

Enhancing Students' Interest in Biology Through Demonstration and Instructional Analogy Teaching Methods in Delta State, Nigeria

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Abstract

This study investigated the effectiveness of demonstration and instructional analogy teaching methods in enhancing secondary school students' interest in Biology in Delta State, Nigeria. The study adopted a quasi-experimental pretest-posttest non-equivalent control group design involving two experimental groups (demonstration and instructional analogy) and one control group (lecture method). The population comprised 39,904 Senior Secondary School Two (SS II) Biology students in 474 public mixed secondary schools in Delta State. A sample of 298 students drawn from six public mixed secondary schools was selected using a stratified random sampling technique. Data were collected using the Biology Interest Scale (BIS), which yielded a Cronbach Alpha reliability coefficient of 0.78. Mean and standard deviation were used to answer the research questions, while Analysis of Covariance (ANCOVA), Scheffé post hoc test, and independent samples t-test were used to test the hypotheses at the 0.05 level of significance. The findings revealed a significant difference in the interest scores of students taught Biology using demonstration, instructional analogy, and lecture methods, with the demonstration method producing the highest level of students' interest. The Scheffé post hoc analysis further showed that the demonstration method was significantly more effective than both instructional analogy and lecture methods, whereas no significant difference existed between instructional analogy and lecture methods. The study also found no significant gender differences in the interest scores of students taught using either the demonstration or instructional analogy method. The study concluded that the demonstration method is the most effective instructional approach for enhancing students' interest in Biology. It was recommended that Biology teachers should adopt demonstration and instructional analogy teaching methods to promote students' interest in Biology.

Keywords: *Biology, Biology interest, demonstration method, instructional analogy, lecture method, secondary school students, Delta State, Nigeria.*

Introduction

Biology occupies a central position in science education because it provides learners with the knowledge and skills needed to understand living organisms, environmental interactions, human health, biotechnology, and sustainable development. The subject serves as a prerequisite for careers in medicine, nursing, pharmacy, agriculture, environmental science, and other science-related professions (Negerie et al., 2026). Consequently, improving students' engagement and interest in Biology remains a major concern for educators and policymakers seeking to enhance scientific literacy and human capital development. However, achieving meaningful learning outcomes in Biology depends not only on curriculum content but also on the instructional approaches adopted by teachers. Recent studies have shown that learner-centred instructional strategies significantly improve students' motivation, engagement, and classroom participation compared with conventional teaching approaches (Negerie et al., 2026; Butera & Mukamwambali, 2026). Since students' interest strongly influences learning outcomes, it is important to understand how different teaching methods shape learners' enthusiasm for Biology. Interest is widely recognized as an important affective variable that influences students' willingness to learn, persistence in solving academic problems, classroom participation, and overall academic achievement. Students who develop genuine interest in Biology are more likely to participate actively during lessons, retain scientific concepts, and pursue science-related careers. Conversely, low interest often results in poor classroom engagement, weak conceptual understanding, and declining enrolment in science disciplines. Researchers have therefore emphasized the need for instructional strategies capable of stimulating learners' curiosity and sustaining their attention throughout the teaching-learning process (Gayus et al., 2026; Dajal & Awoyeye, 2026). The search for effective instructional approaches has consequently drawn attention to learner-centred teaching methods such as demonstration and instructional analogy.

Demonstration teaching method is one of the practical instructional approaches frequently recommended for Biology because it enables teachers to present abstract concepts through observable activities, experiments, models, and practical illustrations. Rather than relying solely on verbal explanations, demonstration allows learners to visualize biological processes, manipulate instructional materials, and actively participate in classroom activities, thereby making learning more meaningful. Previous studies have reported that demonstration-based instruction improves students' understanding, academic achievement, and classroom participation when compared with conventional lecture methods (Inyang & Isaac, 2023; Nwankwo & Oforka, 2026). Although these findings highlight the instructional value of demonstration, educators have continued to explore complementary strategies capable of simplifying difficult biological concepts through meaningful comparisons. One such learner-centred strategy is instructional analogy, which involves explaining unfamiliar scientific concepts by relating them to familiar objects, situations, or experiences within learners' everyday environment. Through carefully constructed analogies, teachers bridge the gap between students' prior knowledge and new scientific ideas, thereby facilitating conceptual understanding and stimulating interest in learning. The effectiveness of analogy-based instruction has received increasing attention in science education because it promotes meaningful learning, conceptual change, and long-term retention of knowledge. Studies have shown that instructional analogy significantly enhances students' understanding and interest in Biology compared with conventional teaching methods

(Mohammed, 2025; Gayus et al., 2026). Similarly, reviews of science education literature have emphasized that well-designed analogies improve students' reasoning processes and conceptual comprehension when appropriately integrated into classroom instruction (Akçay, 2016; Hernández & Espitia, 2021). While the educational benefits of analogy have been widely acknowledged, its effectiveness requires comparison with other innovative instructional approaches.

Comparative studies involving innovative teaching methods have become increasingly important because they enable educators to identify instructional strategies that produce the greatest improvement in students' learning outcomes (Nwankwo & Oforka, 2026). While both demonstration and instructional analogy encourage active learning, they employ different mechanisms to facilitate understanding and stimulate learners' interest. Demonstration emphasizes observation and practical experience, whereas instructional analogy focuses on connecting unfamiliar concepts with learners' existing knowledge structures. Empirical evidence suggests that both approaches outperform the conventional lecture method in promoting students' engagement and achievement in science subjects, although differences may exist in their relative effectiveness depending on the learning context and instructional objectives (Nwankwo & Oforka, 2026; Mohammed, 2025). Besides instructional methods, another variable frequently examined in science education research is gender. Gender has remained an important variable in Biology education because researchers have produced inconsistent findings regarding male and female students' affective responses to innovative instructional strategies. While some studies reported no significant gender differences in students' interest following learner-centred instruction, others observed slight variations attributable to classroom interaction patterns and learning preferences (Dajal & Awoyeye, 2026; Gayus et al., 2026). These inconsistent findings suggest that the effectiveness of instructional methods should not only be evaluated in terms of overall student interest but also across gender groups to determine whether the approaches provide equitable learning opportunities for both male and female students. This underscores the need for context-specific investigations within different educational settings. Although previous studies have demonstrated the effectiveness of demonstration and instructional analogy in improving various learning outcomes in Biology, many of these studies have focused primarily on academic achievement, conceptual understanding, or engagement, with relatively fewer investigations emphasizing students' interest, particularly within the context of Delta State, Nigeria. Furthermore, limited empirical evidence exists comparing demonstration, instructional analogy, and the conventional lecture method simultaneously while also examining gender differences in students' interest. Addressing this gap is important because sustained interest constitutes a major determinant of successful Biology learning and future participation in science-related careers. It was against this background that this study investigated the effectiveness of demonstration and instructional analogy teaching methods in enhancing secondary school students' interest in Biology in Delta State, Nigeria.

Statement of the Problem

Biology is one of the core science subjects offered in secondary schools because of its relevance to scientific literacy, technological advancement, environmental sustainability, and the preparation of students for careers in medicine, agriculture, pharmacy, and other health-related professions. Despite its importance, many secondary school students continue to exhibit low interest in Biology lessons, as evidenced by poor classroom participation, lack of enthusiasm during instruction, and declining motivation to pursue Biology-related careers. This situation has been attributed partly to the persistent use of teacher-centred instructional approaches, particularly the conventional lecture

method, which often limits students' active involvement in the learning process and makes abstract biological concepts difficult to understand. Consequently, there is increasing advocacy for learner-centred instructional strategies capable of stimulating students' curiosity, participation, and sustained interest in Biology. Among the learner-centred instructional approaches recommended by science educators are demonstration and instructional analogy teaching methods, both of which have shown promise in improving students' engagement and learning outcomes. However, available empirical findings remain inconsistent regarding their relative effectiveness in enhancing students' interest, while few studies have simultaneously compared these methods with the conventional lecture method and examined whether gender influences students' interest under these instructional approaches, particularly in Delta State, Nigeria. This gap in empirical evidence limits teachers' ability to identify the most effective strategy for fostering students' interest in Biology. **It is against this backdrop** that this study sought to determine the effectiveness of demonstration and instructional analogy teaching methods in enhancing secondary school students' interest in Biology in Delta State, Nigeria.

Purpose of the Study

The aim of this study was to investigate the effectiveness of demonstration and instructional analogy teaching methods in enhancing secondary school students' interest in Biology in Delta State. Specifically, the study sought to:

1. determine the difference in the mean interest scores of students taught Biology using demonstration method, instructional analogy teaching method, and lecture method.
2. determine the difference in the mean interest scores of male and female students taught Biology using the demonstration method.
3. determine the difference in the mean interest scores of male and female students taught Biology using the instructional analogy teaching method.

Research Questions

The following research questions guided the study:

1. What is the difference in the mean interest scores of students taught Biology using demonstration method, instructional analogy teaching method, and lecture method?
2. What is the difference in the mean interest scores of male and female students taught Biology using the demonstration method?
3. What is the difference in the mean interest scores of male and female students taught Biology using the instructional analogy teaching method?

Hypotheses

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

1. There is no significant difference in the mean interest scores of students taught Biology using demonstration method, instructional analogy teaching method, and lecture method.
2. There is no significant difference in the mean interest scores of male and female students taught Biology using the demonstration method.
3. There is no significant difference in the mean interest scores of male and female students taught Biology using the instructional analogy teaching method.

Methodology

This study adopted a quasi-experimental research design, specifically the pretest–posttest non-equivalent control group design, to investigate the effectiveness of demonstration and instructional analogy teaching methods in enhancing students' interest in Biology. The design was considered appropriate because intact classes were used without random assignment of individual students to treatment groups, thereby preserving the natural classroom setting. The study comprised two experimental groups (demonstration and instructional analogy) and one control group (lecture method). The independent variable was teaching method at three levels (demonstration, instructional analogy, and lecture), while the dependent variable was students' interest in Biology. Sex served as a moderating variable. The pretest–posttest design enabled the researcher to determine changes in students' interest following the treatment and compare the effectiveness of the experimental teaching methods with the conventional lecture method. Similar quasi-experimental designs have been widely employed in Biology education research because they provide valid evidence of instructional effectiveness under normal classroom conditions (Gayus et al., 2026; Nwankwo & Oforka, 2026). The population of the study comprised 39,904 Senior Secondary School Two (SS II) Biology students enrolled in 474 public mixed secondary schools across the three senatorial districts of Delta State during the 2023/2024 academic session. Public mixed secondary schools were selected because they provided comparable learning environments in which both male and female students received instruction under similar curricular conditions. Private and single-sex schools were excluded from the study to ensure uniformity in the study population. The selection of SS II students was based on their adequate exposure to the senior secondary Biology curriculum and their readiness to learn the selected Biology concepts. The population statistics were obtained from the Delta State Ministry of Education.

A sample of 298 SS II Biology students drawn from six public mixed secondary schools participated in the study. A stratified random sampling technique was employed in selecting the participants. Delta State was first stratified into Delta Central, Delta North, and Delta South Senatorial Districts. Thereafter, two Local Government Areas were randomly selected from each senatorial district using the balloting method. One public mixed secondary school was subsequently selected from each sampled Local Government Area through simple random sampling. The SS IIA intact class in each selected school constituted the study sample because it comprised students offering Biology as a core science subject. The selected schools also had qualified Biology teachers who served as research assistants throughout the treatment period. The use of intact classes was consistent with the requirements of quasi-experimental studies in educational settings where random assignment of individual students is impracticable (Gayus et al., 2026). Data for the study were collected using the Biology Interest Scale (BIS). The instrument was adapted from Thompson and Garcia (2023) and modified to suit the objectives of the study and the Biology learning context. The Biology Interest Scale consisted of two sections. Section A elicited respondents' demographic information, while Section B comprised 25 items measuring students' interest in Biology using a four-point scale of Strongly Agree (4), Agree (3), Disagree (2), and Strongly Disagree (1). The maximum obtainable score on the instrument was 100, with higher scores indicating greater interest in Biology. Standardized interest scales have been widely recommended for measuring students' affective outcomes because they provide dependable information on learners' attitudes and interest toward science learning (Dajal & Awoyeye, 2026). The Biology Interest Scale was subjected to face validity by three experts comprising an experienced Biology teacher, a lecturer in Measurement and Evaluation, and a lecturer in Science Education. The experts assessed the clarity, appropriateness, relevance, and suitability of the

instrument in measuring students' interest in Biology. Their observations and recommendations were incorporated into the final version of the instrument before administration. The reliability of the instrument was established using the Cronbach Alpha technique. The instrument was administered to 30 SS II Biology students from a school outside the study area, and the responses were analyzed using the Statistical Package for the Social Sciences (SPSS). A reliability coefficient of 0.78 was obtained, indicating that the instrument possessed satisfactory internal consistency for measuring students' interest in Biology. The treatment lasted for six weeks and was implemented by the regular Biology teachers in the participating schools who served as research assistants after receiving orientation on the instructional packages. The six sampled schools were randomly assigned to two experimental groups and one control group, with two schools in each group. Students in the first experimental group were taught the selected Biology concepts using the demonstration method, while those in the second experimental group received instruction using the instructional analogy method. Students in the control group were taught the same Biology concepts using the conventional lecture method. Before the commencement of the treatment, the Biology Interest Scale was administered as a pretest to determine the initial equivalence of the groups. At the end of the six-week treatment period, the same instrument, with the items reshuffled, was administered as a posttest to determine the effect of the instructional methods on students' interest in Biology. The use of structured instructional packages and prior training of the research assistants ensured uniformity in the implementation of the treatments across the participating schools (Mohammed, 2025; Nwankwo & Oforka, 2026).

The data collected were analyzed using the Statistical Package for the Social Sciences (SPSS). The research questions were answered using mean and standard deviation. Analysis of Covariance (ANCOVA) was used to test the hypothesis comparing the posttest mean interest scores of students in the demonstration, instructional analogy, and lecture groups while controlling for differences in their pretest scores. Where a significant difference was observed, Scheffé post hoc analysis was conducted to determine the specific groups responsible for the difference. The hypotheses comparing the posttest mean interest scores of male and female students taught using the demonstration method and instructional analogy were tested using the independent samples *t*-test. All hypotheses were tested at the 0.05 level of significance, consistent with established practice in experimental educational research (Gayus et al., 2026; Dajal & Awoyeye, 2026).

Results

Table 1: Descriptive Statistics Comparing the Pretest and Posttest Mean Interest Scores of Students Taught Biology Using Demonstration Method, Instructional Analogy and Lecture Method

Method	Testing	N	$\bar{x}$	MD	SD
Demonstration	Pretest	106	24.43	38.18	8.94
	Posttest		62.61		5.46
Analogy	Pretest	98	23.56	36.70	5.58
	Posttest		60.26		9.10
Lecture	Pretest	94	23.14	36.01	7.36
	Posttest		59.15		9.90

Table 1 shows that students in all three groups had higher posttest mean interest scores than pretest mean interest scores. However, students taught using the demonstration method recorded the highest posttest mean score (62.61), followed by those taught using the instructional analogy method (60.26), while those taught using the lecture method had the lowest posttest mean score

(59.15). This indicates that the demonstration method was the most effective in enhancing students' interest in Biology.

Table 2: ANCOVA Comparison of the Difference in the Mean Interest Scores of Students Taught Biology Using Demonstration Method, Instructional Analogy and Lecture Method

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	709.582 ^a	3	236.527	3.441	.017
Intercept	92890.343	1	92890.343	1351.498	.000
Pretest	76.644	1	76.644	1.115	.292
Methods	597.887	2	298.943	4.349	.014
Error	20207.035	294	68.731		
Total	1120522.000	298			
Corrected Total	20916.617	297			

Table 2 reveals that there was a significant difference in the mean interest scores of students taught Biology using demonstration, instructional analogy, and lecture methods ($F = 4.349$, $p = .014 < .05$). Therefore, the null hypothesis was rejected, indicating that the teaching methods differed significantly in their effectiveness in enhancing students' interest in Biology.

Table 3: Scheffe Post-Hoc Test Comparison of the Difference in the Mean Interest Scores of Students Taught Biology Using Demonstration Method, Instructional Analogy and Lecture Method

(I) methods	Teaching(J) methods	TeachingMean Difference (I-J)	Std. Error	Sig. ^b	95% Confidence Interval for Difference ^b	
					Lower Bound	Upper Bound
Demonstration	Lecture	3.376*	1.178	.004	1.058	5.693
	Analogy	2.299*	1.163	.049	.009	4.588
Lecture	Demonstration	-3.376*	1.178	.004	-5.693	-1.058
	Analogy	-1.077	1.197	.369	-3.433	1.279
Analogy	Demonstration	-2.299*	1.163	.049	-4.588	-.009
	Lecture	1.077	1.197	.369	-1.279	3.433

Table 3 shows that the demonstration method produced significantly higher interest scores than both the lecture method (Mean Difference = 3.376, $p = .004$) and the instructional analogy method (Mean Difference = 2.299, $p = .049$). However, there was no significant difference between the instructional analogy and lecture methods (Mean Difference = 1.077, $p = .369$). This indicates that the demonstration method was significantly more effective than the other two methods in improving students' interest in Biology.

Table 4: Descriptive Statistics Comparing the Posttest Mean Interest Scores of Male and Female Students Taught Biology Using Demonstration Method

Sex	N	$\bar{x}$	MD	SD
Male	44	62.59	0.04	5.45
Female	62	62.63		5.51

Table 4 indicates that male and female students taught Biology using the demonstration method had almost identical posttest mean interest scores. Male students obtained a mean score of 62.59, while female students recorded 62.63, suggesting little or no difference in their level of interest.

Table 5: Independent Sample t-test Comparison of the Posttest Mean Interest Scores of Male and Female Students Taught Biology Using Demonstration Method

Sex	N	$\bar{x}$	SD	df	t-cal.	Sig.(2-tailed)	Remark
Male	44	62.59	5.45	104	0.035	0.972	HO ₂ is not rejected
Female	62	62.63	5.51				

Table 5 shows that there was no significant difference in the mean interest scores of male and female students taught Biology using the demonstration method ($t = 0.035$, $p = .972 > .05$). Therefore, the null hypothesis was not rejected, indicating that the demonstration method enhanced the interest of both male and female students equally.

Table 6: Descriptive Statistics Comparing the Posttest Mean Interest Scores of Male and Female Students Taught Biology Using Analogy

Sex	N	$\bar{x}$	MD	SD
Male	42	59.38	1.53	9.93
Female	56	60.91		8.46

Table 6 reveals that female students taught Biology using the instructional analogy method obtained a slightly higher posttest mean interest score (60.91) than their male counterparts (59.38). However, the difference in the mean scores was small.

Table 7: Independent Sample t-test Comparison of the Posttest Mean Interest Scores of Male and Female Students Taught Biology Using Instructional Analogy

Sex	N	$\bar{x}$	SD	df	t-cal.	Sig.(2-tailed)	Remark
Male	42	59.38	9.93	96	0.822	0.413	HO ₃ is not rejected
Female	56	60.91	8.46				

Table 7 indicates that there was no significant difference in the mean interest scores of male and female students taught Biology using the instructional analogy method ($t = 0.822$, $p = .413 > .05$). Therefore, the null hypothesis was not rejected, indicating that instructional analogy was equally effective in enhancing the interest of both male and female students.

Discussion

The findings of this study revealed a significant difference in the interest of students taught Biology using demonstration, instructional analogy, and lecture methods. Students exposed to the demonstration method recorded the highest mean interest score, followed by those taught using instructional analogy, while the lecture method produced the lowest mean interest score. The superior performance of the demonstration method may be attributed to its ability to actively engage learners through practical activities, observation, and direct interaction with instructional materials, thereby making Biology concepts more concrete and interesting. The finding supports the constructivist view that meaningful learning occurs when learners actively participate in the learning process. The result is consistent with the findings of Nwankwo and Oforka (2026), who reported that demonstration-based instruction significantly enhanced students' learning outcomes

in Biology. It also agrees with the findings of Inyang and Isaac (2023) that demonstration teaching improved students' classroom participation and interest more than conventional instructional approaches. The finding further corroborates Gayus et al. (2026), who found that learner-centred instructional strategies significantly enhanced students' interest in Biology compared with traditional teaching methods. The Scheffé post hoc analysis further showed that the demonstration method was significantly more effective than both the instructional analogy and lecture methods, whereas no significant difference existed between the instructional analogy and lecture methods. This finding suggests that although instructional analogy improves students' interest, practical demonstration provides richer learning experiences that stimulate greater curiosity and sustained engagement. Biology is a practical-oriented discipline, and students are more likely to develop interest when they observe biological processes and manipulate learning materials directly. This finding agrees with Mohammed (2025), who reported that analogy-based instruction improves students' motivation and learning outcomes but recommended combining it with practical classroom activities for maximum effectiveness. The result also aligns with the findings of Butera and Mukamwambali (2026), who emphasized that interactive instructional approaches create more engaging learning environments than passive teaching methods.

The findings further indicated that there was no significant difference in the interest scores of male and female students taught Biology using the demonstration method. This implies that demonstration teaching benefited both sexes equally in stimulating interest in Biology. The finding suggests that the practical and participatory nature of demonstration instruction provides equal learning opportunities regardless of gender. This result is in agreement with Dajal and Awoyeye (2026), who found that learner-centred instructional strategies enhanced students' interest irrespective of gender. It also supports the findings of Gayus et al. (2026) that innovative instructional methods minimize gender disparities by promoting active participation among all learners. Similarly, the study revealed that male and female students taught using instructional analogy did not differ significantly in their interest scores. Although female students recorded a slightly higher mean score than their male counterparts, the difference was not statistically significant. This finding indicates that instructional analogy is equally beneficial to both male and female students because it links unfamiliar Biology concepts with familiar experiences accessible to all learners. The finding agrees with Hernández and Espitia (2021), who observed that carefully designed analogies enhance conceptual understanding and learner engagement irrespective of gender. It also supports Akçay (2016), who maintained that appropriately selected analogies improve students' reasoning and interest in science classrooms without favouring either sex.

Conclusion

The study concluded that teaching methods significantly influence students' interest in Biology. Among the instructional approaches investigated, the demonstration method proved to be the most effective in enhancing students' interest, followed by instructional analogy, while the conventional lecture method was the least effective. The study also established that both demonstration and instructional analogy teaching methods promoted students' interest irrespective of gender. Therefore, adopting learner-centred instructional approaches, particularly the demonstration method, can substantially improve students' interest in Biology in secondary schools.

Recommendations

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

1. Biology teachers should adopt the demonstration method more frequently in classroom instruction to enhance students' interest in Biology.
2. Instructional analogy should be incorporated into Biology teaching, particularly when explaining abstract or difficult concepts, to make learning more meaningful and interesting.
3. School administrators and educational authorities should organize regular workshops and in-service training to equip Biology teachers with practical skills in the effective use of demonstration and instructional analogy teaching methods.
4. Biology teachers should provide equal learning opportunities for both male and female students by adopting learner-centred instructional strategies that encourage active participation irrespective of gender.

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