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EDITORIAL

Journal of Innovations in Science Education (JISE) is a Publication of Association of Science Educators Anambra (ASEA). It is publishable both online and offline. The publication is twice a year. It embraces only on science education and innovative ideas. JIES provide an avenue for dissemination of research findings, innovative ideas and practices between researchers, science educators and policy makers in the form of original research, book review, theoretical and conceptual papers which will serve as an important reference for the advancement of teaching, learning and research in the field of science education.

We are grateful to the contributors and hope that our readers will enjoy reading these contributions.

Prof. Josephine N. Okoli
Editor-in-Chief

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**EFFECT OF CHATGPT- ASSISTED LEARNING INSTRUCTIONAL
APPROACH ON SENIOR SECONDARY STUDENTS' ACADEMIC
ACHIEVEMENT IN DATA PROCESSING IN ONITSHA EDUCATION ZONE**

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Abstract

This study investigated the effect of the ChatGPT-Assisted Learning Instructional Approach on the academic achievement of Senior Secondary School II (SSII) students in Data Processing in Onitsha Education Zone, Anambra State. Two research questions were answered and three null hypotheses were tested at the 0.05 level of significance. A quasiexperimental pretest-posttest non-equivalent control group design was adopted. The population comprised 3,642 SSII students offering Data Processing in public secondary schools in the education zone, while a sample of 95 students from two co-educational public secondary schools participated in the study. The Data Processing Achievement Test (DPAT), consisting of 50 multiple-choice items, was used for data collection. The instrument was validated by three experts and had a reliability coefficient of 0.72 using the KuderRichardson Formula 20. Mean and standard deviation were used to answer the research questions, while Analysis of Covariance (ANCOVA) was used to test the hypotheses at the 0.05 level of significance. The findings revealed that students taught using the ChatGPTAssisted Learning Instructional Approach achieved significantly higher academic achievement than those taught using the traditional Discussion Method. Gender had no significant effect on students' academic achievement, and there was no significant interaction effect between teaching method and gender. It was recommended that teachers of Data Processing integrate ChatGPT-Assisted Learning Instructional Approach into classroom instruction to enhance students' academic achievement.

Keyword: Chatgpt –Assisted Instructional Approach, Academic Achievement

Introduction

Education plays an important role in national development by equipping individuals with knowledge, skills, and competencies needed for effective participation in society. In Nigeria, secondary education is expected to prepare learners for further education, employment, and self-reliance. However, the education system continues to face challenges such as inadequate infrastructure, overcrowded classrooms, insufficient instructional materials, and limited access to qualified teachers, particularly in public schools (Federal Ministry of Education, 2023). These challenges have created a need for innovative instructional approaches that can improve teaching and learning through the effective use of digital technologies.

Computer-related education has become increasingly important because of the growing demand for digital literacy and technological competence. Computer Studies was introduced into the Nigerian secondary school curriculum following the Federal Government's approval of the National Policy on Computer Education in 1988 (Federal Ministry of Education, 1988). Subsequent curriculum reforms introduced Data Processing as a distinct subject at the senior secondary school level (NERDC, 2008). Data Processing develops students' competencies in areas such as data management, word processing, database applications, and other computer-based activities. The subject is therefore important for developing the practical and digital skills required for further education, employment, and participation in the digital economy.

Despite its importance, students' achievement in Data Processing remains a concern. Evidence reported in the WAEC Chief Examiners' Reports indicates fluctuations in students' performance over the years, with persistent difficulties particularly in practical areas involving applications such as Microsoft Word and Microsoft Access. Inadequate ICT resources and teachers' limited pedagogical use of available technologies have also been identified as challenges affecting effective ICT instruction (Okafor and Obikwelu, 2019). In addition, conventional classroom instruction may provide limited opportunities for individualized learning, immediate feedback, and repeated practice, particularly in large classes. These challenges suggest the need for instructional approaches that can provide students with more interactive and personalized learning experiences.

Artificial Intelligence (AI) has emerged as a promising technology for supporting teaching and learning. One such technology is ChatGPT, a generative artificial intelligence tool developed by OpenAI that can respond to questions, explain concepts, provide examples, generate learning materials, and offer immediate feedback. In education, these capabilities can support personalized learning, independent study, and clarification of difficult concepts (Kasneci et al., 2023). Research has also reported positive effects of ChatGPT-supported learning on students' learning outcomes when the technology is incorporated into structured instructional approaches (Deng et al., 2025; Zeng et al., 2024).

The potential usefulness of ChatGPT is particularly relevant to Data Processing because the subject requires students to understand concepts as well as develop practical competencies. Through guided interaction with ChatGPT, learners can obtain explanations, ask follow-up questions, practise concepts, and receive immediate responses to areas they find difficult. Such interaction may encourage active engagement and provide learning support that is not always possible through conventional classroom instruction.

Academic achievement refers to the extent to which students attain the intended learning outcomes and demonstrate mastery of the knowledge and skills taught. In secondary education, it is commonly measured through students' performance in tests, examinations, and other assessment activities. Academic achievement is an important indicator of the effectiveness of instructional methods because it provides evidence of the extent to which students have understood and can apply the content taught. In Data Processing, achievement is particularly important because students are expected to acquire both conceptual knowledge and practical skills in areas such as word processing, database management, and other computer-based applications. Consequently, instructional approaches that provide students with opportunities for active participation, immediate feedback, practice, and clarification of difficult concepts may contribute to improved academic achievement. Evidence from studies on ChatGPT-supported learning also suggests that structured use of the technology can improve students' learning outcomes (Deng et al., 2025; Zeng et al., 2024). This provides a basis for examining whether ChatGPT-Assisted Learning Instructional Approach can improve the academic achievement of senior secondary school students in Data Processing.

Gender has also been considered in studies of technology-supported learning because male and female students may differ in their exposure to and use of emerging digital technologies. For example, Møgelvang et al. (2024) reported gender differences in the use of generative AI chatbots in higher education. However, differences in technology use do not necessarily imply differences in academic outcomes. It is therefore important to determine whether the effectiveness of ChatGPT-assisted instruction differs according to students' gender.

Although studies have reported beneficial effects of artificial intelligence and ChatGPT on learning outcomes, there is limited empirical evidence on the effectiveness of a ChatGPT-Assisted Learning Instructional Approach for teaching Data Processing among senior secondary school students in the Nigerian context. This creates a need for context-specific evidence on whether integrating ChatGPT into Data Processing instruction can improve students' academic achievement and whether gender influences its effectiveness. Therefore, this study investigated the effect of the ChatGPT-Assisted Learning Instructional Approach on the academic achievement of Senior Secondary School II students in Data Processing in Onitsha Education Zone, Anambra State.

State of the Problem

Students' academic achievement in Data Processing in Nigerian secondary schools has remained fluctuating over the years, despite the subject's important role in developing digital literacy, practical ICT skills, and problem-solving abilities needed in today's digital world. Evidence from the West African Examinations Council (WAEC) Chief Examiners' Reports from 2014 to 2025 shows that students' performance has not been steady, as it moves up and down across different years. WAEC Chief Examiners' Reports consistently show that students still struggle with practical parts of Data Processing, especially Microsoft Access, database design, and query handling. Many students understand the theory but find it difficult to apply what they have learned in real tasks. This may be linked to the way the subject is taught, where traditional classroom methods are still commonly used, with less focus on practical, hands-on learning. Because of this, there is a need to explore better ways of teaching Data Processing. One possible approach is the use of ChatGPT-assisted learning Instructional Approach, which can support students through simple explanations, step-by-step guidance, and practice support. This approach may help improve students'

understanding, make learning more practical, and help stabilize their academic performance in Data Processing.

Purpose of the Study

The purpose of this study is to investigate the effect of ChatGPT-Assisted Learning Instructional Approach on the academic achievement of senior secondary school students in Data Processing in Onitsha education zone. Specifically, the study sought to determine the:

1. mean academic achievement scores of students taught Data Processing using ChatGPT-Assisted Learning Instructional Approach and of those taught using traditional method (Discussion method)?
2. mean academic achievement scores of male and female students taught Data Processing using ChatGPT-Assisted Instructional Approach.
3. interaction effect of the teaching methods and gender on students' academic achievement in Data Processing

Research Questions

The following research questions guided the study;

1. What is the mean academic achievement scores of students taught Data Processing using ChatGPT-Assisted Learning Instructional Approach and of those taught using traditional method (Discussion method)?
2. What is the mean academic achievement scores of male and female students taught Data Processing using the ChatGPT-Assisted Learning Instructional Approach?

Hypotheses

The following null hypotheses were formulated and tested at 0.05 level of significance;

1. There is no significant difference in the mean academic achievement scores of students taught Data Processing using ChatGPT-Assisted Learning Instructional

Approach and those taught using the traditional teaching method (Discussion method).

2. There is no significant difference in the mean academic achievement scores of male and female students taught Data Processing using ChatGPT-assisted.
3. There is no interaction effect of the teaching methods and gender on students' academic achievement in Data Processing

Methodology

The study adopted a quasi-experimental pretest-posttest non-equivalent control group design and was conducted in Onitsha Education Zone of Anambra State, Nigeria. The population comprised 3,642 SSII students offering Data Processing, from which 95 students were selected from two co-educational public secondary schools using multistage sampling. The sample comprised 55 students in the ChatGPT-Assisted Learning Instructional Approach group and 40 in the traditional Discussion Method group. Data were collected using a 50-item Data Processing Achievement Test (DPAT), adapted from WAEC past questions, validated by three experts, and found reliable using KR-20 with a coefficient of 0.72. The experimental group received ChatGPT-assisted instruction, while the control group received the traditional Discussion Method for four weeks, covering Operating System, Microsoft Word, Database Concepts, and Introduction to Microsoft Access. A pretest was administered before the treatment and a posttest afterward. Data were analyzed using mean and standard deviation, while ANCOVA was used to test the hypotheses at the 0.05 level of significance, with pretest scores as the covariate.

Results

Research Question One: What is the mean academic achievement scores of students taught Data Processing using ChatGPT-Assisted Learning Instructional Approach and those taught using the traditional teaching method (Discussion)?

Table 1: Pretest and Posttest Mean Achievement Scores of Students by Teaching Method

Groups	N	Pretest Mean	SD	Posttest Mean	SD	Gained Mean
ChatGPT-assisted Instructional Approach (Experimental)	55	26.07	4.92	32.95	3.63	6.88
Traditional Method (Discussion) (Control)	40	23.85	5.90	24.35	5.55	0.50
Mean Difference		2.22		8.60		6.38

Table 1 presents the pretest and posttest mean achievement scores of students taught Data Processing using the ChatGPT-Assisted Learning Instructional Approach and those taught using the traditional teaching method. Before the treatment, students in the experimental group obtained a pretest mean score of 26.07 with a standard deviation of 4.92, while those in the control group had a pretest mean score of 23.85 with a standard deviation of 5.90. The pretest mean scores suggest that both groups had fairly similar levels of academic achievement before the treatment, although the control group exhibited slightly greater variability in scores, as indicated by its higher standard deviation.

Research Question Two: What is the mean academic achievement scores of male and female students taught Data Processing using ChatGPT-assisted

Table 2: Mean and Standard Deviation of Posttest Scores by Teaching Method and Gender

Group	Gender	N	Mean	SD	Mean Difference
ChatGPT-assisted Instructional Approach	Male	22	32.27	3.30	1.12
	female	33	33.39	3.82	

Table 2 presents the mean and standard deviation of posttest academic achievement scores of male and female students taught Data Processing using the ChatGPTAssisted Learning Instructional Approach. The male students obtained a mean achievement score of 32.27 with a standard deviation of 3.30, while female students obtained a slightly higher mean achievement score of 33.39 with a standard deviation of 3.82. The mean difference of 1.12 indicates that female students achieved slightly higher scores than the male students. The standard deviation values of 3.30 and 3.82 are relatively close, indicating that the achievement scores of both male and female students were fairly consistent. Although female students had a slightly higher mean achievement score than male students, the difference was not statistically significant.

H0₁: There is no significant difference in the mean academic achievement scores of students taught Data Processing using ChatGPT-Assisted Learning Instructional Approach and those taught using the traditional teaching method (Discussion method).

Table 3: Analysis of Covariance (ANCOVA) of the Difference in the Mean Academic Achievement Scores of Students by Teaching Method

Source	SS	Df	Mean Square	F	Sig.	Decision
Corrected Model	3116.076 ^a	2	1558.038	280.613	.000	Sig.
Intercept	451.708	1	451.708	81.356	.000	
Pretest	1405.128	1	1405.128	253.073	.000	Sig.
Teaching Method (Group)	1082.036	1	1082.036	194.882	.000	Sig.
Error	510.809	92	5.552			
Total	85330.000	95				
Corrected Total	3626.884	94				

Table 3 presents the Analysis of Covariance (ANCOVA) of the posttest academic achievement scores of students taught Data Processing using the ChatGPT-Assisted Learning Instructional Approach and the Traditional Teaching Method, with the pretest scores used as the covariate. The result shows that the effect of the teaching method on students' academic achievement is statistically significant, $F(1, 92) = 194.882$, $p < .05$. Since the probability value ($p = .000$) is less than the 0.05 level of significance, the null hypothesis is rejected. The finding indicates that there is a statistically significant difference in the mean academic achievement scores of students taught using the ChatGPT-Assisted Learning Instructional Approach and those taught using the Traditional Teaching Method after controlling for the effect of the pretest scores. Therefore, the ChatGPT-Assisted Learning Instructional Approach had a significant positive effect on students' academic achievement in Data Processing.

H0₂: There is no significant difference in the mean academic achievement scores of male and female students taught Data Processing using ChatGPT-assisted instruction.

Table 4: Analysis of Covariance (ANCOVA) of the Difference in the Mean Academic Achievement Scores of Male and Female Students Taught Data Processing Using the ChatGPT-Assisted Learning Instructional Approach.

Source	SS	Df	Mean Square	F	Sig.	Decision
Corrected Model	366.251 ^a	2	183.126	27.475	.000	Sig.
Intercept	560.345	1	560.345	84.071	.000	
Pretest	349.657	1	349.657	54.461	.000	Sig.
Gender	10.844	1	10.844	1.627	.208	Not Sig.
Error	346.585	52	6.665			
Total	60410.000	55				
	712.836					
Corrected Total		54				

Table 4 presents the Analysis of Covariance (ANCOVA) of the posttest academic achievement scores of male and female students taught Data Processing using the ChatGPT-Assisted Learning Instructional Approach, with the pretest scores used as the covariate. The result shows that the effect of gender on students' academic achievement was not statistically significant, $F(1, 52) = 1.627$, $p = .208$. Since the probability value ($p = .208$) is greater than the 0.05 level of significance, the null hypothesis was not rejected. The finding indicates that there is no statistically significant difference in the mean academic achievement scores of male and female students taught Data Processing using the ChatGPT-Assisted Learning Instructional Approach after controlling for the effect of the pretest scores. Therefore, gender did not have a significant effect on the academic achievement of students taught Data Processing using the ChatGPT-Assisted Learning Instructional Approach.

H0₃: There is no significant interaction effect between teaching method and gender on students' academic achievement.

Table 5: Analysis of Covariance (ANCOVA) of the Interaction Effect of Teaching Method and Gender on Students' Academic Achievement

Source	SS	Df	Mean Square	F	Sig.	Decision
Corrected Model ^a	3152.873	4	788.218	149.658	.000	Sig.
Intercept	361.003	1	361.003	68.543	.000	
Pretest	1396.846	1	1396.846	265.218	.000	Sig.
Teaching Method (Group)	1055.293	1	1055.293	200.367	.000	Sig.
Gender	17.783	1	17.783	3.376	.069	Not Sig.
Gender × Method	13.286	1	13.286	2.523	.116	Not Sig.
Error	474.011	90	5.267			
Total	85330.000	95				
Corrected Total	3626.884	94				

In Table 5, it presents the Analysis of Covariance (ANCOVA) of the interaction effect of teaching method and gender on students' academic achievement in Data Processing, using the pretest scores as the covariate. The result shows that the interaction effect between teaching method and gender on students' academic achievement was not statistically significant, $F(1, 90) = 2.523$, $p = .116$. Since the probability value ($p = .116$) is greater than the 0.05 level of significance, the null hypothesis was not rejected. The finding indicates that there is no statistically significant interaction effect between teaching method and gender on students' academic achievement after controlling for the effect of the pretest scores. This implies that the effect of the ChatGPT-Assisted Learning Instructional Approach on students' academic achievement was similar for both male and female students. In other words, the effectiveness of the ChatGPT-Assisted Learning Instructional Approach did not depend on students' gender.

Discussion

The findings of this study revealed that the ChatGPT-Assisted Learning Instructional Approach significantly improved students' academic achievement in Data Processing compared with the Traditional Teaching Method. This finding suggests that the interactive and learner-centered nature of the ChatGPT-Assisted Learning Instructional Approach enhanced students' understanding of Data Processing concepts. Through continuous interaction with ChatGPT, students were able to ask questions, receive immediate feedback, revisit difficult concepts, and clarify misconceptions, thereby promoting active participation in the learning process and improving their academic performance. This finding supports the Constructivist Learning Theory, which posits that learners actively construct knowledge through interaction, exploration, and meaningful engagement with learning experiences. It also agrees with the Information Processing Theory, which emphasizes that meaningful interaction, rehearsal, and timely feedback facilitate effective encoding and retrieval of information, thereby enhancing learning outcomes. The finding is consistent with López-Fernández and Vergaz (2024) who reported that the integration of generative artificial intelligence tools enhanced students' learning engagement and academic performance in higher education. Similarly, Henkel, Mensah, and Boateng (2024) found that an AI chatbot tutor significantly improved students' mathematics learning outcomes through personalized learning support and immediate feedback. Likewise, Boateng et al. (2023) reported that the AI-powered teaching assistant, Kwame, effectively supported science learning

among West African secondary school students by improving conceptual understanding and encouraging independent learning. In addition, Malik, Kousar, and Arshad (2025) found that ChatGPT facilitated knowledge acquisition and improved students' learning outcomes by providing adaptive and interactive learning experiences.

The findings of this study revealed that gender did not significantly influence academic achievement of students taught Data Processing using the ChatGPT-Assisted Learning Instructional Approach. This finding suggests that both male and female students benefited similarly from the ChatGPT-Assisted Learning Instructional Approach. The interactive, learner-centered, and personalized nature of ChatGPT may have provided equal learning opportunities for both genders by allowing students to learn at their own pace, seek clarification whenever necessary, and receive immediate feedback without bias. Consequently, the instructional approach appeared to minimize gender-related differences in learning outcomes and created a more inclusive learning environment. The finding is consistent with Okeke, Nwankwo, and Anyanwu (2022) who found no significant gender difference in the academic achievement of secondary school students in Computer Science in SouthEast Nigeria. Similarly, Adigun et al. (2020) reported that gender had no significant influence on students' academic performance in Computer Studies among secondary school students in Niger State. Likewise, Akinyemi and Ebimomi (2020) found that male and female students achieved comparable learning outcomes in Computer Studies when provided with equal learning opportunities. In addition, the findings of this study revealed that the interaction between teaching method and gender did not significantly influence students' academic achievement in Data Processing. This finding suggests that the effectiveness of the ChatGPT-Assisted Learning Instructional Approach in improving students' academic achievement was similar for both male and female students. In other words, the instructional approach provided comparable learning opportunities for students regardless of gender, indicating that its effectiveness was not dependent on whether the learner was male or female. This finding further supports the view that learner-centered and technology-supported instructional approaches can provide equitable learning experiences for students of both genders.

Conclusion

Based on the findings of this study, it is concluded that the ChatGPT-Assisted Learning Instructional Approach is more effective than the traditional Discussion Method in improving students' academic achievement in Data Processing and its integration into classroom instruction can significantly enhance the academic achievement of the students irrespective of their gender.

Recommendation

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

1. Teachers of Data Processing should integrate the ChatGPT-Assisted Learning Instructional Approach into classroom instruction to enhance students' academic achievement.
2. School administrators should provide adequate technological infrastructure, such as computers, internet access, and digital learning tools, to support AI-assisted instruction.
3. Educational authorities should organize training programs and workshops to equip teachers with the skills required to effectively use ChatGPT and similar AI tools in classroom instruction.
4. Curriculum planners should incorporate AI-assisted learning strategies into the teaching of Data Processing and other related subjects to improve students' learning outcomes.
5. Students should be encouraged to use ChatGPT as a supplementary learning tool for revision, practice, and clarification of difficult concepts.

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