Zamfara International Journal of Sci. Tech. Educ. & Mathematics
The Official Journal of the Department of Science Education
Federal University Gusau, Zamfara State, Nigeria
Volume 2, Number 2, September, 2025
ISSN: 2251 – 0974

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DOI: I: https://doi.org/10.64348/zije.2025113

Impact of Team-Teaching Strategy on Performance and Retention in Biology Concept among Secondary School Students in Sokoto State, Nigeria

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Abstract
This study examines, the impact of team- teaching strategy on performance and retention in biology concept among secondary school students in Sokoto State, Nigeria. A quasi-experimental research design, involving pre-test and post-test assessments, was adopted to answer two research questions and test two corresponding hypotheses. A total of 357 SS-I biology students from four public secondary schools were selected through stratified random sampling to ensure gender and school type representation. The students were divided into experimental groups (190 students) taught using the team teaching method and control groups (167 students) instructed with conventional methods. Data collection was conducted using the Biology Achievement and Retention Test (BART), the instrument was validated by experts and also achieved the reliability coefficient of 0.78, a 20-item objective test administered as both pre-test, post-test and retention test. Descriptive statistics, including mean scores, were used to answer the research questions, while independent sample t-tests was used to test the hypotheses at a 0.05 significance level. These findings were that , team teaching enhances students' understanding, retention of biological concepts, making it a promising approach to improve academic outcomes in secondary education. Based on these results, the researcher recommends integrating team teaching into school curricula to foster interactive and effective learning environments. These findings suggest that longitudinal research should be conducted to examine the long-term effects of team teaching on student performance and knowledge retention over multiple academic years. This would provide insights into the sustainability of the benefits observed in this study.
***Keywords**: Team Teaching, Academic Performance, Retention, Biology Education*

Introduction
Education is fundamental to national development as it shapes the knowledge, skills, and competencies necessary for societal progress. The quality of education depends largely on the teaching strategies employed, which directly influence student learning outcomes. The advancement of any nation is closely linked to its scientific, technological, and educational progress (Anaeto, Asiabaka, Ani, Nnadi, Ugwoke, Asiabaka, Anaeto & Ihekerony, 2016). A well-structured education system is essential for equipping individuals with the skills needed to tackle contemporary challenges and drive economic growth. Science and technology have proved to be significantly useful in man's daily struggle to control his environment and build a comfortable world. The teaching of science offers students the ability to access a wealth of knowledge and information which will contribute to an overall understanding of how and why things work like they do. Hence, Igwe (2017) defined science

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as a systematic process of obtaining knowledge and behaviour of the physical diverge through observation, experimentation, measurement and recording of information. Biology as a key science subject deals with the study of plants and animals. Biology is a natural science subject that deals with the study of living organisms including their structure, function, growth, distribution and taxonomy (Okenyi, 2015).

Team teaching promotes a collaborative, multi-faceted approach to instruction, combining subject expertise and various teaching techniques to create an engaging learning environment (Haruna, 2021). By sharing planning and delivery responsibilities, teachers can address students' needs more effectively, enriching their educational experience. Furthermore, team teaching fosters professional collaboration among educators, enabling them to refine their instructional techniques and enhance student learning through active engagement and critical thinking (Awodun & Alake, 2023). With multiple instructors available, students benefit from immediate feedback, which helps clarify concepts and improve academic performance (Davis, 2021). Additionally, the integration of different teaching perspectives fosters a broader understanding of the material, offering students alternative approaches to problem-solving (Darma, 2018). The concept of team teaching emerged in the mid-20th century, with Harvard University pioneering its implementation through an internship program in 1955. This model involved five teacher trainees working under the supervision of an experienced teacher. By 1965, team teaching had gained traction in England and reached its peak popularity in the Western world during the 1970s (Hooda & Sharma, 2016). Research indicates that team teaching enhances student comprehension by incorporating diverse instructional approaches, facilitating immediate clarification of misconceptions, and promoting active engagement in the classroom.

The concept "retention" is describes the remembering of a fact or idea after a passage of time. Meaningful learning is deemed to have taken place if after a passage of time the student could recall and apply information which he/she had been taught previously(Ibok & Unoh,2019) And this takes place when learning is coded into memory. In Nigeria, the predominant instructional approach in secondary schools is the conventional single-teacher method, where one teacher is responsible for instructing the entire class. While this method is widely used, it has certain limitations. It often relies on lecture-based instruction, where students passively absorb information (Noreen & Rana, 2019). Although effective in some contexts, it typically does not offer enough opportunities for active student engagement or deep exploration of complex subjects like biology (Behlol, 2009). Researchers suggest that collaborative teaching strategies, such as team teaching, enhance student engagement and improve knowledge retention, particularly in subjects like biology (Awodun & Alake, 2023;). Academic performance reflects an individual's level of knowledge and competence, distinguishing those with higher proficiency from those with lower achievement (Pareek, 2019). Several studies have examined the impact of team teaching and retention on academic performance across various subjects and educational levels. Akpan, Usoro, Akpan & Ekpo (2010) studied the effects of team teaching on student performance in Introductory Technology among Junior Secondary School students in Akwa Ibom State, Nigeria. Using a pre-test post-test non-randomized experimental design, 316 students from four schools participated. The results indicated that students taught using team teaching significantly outperformed those taught by a single instructor, leading to recommendations for adopting team teaching in Introductory Technology instruction. While this study targeted Introductory Technology students, the current research examines Biology students. Ahmed, Bello, Alabi, Sulaiman and Ahmed, (2022) investigated the effects of team teaching on senior school

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students' achievement in adaptation using a 20-item Adaptation Achievement Test (AAT) with 99 participants. A quasi-experimental design was used and hypotheses were tested via paired t-tests and ANCOVA. Results showed no significant difference in achievement when students were taught using team teaching, regardless of ge nder or initial performance levels. The study concluded that team teaching alone did not enhance learning outcomes and recommended integrating multiple teaching methods for better results in biology education. This study is very relevant to the current study because it studies effects of team teaching on senior school students achievement while the current research studies impact of team teaching on senior school students performance.

Ajayi and Ayeni (2019) explored the effect of team teaching on the academic performance of senior secondary school students in Lagos State, Nigeria. Using a quasi-experimental design with a sample size of 200 students, the study revealed that the experimental group (team teaching) had significantly better performance in their biology assessments compared to the control group (traditional teaching). Akinbode, Adepoju and Yusuf (2020) examined the influence of team teaching on the retention of biology knowledge among Nigerian secondary school students. A quasi-experimental design was employed with a sample size of 150 students across three schools in Ibadan. The study concluded that team teaching significantly improved students' retention of biological concepts, particularly in areas such as cell biology and human physiology. Zhang and Huang (2022) examined the impact of team teaching on biology education in rural secondary schools in China. A total of 300 students participated in a quasi-experimental study. The researchers found that students who received team-teaching instruction showed greater understanding and retention of biology topics, particularly in areas like ecology and genetics. The study concluded that team teaching should be encouraged to improve student outcomes, especially in resource-limited settings.

Statement of the Problem

One of the key topics in the Biology syllabus is the concept of microorganisms, which is crucial for understanding health, disease prevention, and various biotechnological applications. On the other hand, despite its importance, research and public examination reports West African Examination Council (WAEC) 2020, have consistently indicated that students' performance in Biology, particularly in concepts requiring abstract reasoning such as microorganisms, remains poor. This poor performance is often accompanied by low retention, meaning that students quickly forget what they have learned which undermines both examination success and long term scientific literacy. This study aims to investigate the impact of team teaching on students' academic performance and retention in Biology among senior secondary school students in Sokoto South Local Government Area, Sokoto State, Nigeria. By exploring how team teaching affects students' understanding and retention of biological concepts, the study seeks to provide valuable insights into the potential benefits of team-based instructional strategies in the Nigerian education system, contributing to the enhancement of teaching methods and student outcomes in science education.

Objectives of the study

The main objective of this study is to examine the impact of team teaching on secondary school students' academic performance and retention on microorganism concepts in Sokoto South Local Government Area, Sokoto State, Nigeria. The specific objectives of the study are to:

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1. Investigate the difference in academic performance between secondary school students taught microorganisms concepts using team teaching and those taught with the conventional (single-teacher) approach
2. Investigate the difference in retention between secondary school students taught microorganisms concepts using team teaching and those taught with the conventional (single-teacher) approach

Research Questions

The following research questions guided the study:

1. What is the difference in academic performance of secondary schools biology students taught microorganisms concepts using team teaching and those taught using conventional (single teacher) approach?
2. What is the difference in retention of secondary schools biology students taught microorganisms concepts using team teaching and those taught using conventional (single teacher) approach?

Null Hypotheses

The following null hypotheses were stated at 0.05 confidence level, to carry out the study:

H_{o1}: There is no significant difference in academic performance of secondary school biology student taught microorganisms concepts using team teaching and those taught using conventional (single teacher) approach.

H_{o2}: There is no significant difference in retention of secondary school biology student taught microorganisms concepts using team teaching and those taught using conventional (single teacher) approach.

Methodology

This study targeted Senior Secondary School I (SSS I) students in Sokoto South Local Government Area, Sokoto State, Nigeria, with a focus on those studying Biology. This study utilized Quasi experimental design. The target population comprised 7,185 students enrolled in 21 public secondary schools. A stratified random sampling technique was employed to select 357 students as sample from four secondary schools, ensuring fair representation of both boys' and girls' schools. Within each school, 190 students were assigned to the experimental group, which received team teaching, and 167 students were assigned to the control group, which received instruction using conventional teaching method. To assess academic performance and retention, the researcher developed the Biology Achievement and Retention Test for Secondary School Students (BARTSSS), which consisted of 20 multiple-choice questions covering key Biology topics. The test was designed to measure both academic performance and retention. Additionally, demographic data, including age and gender, was collected using a questionnaire. The instruments were validated through peer reviews and expert evaluations, with a satisfactory inter-rater agreement of 80%. A pilot study was conducted at the Women Center for Continuing Education, Sokoto, to assess the clarity and reliability of the instruments, resulting in a reliability coefficient of 0.78, which met the acceptable threshold. Ethical approval was obtained from the relevant authorities, including the Sokoto State Ministry of Education and school principals. The study followed ethical guidelines, ensuring the anonymity and confidentiality of participants. Data collection was carried out in phases: a questionnaire was administered before the pre-test, followed by the pre-test using BARTSSS to establish baseline performance. Afterward, the experimental group was taught using the team teaching method, and the control group received instruction using conventional instruction over four periods (160 minutes). Finally, a post-test was administered to assess changes in academic

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performance and followed by retention test. Descriptive statistics of mean and standard deviation were used to answer the research questions and Independent sample t-test was at 0.05 significance level used to test the null hypotheses and evaluate the impact of team teaching on academic performance and retention.

Presentation of Results

Research Question 1

What is the difference in academic performance of secondary schools biology students taught microorganism concepts using team teaching and those taught using conventional (single teacher) approach?

To answer this, the mean academic performance scores and standard deviations for both the team teaching (Experimental) and conventional (Control) groups were calculated from the post-test results.

Table 1: Mean Academic Performance Scores of Team Teaching and Conventional Groups

Group	N	Mean	Std. Deviation
Experimental	190	3.01	0.25
Control	167	2.35	0.30

Source: Field Work (2024)

Table1: presents the descriptive statistics for academic performance on the post-test regarding methods used for teaching microorganisms concepts. The Experimental group, which received instruction through team teaching (N=190), achieved a mean academic performance score of 3.01 with (SD = 0.25). In contrast, the Control group, taught using the conventional approach (N=167), recorded a mean score of 2.35 (SD = 0.30). A direct comparison of these means indicates an observable difference in academic performance between the two groups. Specifically, students taught using the team teaching approach (Mean = 3.01) appear to have performed higher in academic performance on microorganism concepts compared to those taught with the conventional approach (Mean = 2.35).

Research Question 2

What is the difference in retention of secondary schools biology students taught microorganism concepts using team teaching and those taught using conventional (single teacher) approach?

To answer this question, the mean retention scores and standard deviations for both the experimental (team teaching) group and the control (conventional) group were calculated from the retention post-test results.

Table 2: Mean Retention Scores between Experimental and Control Group

Group	N	Mean	Std. Deviation
Experimental	190	3.03	0.39
Control	167	2.51	0.55

Source: Field Work (2024)

Table 2 presents the descriptive statistics for students' retention of microorganism concepts on the post-test. The Experimental group (N=190), which experienced team teaching, showed a mean retention score of 3.03 (SD = 0.39). In contrast, the Control group (N=167), taught conventionally, had a mean retention score of 2.51 (SD = 0.55).

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An initial examination of these means indicates that the team teaching group (Mean = 3.03) appears to have retained more information compared to the conventional group (Mean = 2.51). This suggests a potential positive impact of team teaching on the long-term retention of microorganisms concepts.

Hypothesis 1

H_{o1}: There is no significant difference in academic performance of secondary school biology student taught microorganism concepts using team teaching and those taught using conventional (single teacher) approach

To test this hypothesis, an Independent Samples t-test was conducted to compare the mean academic performance scores of the experimental (team teaching) group and the control (conventional) group on the post-test. The significance level (α) was set at 0.05.

Table 3: Independent Samples t-test to compare the academic performance

Group	N	Mean	SD	Df	t-value	P-value	Decision
Experimental Group	190	3.01	0.25				
				344	15.83	.000	Rejected
Control Group	167	2.35	0.30				

Source: Field Work (2024)

The results of the Independent Samples t-test, as presented in Table 3, indicate a statistically significant difference in the academic performance of secondary school biology students taught microorganisms concepts using team teaching and those taught using the conventional approach. The null hypothesis (Ho1), which posits no significant difference in academic performance between the two groups, is rejected ($t(346) = 15.83$, $p < .001$).

A comparison of the mean scores reveals that students in the experimental group (team teaching) achieved a higher mean score ($M = 3.01$, $SD = 0.25$) compared to students in the control group (conventional approach) ($M = 2.35$, $SD = 0.30$). This suggests that the team teaching approach has a positive impact on students' academic performance.

Hypothesis 2

H_{o2}: There is no significant difference in retention of secondary school biology student taught microorganism concepts using team teaching and those taught using conventional (single teacher) approach.

To test this hypothesis, an Independent Samples t-test was conducted to compare the mean retention scores of the experimental (team teaching) group and the control (conventional) group on the post-test for retention. The significance level (α) was maintained at 0.05.

Table 4: Independent Samples t-test to compare the Retention of Students

Group	N	Mean	SD	Df	t-value	P-value	Decision
Experimental Group	190	3.03	0.39				
				180	10.83	.000	Rejected
Control Group	167	2.51	0.55				

Source: Field Work (2024)

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The independent samples t-test revealed a statistically significant difference in retention scores between the experimental group (team teaching) and the control group (conventional teaching). The experimental group has a higher mean retention score (3.03) compared to the control group (2.51), with a t-value of 10.83 and a p-value of .000.

These findings suggest that team teaching is a more effective instructional strategy for promoting retention of biological concepts among secondary school students. The results have implication for teaching practices and suggest that educators should consider adopting team teaching approaches to improve student outcomes in biology. In conclusion, the study provides empirical evidence to support the effectiveness of team teaching in enhancing student retention, and it is recommended that educators and policymakers consider these findings when designing instructional strategies for secondary school students.

Discussion of Findings

The finding indicates that students taught using team teaching performed significantly better than those taught with the conventional approach. This study is in line with Akpan et al. (2010) submission that team teaching significantly improved student performance in Introductory Technology among Junior Secondary School students. The study also aligns with Ajayi and Ayeni (2019) that team teaching significantly improved academic performance in biology among senior secondary school students. These studies suggest that team teaching is an effective instructional strategy for improving student performance. However, the study contradicts Ahmed et al. (2022), submission that team teaching alone did not enhance learning outcomes. These contrasting findings may be due to variations in implementation and context. The finding demonstrates that team teaching led to higher retention scores compared to the conventional method. This study is in line with Akinbode et al. (2020) submission that team teaching significantly improved students' retention of biological concepts. The study also aligns with Zhang and Huang (2022) that team teaching improved student understanding and retention of biology topics. These studies suggest that team teaching is an effective approach for enhancing retention and promoting long-term learning. However, further research may be needed to explore the specific factors contributing to improved retention in team teaching settings.

Conclusion

The findings from this study clearly demonstrate that team teaching is a highly effective instructional strategy for enhancing both the academic performance and retention of biological concepts related to microorganisms among secondary school students. Students exposed to the collaborative teaching approach showed significant improvements in their scores and retained information more effectively than their peers taught through traditional methods. These results suggest that adopting team teaching in secondary education can lead to more engaging, effective, and lasting learning experiences in biological sciences. Implementing collaborative teaching strategies can help educators address diverse learning needs, foster active participation, and improve overall educational outcomes. Therefore, curriculum developers and educators should consider integrating team teaching approaches to enrich biology instruction and promote sustained conceptual understanding among students.

Recommendations

Based on the findings of this study, the following recommendations are made by the researcher, to enhance teaching practices and improve educational outcomes in biology education:

1. Educational institutions should adopt team teaching methodologies as a standard practice in secondary school biology classrooms. The implementation of collaborative teaching

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approaches can engage students more effectively and improve their overall understanding and retention of biological concepts.

2. Schools should invest in professional development programs that focus on collaborative teaching techniques. Educators need training on how to effectively implement team teaching strategies, foster teamwork among staff, and create an engaging learning environment that maximizes student participation.

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