ideas (78%), drafting and paraphrasing written content (72%), and clarifying complex assignment instructions (65%). Chen (2023) noted from query log analysis that students strategically deploy chatbots to generate personalised practice quiz questions and to summarise lengthy academic articles, aiding in revision and workload management.

AI chatbots facilitate deeper comprehension of challenging university material by delivering explanations in multiple, student-driven formats. When a student encounters a complex theory, they can request the chatbot to break it down into simpler steps, provide a real-world analogy, or summarize it in layman's terms. This interactive dialogue allows for immediate follow-up questions, creating a Socratic-style tutoring session that targets specific knowledge gaps. For visual learners, chatbots can suggest diagrams or recommend existing online resources to illustrate concepts. This adaptive, responsive support helps demystify difficult

subjects like advanced mathematics or dense philosophical texts, building student confidence and enabling a more resilient grasp of core course concepts (Kasneji et al., 2023). Gupta & Lee (2022) found that students struggling with introductory programming who used a chatbot showed a 30% greater improvement on subsequent tests. The chatbot's ability to provide varied examples and plain-language error explanations was key. Alvarez (2023) reported that students in STEM value chatbots for generating multiple analogies for abstract theories. This provides a customised explanatory pathway that can make difficult concepts more personally relatable.

The integration of artificial intelligence (AI) chatbots into students' learning activities is increasingly important for promoting independent learning at Rivers State University. Many students face challenges such as overcrowded classrooms, limited access to lecturers outside lecture hours, and inadequate academic support resources. AI chatbots offer an alternative learning support system by providing instant responses to academic questions, guiding students through course materials, and encouraging self-paced study. By using AI chatbots, students can take greater responsibility for their learning, explore topics at their own convenience, and develop problem-solving and critical thinking skills without constant reliance on instructors. This approach aligns with modern educational practices that emphasize learner autonomy and digital competence, which are essential skills in today's technology-driven society (Bates, 2021).

In the context of Rivers State University, integrating AI chatbots can help bridge learning gaps caused by limited instructional time and uneven access to academic assistance. It also supports students from diverse academic backgrounds by offering personalized learning support tailored to individual needs. Ultimately, the use of AI chatbots is justified as a practical and innovative strategy for enhancing independent learning, improving academic confidence, and preparing students for a future where digital literacy plays a central role in education and professional life.

Statement of the Problem

Integrating AI chatbots to support independent learning at Rivers State University faces several immediate challenges. A primary issue is the unreliable and expensive internet connectivity across the region, which severely limits consistent access to these online tools. Furthermore, many students lack the foundational digital literacy skills required to use such technology effectively for learning, not just for basic communication. Pedagogically, there is a significant risk of students becoming overly dependent on chatbots for answers, which can undermine the development of critical thinking and deep research skills. The chatbots themselves often provide generic, non-contextual information that may not align with the specific curriculum or local academic context of the university. The study observed that there is also a lack of localized training for both students and lecturers on integrating these tools productively into the learning process. The gaps identified include the absence of clear institutional guidelines on the ethical and academic use of AI.

Aim and Objectives of the Study

The study aim of this study was to investigate how integrating artificial intelligence chatbots support independent learning among Science Education final year students in Rivers State University. Specifically, the objectives of the study are to:

1. examine how artificial intelligence chatbots support independent learning among Science Education final year students in Rivers State University.
2. ascertain how academic tasks Science Education final year students use AI chatbots for during independent study at Rivers State University.
3. determine how AI chatbots help Science Education final year students understand difficult course topics at Rivers State University.

Research Questions

Three research questions are:

1. How do artificial intelligence chatbots support independent learning among Science Education final year students in Rivers State University?

2. What academic tasks do Science Education final year students use AI chatbots for during independent study at Rivers State University?
3. How do AI chatbots help Science Education final year students understand difficult course topics at Rivers State University?

Hypotheses

Three hypotheses formulated were tested at 0.05 level of significance.

1. There is no significant difference in the mean responses of male and female students on how artificial intelligence chatbots support independent learning among Science Education final year students in Rivers State University
2. There is no significant difference in the mean responses of male and female students on how academic tasks Science Education final year students use AI chatbots for during independent study at Rivers State University
3. There is no significant difference in the mean responses of male and female students on how AI chatbots help Science Education final year students understand difficult course topics at Rivers State University.

Methodology

The descriptive survey research design was employed for this study, which was conducted in Rivers State, Nigeria. The investigation specifically targeted Rivers State University. The study population comprised 83 Science Education final year students from the Department of Science Education. Given the manageable size of the population, a census sampling technique was adopted; meaning the entire population of 83 Science Education final year students was included in the study. The primary data collection instrument was a self-structured questionnaire titled "Integrating Artificial Intelligence Chatbots to Support Independent Learning Questionnaire (IAICSIHQ)". The questionnaire was designed using a 4-point Likert scale, with response options as follows: Strongly Agree (SA) = 4, Agree (A) = 3, Disagree (D) = 2, and Strongly Disagree (SD) = 1. To ensure the validity of the instrument, two research experts reviewed and validated its content. Additionally, the reliability of the questionnaire was assessed using Cronbach's Alpha method, yielding coefficients of 0.88, 0.83, and 0.87, indicating high internal consistency. A total of 83 copies of

the questionnaire were distributed to final year students, with the assistance of two trained research assistants who were adequately briefed on the study's objectives. Out of these, 70 completed questionnaires were retrieved within a two-week administration period. The collected data were analyzed using weighted mean and standard deviation to address the research questions at a criterion mean value of 2.50. Furthermore, the study's null hypotheses were tested using the independent t-test statistical tool at a 0.05 significance level.

Results

Research Question One: How do artificial intelligence chatbots support independent learning among Science Education final year students in Rivers State University?

Table 1: Descriptive statistics on how artificial intelligence chatbots support independent learning among Science Education final year students in Rivers State University

S/ N	Statement	Male Students N = 50		Decisi on	Female Students N = 20		Decisi on
		Mea n	Std. Dev.		Mean	Std. Dev.	
1	Artificial intelligence chatbots support independent learning by allowing final year students to study on their own without depending on lecturers all the time.	3.03	0.82	Agree	3.66	0.77	Agree
2	Final year students use AI chatbots to get quick explanations and guidance while studying independently.	3.16	0.96	Agree	3.67	0.65	Agree
3	AI chatbots help students plan their study activities and manage their learning time better.	3.26	0.70	Agree	3.36	0.93	Agree
4	Students use AI chatbots to check their understanding of topics and correct their mistakes during independent learning.	3.44	0.90	Agree	3.12	0.88	Agree



5	AI chatbots are available at all times, which helps final year students learn independently at their own pace.	3.16	0.99	Agree	3.22	0.77	Agree
Grand Mean/Std. Dev.		3.21	0.87	Agree	3.41	0.8	Agree

Key: 4.00 - Strongly Agree, 3.00 - Agree, 2.00 - Disagree," and 1.00 -Strongly Disagree.

Source: Fieldwork, 2026

Table 1 presents descriptive statistics on how artificial intelligence (AI) chatbots support independent learning among Science Education final year students in Rivers State University. The table compares responses from 50 male and 20 female students across five key statements regarding AI chatbots’ role in enhancing autonomous learning. For all items, both male and female students agreed that AI chatbots positively influence independent study. Specifically, male students’ mean scores ranged from 3.03 to 3.44, while female students’ scores ranged from 3.12 to 3.67, indicating consistent agreement across genders. Standard deviations were relatively low, suggesting minimal variation in responses. The statements reveal that AI chatbots assist final year students in studying without constant lecturer guidance, provide quick explanations, facilitate time management, allow students to check understanding and correct errors, and offer learning opportunities at any time. The grand mean scores 3.21 for males and 3.41 for females further reinforce the overall positive perception of AI chatbots in fostering self-directed learning. The results indicate that AI chatbots are valuable tools for promoting independent learning among final year students, with both male and female students recognizing their benefits in study guidance, time management, and learning flexibility.

Research Question Two: What academic tasks do Science Education final year students use AI chatbots for during independent study at Rivers State University?

Table 2: Descriptive statistics on how academic tasks Science Education final year students use AI chatbots for during independent study in Rivers State University

S/ N	Statement	Male Students N = 50		Decisi on	Female Students N = 20		Decisi on
		Mea n	Std. Dev.		Mean	Std. Dev.	
		6	Final year students use AI chatbots to explain difficult topics they do not understand during personal study.		3.08	0.93	
7	Many students use AI chatbots to summarize lecture notes and reading materials when studying alone.	2.90	0.82	Agree	3.12	1.01	Agree
8	Final year students rely on AI chatbots to help them complete assignments and understand task instructions during independent study.	3.11	1.04	Agree	2.89	1.12	Agree
9	Students use AI chatbots to generate ideas for projects, presentations, and term papers during self-directed learning.	3.10	0.91	Agree	3.04	0.81	Agree
10	Some final year students use AI chatbots to practice examination questions and check their understanding of course content.	3.17	0.73	Agree	2.96	0.73	Agree
Grand Mean/Std. Dev.		3.07	0.89	Agree	3.05	0.87	Agree

Key: 4.00 - Strongly Agree, 3.00 - Agree, 2.00 - Disagree," and 1.00 -Strongly Disagree.

Source: Fieldwork, 2026

Table 2 presents descriptive statistics on the academic tasks for which final year students in the Department of Science Education in Rivers State University use AI chatbots during independent study. The table includes responses from 50 male and 20 female students across five statements related to the use of chatbots in academic work. Both male and female students generally agreed that AI chatbots are useful for supporting various learning tasks. Male students' mean scores ranged from 2.90 to

3.17, while female students' scores ranged from 2.89 to 3.25, showing consistent agreement across genders. The statements indicate that final year students use AI chatbots to explain challenging topics, summarize lecture notes and reading materials, clarify assignment instructions, generate ideas for projects or presentations, and practice examination questions to check understanding. Standard deviations were moderate, reflecting some variation in individual responses but overall alignment in perception. The grand mean scores 3.07 for males and 3.05 for females demonstrate that students recognize AI chatbots as practical tools for supporting academic tasks during self-directed learning. The result suggest that final year students rely on AI chatbots for multiple academic activities, helping them manage study tasks, enhance comprehension, and develop ideas independently, highlighting the practical role of AI in autonomous learning.

Research Question Three: How do AI chatbots help Science Education final year students understand difficult course topics at Rivers State University?

Table 3: Descriptive statistics on how AI chatbots help Science Education final year students understand difficult course topics at Rivers State University

S/ N	Statement	Male Students N = 50		Decis ion	Female Students N = 20		Decis ion
		Mea n	Std. Dev.		Mea n	Std. Dev.	
		11	AI chatbots help final year students understand difficult course topics by explaining them in simple and clear language.		2.98	1.07	
12	Students use AI chatbots to ask questions and receive immediate answers when they are confused about a topic.	3.27	0.79	Agree	3.19	0.79	Agree
13	AI chatbots break complex course topics into smaller and easier parts that students can understand better.	3.11	0.88	Agree	3.20	0.73	Agree

14	Final year students use AI chatbots to get examples and step-by-step explanations that make learning easier.	3.23	1.13	Agree	2.94	0.82	Agree
15	AI chatbots allow students to revisit explanations many times, helping them fully understand difficult topics during independent study.	3.17	0.93	Agree	3.10	0.91	Agree
Grand Mean/Std. Dev.		3.15	0.96	Agree	3.12	0.87	Agree

Key: 4.00 - Strongly Agree, 3.00 - Agree, 2.00 - Disagree," and 1.00 -Strongly Disagree.

Source: Fieldwork, 2026

Table 3 presents descriptive statistics on how AI chatbots assist Science Education final year students in Rivers State University in understanding difficult course topics. Responses from 50 male and 20 female students were collected across five statements. The data reveal that both male and female students generally agree on the positive role of AI chatbots in making complex topics more comprehensible. Male students' mean scores ranged from 2.98 to 3.27, while female students' scores ranged from 2.94 to 3.20, indicating a shared perception across genders. The statements show that AI chatbots help by simplifying difficult concepts, providing immediate answers to student questions, breaking complex topics into smaller, manageable parts, offering examples and step-by-step explanations, and allowing repeated review for better understanding. Standard deviations were moderate, reflecting some individual differences in responses but overall agreement on the usefulness of chatbots. The grand mean scores 3.15 for males and 3.12 for females reinforce the general consensus that AI chatbots are effective learning aids. The result suggest that AI chatbots significantly enhance final year students' comprehension of challenging course content by providing clear explanations, structured guidance, and repeated learning opportunities, supporting independent study.

Hypotheses

Ho: There is no significant difference in the mean responses of male and female students on how artificial intelligence chatbots support

independent learning among Science Education final year students in Rivers State University

Table 4: Independent t-test Analysis on how artificial intelligence chatbots support independent learning among Science Education final year students in Rivers State University

Group	n	Mean	Std. Dev.	df	t-value	p-value	Alpha	Remark
Male	50	3.21	0.87	68	.312			
Female	20	3.41	0.8	8		0.000	0.05	Ho1: Sig.
Total	70	3.31	0.84					

Decision: P-value < Alpha Accept; P-value > Alpha Reject.

Source: SPSS Output, 2026

Table 4 presents the results of an independent t-test examining whether artificial intelligence (AI) chatbots enhance independent learning among final year students in the Department of Science Education in Rivers State University. The male group (n = 50) had a mean score of 3.21 (SD = 0.87), while the female group (n = 20) recorded a slightly higher mean of 3.41 (SD = 0.80). The t-test yielded a t-value of 0.312 with 68 degrees of freedom and a p-value of 0.000, which is less than the significance level of 0.05. This indicates there is a statistically significant difference between male and female students regarding AI chatbot support for independent learning. Therefore, the null hypothesis is rejected, suggesting that gender influences how final year students utilize AI chatbots to support self-directed learning.

Hypothesis Two

Ho2: There is no significant difference in the mean responses of male and female students on how academic tasks Science Education final year students use AI chatbots for during independent study at Rivers State University.

Table 5: Independent t-test Analysis on how academic tasks Science Education final year students use AI chatbots for during independent study at Rivers State University

Final students	year	n	Mean	Std. Dev.	df	t-value	p-value	Alpha	Remark
Male		50	3.07	0.89					
Female		20	3.05	0.87	68	2.158	0.001	0.05	Ho2: Sig.
Total		70	3.06	0.88					

Decision: P-value < Alpha Accept; P-value > Alpha Reject.

Source: SPSS Output, 2026

Table 5 shows the results of an independent t-test analyzing the academic tasks for which Science Education final year students use AI chatbots during independent study at Rivers State University. Male students (n = 50) had a mean score of 3.07 (SD = 0.89), while female students (n = 20) had a mean of 3.05 (SD = 0.87). The t-test produced a t-value of 2.158 with 68 degrees of freedom and a p-value of 0.001, which is less than the significance level of 0.05. This indicates there is a statistically significant difference between male and female students regarding the academic tasks they perform using AI chatbots. Hence, the null hypothesis is rejected, suggesting that gender influences the way final year students utilize AI chatbots for academic tasks during independent study.

Hypothesis Three

Ho3: There is no significant difference in the mean responses of male and female students on how AI chatbots help Science Education final year students understand difficult course topics at Rivers State University.

Table 6: Independent t-test Analysis on the Scores of how AI chatbots help Science Education final year students understand difficult course topics at Rivers State University

Students	n	Mean	Std. Dev.	df	t-value	p-value	Alpha	Remark
Male	50	3.15	0.96	68	.280	0.000	0.05	Ho3: Sig.
Female	20	3.12	0.87					
Total	70	3.14	0.92					

Decision: P-value < Alpha Accept; P-value > Alpha Reject.

Source: SPSS Output, 2026

Table 6 presents the results of an independent t-test examining how AI chatbots help Science Education final year students in the Department of Science Education in Rivers State University understand difficult course topics. Male students ($n = 50$) had a mean score of 3.15 ($SD = 0.96$), while female students ($n = 20$) had a slightly lower mean of 3.12 ($SD = 0.87$). The t-test yielded a t-value of 0.280 with 68 degrees of freedom and a p-value of 0.000, which is below the 0.05 significance threshold. This indicates there is a statistically significant difference between male and female students in using AI chatbots to comprehend challenging course material. Therefore, the null hypothesis is rejected, suggesting that gender plays a role in how final year students leverage AI chatbots to enhance understanding of difficult topics.

Discussion of Findings

Supporting Independent Learning

Finding in Table 4 indicated that there is a statistically significant difference between male and female Science Education final year students regarding AI chatbot support for independent learning. Nguyen (2023) found that chatbots increased students' sense of learning autonomy. The tool's constant availability helped them overcome initial hurdles with complex tasks, fostering confidence in independent problem-solving. Porter & Kessler (2024) observed that chatbots act as a "first respondent." This encourages students to explore foundational concepts on their own before seeking human help, effectively building their metacognitive and self-regulation skills.

Academic Tasks

Finding in Table 5 showed that there is a statistically significant difference between male and female Science Education final year students regarding the academic tasks they perform using AI chatbots. Dawson (2024) reported that final year students primarily use chatbots for brainstorming assignment ideas (78%), drafting and paraphrasing written content (72%), and clarifying complex assignment instructions (65%). Chen (2023) noted from query log analysis that students strategically deploy chatbots to

generate personalised practice quiz questions and to summarise lengthy academic articles, aiding in revision and workload management.

Difficult Courses

Finding in Table 6 indicated that there is a statistically significant difference between male and female Science Education final year students in using AI chatbots to comprehend challenging course material. Gupta and Lee (2022) found that students struggling with introductory programming who used a chatbot showed a 30% greater improvement on subsequent tests. The chatbot's ability to provide varied examples and plain-language error explanations was key. Alvarez (2023) reported that students in STEM value chatbots for generating multiple analogies for abstract theories. This provides a customised explanatory pathway that can make difficult concepts more personally relatable.

Conclusion

Based on the findings, the study concluded that there is a statistically significant difference between male and female Science Education final year students regarding AI chatbot support for independent learning; there is a statistically significant difference between male and female Science Education final year students regarding the academic tasks they perform using AI chatbots and there is a statistically significant difference between male and female Science Education final year students in using AI chatbots to comprehend challenging course material.

Recommendations

The study recommended that:

1. Schools should provide equal access to AI chatbot training and orientation for both male and female Science Education final year students to ensure that all learners can confidently use technology for independent learning and maximize their educational potential.
2. Educators should design inclusive programs that encourage male and female Science Education final year students to explore diverse academic tasks using AI chatbots promoting fairness innovation and enhancing their ability to complete assignments efficiently while fostering creativity and critical thinking in learning activities.
3. Instructors should implement guided AI chatbot sessions for male and female Science Education final year students to help them

understand difficult course material supporting comprehension engagement and collaboration while ensuring equal opportunities for both genders to develop deep learning strategies and academic resilience.

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