



Effect of collaborative instructional strategy on academic achievement of senior secondary students in biology in Otukpo lga of Benue State, Nigeria

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Abstract

This study investigated the Effect of Collaborative Instructional Strategy on Academic Achievement of Senior Secondary Students in Biology in Otukpo Local Government Area of Benue State, Nigeria. The study has two research objectives, two research questions were raised and answered, and two hypotheses were tested at a 0.05 level of Significance. A quasi-experimental design was adopted. Biology Achievement Test (BAT) instruments were developed and administered to 425 samples from the population of 1484 Senior Secondary School (SSI) students in Otukpo Local Government Area, Benue State. A purposive sampling technique was used in the selection of the samples. Biology Achievement Test (BAT) was validated by three experts. The reliability of the BAT was 0.95 using the Kuder-Richardson formula (K-R20) The experimental group was taught using the Collaborative instructional strategy while the control group was taught using the conventional Teaching method. Research questions were answered using mean and standard deviation, while hypotheses were tested at 0.05 level of significance using ANCOVA. Results revealed significant differences in achievement of students taught using the Collaborative instructional strategy and their counterparts taught using the traditional Teaching method. The study further revealed no statistically significant differences in the achievement of male and female students exposed to the Collaborative instructional strategy. Based on the findings, the study concluded that the Collaborative instructional strategy is effective and gender friendly and it was recommended for adoption in the teaching and learning of sciences, particularly Biology.

Keywords: Collaborative instructional strategy, academic achievement secondary students, Biology

Introduction

A teaching technique is a tool used to successfully provide instruction to participants. It is made up of the ideas and methods of education. Class involvement, demonstration, recital, memory, case study, presentations, or a mix of these are common teaching approaches. According to Meghana (2023), traditional teaching methods are employed in Nigeria's educational institutions. In this observation, teachers demonstrate the concept of the lesson using chalk and a chalkboard or by using assistive materials such as lessons printed on paper, PowerPoint presentations, case studies, debates, field visits, and practical sessions. Teaching methods are categorized into two approaches: teacher-centered and student-centered approaches. According to Ibok and Ntibi (2021) ^[56], the teacher-centered approaches include lecture, expository, demonstration, and discussion, among others. In teacher-centered approaches, the teacher is seen as the only possessor of knowledge and is grounded in behaviorism. On the other hand, student-centered approaches are grounded in constructivism, and students are always active when such methods are used. These instructional methods (student-centered) underscore teachers not as decision makers and problem solvers but rather as guides in the learning process. Examples of student-centered learning approaches include inquiry-based learning, the discovery method, and the laboratory method (virtual and physical laboratories), among others.

The traditional method of learning, called the teacher-centered method, is gradually becoming irrelevant and does not seem to satisfy or meet the current needs of society. This approach of teaching only provides theoretical knowledge, which is irrelevant to students and the society in which they

live (Raza *et al.* 2022) ^[44]. There are new strategies or trends of learning that make efforts to introduce new methods or evolve new techniques of instruction that facilitate positive learning outcomes in education. To understand this study, the focus has to shift from the traditional teacher-centered learning approach to modern classroom techniques-based approaches to learning by adopting new trends and techniques of teaching so that we can produce more intellectual researchers and scientists who would contribute to the process of resolving environmental issues and help to save our earth and society (Raza *et al.* 2022) ^[44].

Science and technology education are the bedrock of human civilization and development. Many of the developed nations were able to achieve their status of development through the knowledge of science and technology. Science in general is defined as an organized body of knowledge about our natural environment (Achor, 2013). Science is a systematic enterprise that builds and organizes knowledge in the form of explanations and predictions about the universe. Igwe (2017) ^[18] defines science as a systematic process of obtaining knowledge and understanding of the physical universe through observation, experimentation, measurement, and recording of information.

Science Education is the field of study that exposes learners to content as well as the methodology (processes) of acquiring scientific knowledge for practical application. Science learning is associated with laboratory activities. Laboratory activities provide opportunities for students to perform various kinds of hands-on experiments. According to Adejoh, Amali & Omega (2013), science contributes enormously to solving societal problems like quality of life in many areas, such as health, nutrition, agriculture,

transportation, information, and communication. Hence, nations all over the world, including Nigeria, are striving to develop technologically and scientifically.

Given the importance of science to the nation, the science education curriculum has been developed at various levels of education in Nigeria. The e-Curriculum of the National Educational Research and Development Council (NERDC) (2024) ^[21] stated that Science Education curricula at the Basic Education Level include Basic Science and Technology at lower and Middle Basic Education levels (primaries 1-6) and Basic Science at Upper Basic Education level (Junior Secondary JS1-3). At the Senior Secondary School Level, Science Education includes: Biology, Chemistry, and Physics, while at the tertiary education level, the contents of the curricula of Science Education include Chemistry Education, Integrated Science Education, Physics Education, and Biology Education, among others.

Biology, as a subject taught in senior secondary school, according to Onu, Anyaegbumam and Uzoigwe (2020) ^[40], is defined as a natural science that studies the existence (evolution, morphology, and physiology) of living things, as well as their interactions with non-living components of the earth. Hence, it is a branch of science that studies living things and their interactions with their natural environment. Biology plays an important role in transforming the environment and improving the general quality of life. Nwuba, Egwu, and Osuafor (2022) ^[23] stressed that the importance of Biology cannot be overemphasized, as it provides the knowledge applied in every sphere of life today, ranging from food production, environmental protection, conservation of resources, bioengineering, and agriculture. Biology as a science subject plays an important role in transforming the environment and improving the general quality of life. Recent studies emphasize that Biology occupies a central position in modern education and national development. With adequate knowledge of Biology at the secondary school level, students are better prepared to pursue professional courses such as Nursing, Pharmacy, Medicine, Dietetics, and Geology in higher institutions. This underscores the need for effective and efficient teaching and learning of Biology in Nigerian secondary schools (Saadu *et al.*, 2024) ^[45].

Teaching methods are ways through which teachers organize and present content and learning. However, despite the importance of science to society, it is quite disheartening to note that there is strong evidence of students' low interest and poor academic achievement in Biology and other science subjects in Nigeria (Aina & Adedaja, 2021; Yusuf & Bello, 2022) ^[3, 59]. In Nigeria, for instance, quite some students who get to senior secondary school drop out of science classes, a trend often described as a swing away from science and unimpressive enrollment in science-related subjects (Ogunleye & Babajide, 2021) ^[29]. There has been persistent poor performance among Biology students and science in general, leading to low interest and poor academic achievement in the sciences, particularly Biology. Reports from the West African Examinations Council (2017–2021) ^[18, 28] have continued to highlight students' weak performance in Biology and other science subjects in Senior Secondary School Certificate Examinations.

Recent studies further reveal that low and poor academic achievement in science and Biology are largely linked to inappropriate and uninspiring traditional teaching approaches, especially during and after the COVID-19

period (Eze & Chukwu, 2023; Ibrahim *et al.*, 2022) ^[6, 16]. It has been noted that many teachers still shy away from activity-oriented and student-centered teaching strategies, relying instead on conventional methods that are often inadequate for meaningful learning (Okeke & Ibrahim, 2023) ^[32]. In addition, factors such as overcrowded classrooms, lack of adequate instructional materials (including indigenous textbooks), insufficient funding, low teacher motivation, and weak monitoring and feedback systems have significantly contributed to poor student outcomes in Biology in Nigeria and Benue State in particular (Olatunde & Nwosu, 2021; Adeyemi, 2022) ^[1, 37]. Moreover, several recent studies confirm that both male and female students continue to record low achievement in senior secondary science subjects, especially Biology (Usman & Adeyinka, 2022; Salami, 2023) ^[48, 50]. Consequently, educators are expected to be more innovative and knowledgeable to improve students' interest and academic achievement. Teachers have the responsibility of equipping learners with the necessary scientific knowledge and skills needed to address contemporary challenges such as disease outbreaks. This can only be effectively achieved through the adoption of improved teaching methods, particularly collaborative instructional strategies.

Biology as a subject is very complex and covers a wide range of knowledge, and several reviewed literature pieces on its studies come with students' misconceptions as well as their difficulties as they learn (Skamp, 2018) ^[27]. There is every need for science (Biology) teachers to make the learning environment conducive to motivating students to study Biology, thereby enhancing their interest and academic achievements. Most teachers of Biology at the senior secondary school level are inexperienced and, in some cases, not adequately qualified (Adamu & Olatunji, 2022) ^[30]. Most of the teachers teach Biology without taking students to the laboratory for practicals, so they can have a better understanding based on what is taught in the class. As a result of this, students tend to achieve and retain very little in Biology. A qualified science teacher possesses appropriate professional teaching credentials such as the Nigerian Certificate in Education (N.C.E), Postgraduate Diploma in Education (PGDE), or a Bachelor of Science degree in Education (B.Sc. (Ed)). Such qualified and well-experienced science teachers are better positioned to adopt innovative teaching approaches in science teaching, particularly in Biology (Ogunode and Adamu, 2022) ^[30].

The achievement of students' in external examinations, particularly the West African Examinations Council (WAEC) reports in Nigeria, has been a subject of considerable concern from 2020 ^[14] to 2024. A notable trend during this period has been the decline in student achievement in Biology which has prompted various stakeholders to analyze the underlying factors contributing to this phenomenon.

The analysis of WAEC results for Biology from 2020 to 2024 ^[31, 51] indicates a negative trend in student achievement over the years. The data from WAEC examinations in Biology from 2020 to 2024 ^[31, 58] indicates a gradual decline in the percentage of students' achieving credit passes (grades A1-C6). In 2020 ^[14], approximately 65% of candidates obtained credit passes in Biology. However, this figure dropped to 60% in 2021, further declining to 55% in 2022. The trend continued with only 50% of candidates achieving credit passes in 2023, and preliminary results for

2024 suggest a further decrease to around 45%. This consistent decline raises significant concerns regarding the effectiveness of Biology education and the preparedness of Students' for higher education and professional pursuits in the sciences. See appendix E (P. 113) for achievement of students' in WAEC for a period of five years from 2020 – 2024^[58].

The decline in achievement in WAEC Biology has far-reaching implications. A decrease in the number of students' achieving credit passes may limit their opportunities for further education in the sciences, thereby affecting the overall scientific literacy of the population. This trend could also impact the workforce, as fewer qualified individuals may enter fields that require a strong foundation in Biology, such as medicine, environmental science, and biotechnology.

The academic achievement of students' can be influenced by a multitude of factors, among which the level of cognitive development plays a crucial role. Cognitive development refers to the progression of mental processes such as thinking, reasoning, problem-solving, and understanding. This development is not uniform across all students' and can significantly impact their academic performance. Piaget studies have indicated that cognitive abilities, including memory, attention, and processing speed, are closely linked to educational outcomes.

Statement of the Problem

Biology, as a science subject, deals basically with man's interactions with his immediate and natural environment. Students need to work together through collaboration to understand the various entry-level knowledge brought into the classroom by others to foster creative ideas, critical thinking, and problem-solving skills, which will lead to specialization in the various aspects of Biology that make the learners useful to their society and the world at large.

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overall scientific literacy of the population. This trend could also impact the workforce, as fewer qualified individuals may enter fields that require a strong foundation in Biology, such as medicine, environmental science, and biotechnology.

Research reports showed that teachers' inability to use innovative or student-centered approaches or strategies, such as collaborative instructional strategy, and guided inquiry teaching approach, is the major cause of low interest and poor academic achievement of senior secondary school students in Biology. This low interest and poor academic achievement in Biology implies that only a few candidates will apply to study Biology and related courses in a tertiary institution. This study, therefore, sought to find out the effect of collaborative instructional strategy on interest and academic achievement of Senior Secondary Students in Biology in Otukpo Local Government Area of Benue State, Nigeria.

Objectives of the Study

The objective of this study was to determine the effect of collaborative instructional strategy on the interest and achievement of senior secondary students in Biology in Otukpo Local Government Area of Benue State. Specifically, the study sought to;

1. determine the mean achievement scores of students taught Biology using a collaborative instructional strategy and those taught using a conventional teaching strategy
2. determine the difference in the mean achievement scores of male and female students taught Biology using a collaborative learning strategy.

Research Questions

The following questions were raised to guide this study.

1. What are the mean achievement scores of students taught Biology using a collaborative instructional strategy and those taught using a conventional teaching strategy?
2. What is the difference in the mean achievement scores of male and female students taught Biology using a collaborative learning strategy?

Hypotheses

The following hypotheses were formulated to guide the study and were tested at 0.05 level of significance.

1. There is no significant difference in the mean achievement scores of students taught Biology using a collaborative learning strategy and those taught using a conventional strategy.
2. There is no significant difference in the mean achievement scores of male and female students taught Biology using a collaborative learning strategy.

Significance of the Study

The findings of this research work would immensely benefit Biology teachers, science curriculum planners and developers, science students, science educators, school administrators, other researchers, and the Federal and State Ministries of Education. The findings of this study would also help Biology teachers acquire the requisite skills for using a collaborative learning strategy that encourages students' active participation and arouses and sustains their

interest for high academic achievement by making learning concrete and permanent.

The findings of this research work would also help students to acquire the requisite knowledge and skills that can integrate the cognitive, affective, and psychomotor skills for meaningful learning to take place. It would also help the students learn how to work with others. It would help them learn to share responsibilities for acquiring new knowledge and understanding with peers and value new experiences as an opportunity for inquiry and learning.

The findings of this study would help science curriculum planners and developers to plan Biology curricula in themes that encourage collaborative instructional strategy, which deals with 'hands-on' activities that aid interest and achievement. The findings of this study might also serve as a guide for the curriculum developers to appreciate that meaningful science curriculum reform should address the central unit of the entire science education enterprise, such that teaching and learning of science should be changed from teacher-centered to student-centered, and Biology serving as a reference point.

The findings of this work would also be relevant to the Federal and State Ministries of Education since it will lead to a complete or partial overhaul of teaching strategies being adopted presently and encourage schools to adopt collaborative instructional strategies in teaching and learning Biology and other science-related subjects.

Scope of the Study

This study is restricted to Senior Secondary One (SS1) Students of Biology in Otukpo Local Government Area of Benue State, Nigeria. The choice of SS1 is because it is the foundation class of senior secondary education, where students are expected to choose subjects and their interests matter. Students in this class are just being introduced to Biology as a subject and need to have a clear understanding of the new concepts in the curriculum, which will form the basis for their preparation for external Biology examinations. Therefore, they need to have a clear understanding of the Biology curriculum and its contents through a collaborative teaching strategy. The content coverage of the study is Ecology, Photosynthesis, and Animal nutrition, which are topics to be taught in Biology.

Methodology

The research design that was used for this study is a Quasi-experimental design of non-equivalent groups. Specifically, a non-randomized, pretest-posttest control group. This design was adopted and considered appropriate for the study because the intact class was used for the study. Egbe (2016)^[7] observed that this research design is appropriate for use where intact classes are to be used in a study. The researcher considers the design appropriate for the study and also adopted it because the researcher could not have a complete randomization of the subjects, as this would have disrupted the normal classroom organization. Both experimental and control groups were given the same pretest before treatment and post-test after the treatment.

Population of the Study

The population of the study is 1484 Senior Secondary (SS1) Biology students from the Secondary Schools in Otukpo Local Government Area of Benue State that offer Biology (Benue State Teaching Service Board, 2023)^[54]. The sample

size of this study consisted of 425 Biology students drawn from four government secondary schools in Otukpo Local Government Area of Benue State. The sample size was determined using Yaro Yamane's formula. A multi-stage sampling technique was adopted for the selection of the sample.

Instruments for Data Collection

One instrument was used for data collection. The instrument was the Biology Achievement Test (BAT). The BAT was developed by the researcher using past West African Examination Council (WAEC) questions. The BAT consists of 30 multiple-choice items and a marking scheme, which were based on the study content coverage and the instructional objectives.

Biology Achievement Test (BAT) was given for face and content validation to three experts. One expert in Test and Measurement from the Department of Guidance and Counselling, Joseph Sarwam Tarka University, Makurdi, another from Nassarawa State University, Keffi, and one experienced Biology teacher from Saint Annes Secondary School, Otukpo. The experts were requested to observe or validate the instrument on content coverage, clarity, simplicity, the language of items, appropriateness of the items constructed, and the structure of questions concerning the stated objectives of the study. The experts who validated the instruments made constructive criticisms, observations, and suggestions, which were addressed accordingly.

Reliability of the Instruments

For reliability of the instrument, the Biology Achievement Test (BAT) was trial-tested using students of St Paul's Secondary School, Otukpo. This set of students was considered to be most appropriate for a trial-test study because they possess similar characteristics to those that were used for the study. After the administration OF (BAT), the researcher, therefore, determined the internal consistency of (BAT) using Kuder-Richardson's formula (K-R20) because it is suitable for objective items that are scored dichotomously. The reliability of the instrument (BAT) was found to be 0.95

Method of Data Collection

The data were collected using BAT by the researcher. During the first week, a pre-test BAT was administered to both experimental and control groups, and the scores were recorded accordingly. Treatment was administered to both experimental and control groups from week two to week seven, and during week eight, a post-test BAT was administered to the two groups (experimental and control), and the scores were recorded to compare with those of the pre-test.

Data Analysis Techniques

Data were collected and analyzed using mean, standard deviation and ANCOVA. The research questions were answered using the descriptive statistic of mean and standard deviation, while the hypotheses were tested using the ANCOVA at 0.05 level of significance.

Data Presentation, Analysis and Interpretation

The result of the data analysis and interpretation are presented according to research questions and hypotheses formulated for the study.

Research Question 1: What are the mean interest ratings of students taught Biology using a collaborative instructional strategy and those taught using a conventional teaching strategy?

To answer this research question, the interest ratings of students are presented in Table 1.

Research Question 1: What are the mean achievement scores of students taught Biology using a collaborative instructional strategy and those taught using a conventional teaching strategy? The answer to this research question is presented in Table 3.

Table 1: Mean Achievement Scores and Standard Deviation of Students in Experimental Groups and Control Groups.

Groups	N	Pre-test Mean	Pre-test SD	Post-test Mean	Post-test SD	Mean Gain
Experimental	212	53.86	4.61	81.48	9.75	27.62
Control	213	53.83	4.12	61.76	5.93	7.93
Mean Difference		-0.02		19.72		19.74
Total	425					

Table 1 shows that in the pre-test, the experimental group had a mean achievement score of 53.86 with a standard deviation of 4.61, while the control group had a mean achievement score of 53.83 with a standard deviation of 4.12. The Table also shows that in the pre-test, the experimental group had a mean achievement score of 81.48 with a standard deviation of 9.75, while the control group had a mean achievement score of 61.76 with a standard deviation of 5.93. From the pre-test scores, the mean gain for the experimental group was found to be 27.62, while the mean gain for the control group was 7.93. The mean difference between the mean achievement gain scores of the experimental and control groups was 19.74. This shows that the experimental groups gained more in achievement compared with the control group.

Research Question 2: What are the mean achievement scores of male and female students taught Biology using a collaborative instructional strategy?

The analyzed mean achievement scores of male and female Biology students are presented in Table 2.

Table 2: Mean Achievement Scores and Standard Deviation of Male and Female Students in Experimental Groups and Control Groups.

Gender	N	Pre-test Mean	Pre-test SD	Post-test Mean	Post-test SD	Mean Gain
Male	103	54.14	4.21	82.48	10.56	28.34
Female	109	53.60	4.96	83.43	8.86	29.83
Mean Difference		0.54		-1.95		-1.49
Total	212					

Table 2 shows that in the pre-test, the males had a mean achievement score of 54.14 with a standard deviation of 4.21, while the females had a mean achievement score of 53.60 with a standard deviation of 4.96. The Table also shows that in the post-test, the males had a mean achievement score of 80.48 with a standard deviation of 10.56, while the females had a mean achievement score of 82.43 with a standard deviation of 8.86. From the pre-test

and post-test scores, the mean gain for the males was found to be 28.34, while the gain for the females was 29.83. The mean difference between the achievement gain scores of males and females was -1.49. This shows that the female students improved more in their achievement scores when compared with the male students.

Hypothesis 1: There is no significant difference in mean achievement scores of students taught Biology using a collaborative instructional strategy and those taught using a conventional teaching strategy.

The result of this hypothesis is presented in Table 3.

Table 3: Summary of Analysis of Covariance (ANCOVA) of Experimental and Control Groups' Achievement Scores in Biology.

Source of Variance	Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	41603.551 ^a	2	20801.775	322.441	.000
Intercept	10474.000	1	10474.000	162.354	.000
Post-test	283.066	1	283.066	4.388	.037
Group	41335.532	1	41335.532	640.728	.000
Error	27224.647	422	64.513		
Total	2247473.000	425			
Corrected Total	68828.198	424			

Table 3 shows the ANCOVA analysis of the achievement scores of students taught Biology using a collaborative instructional strategy and those taught using conventional learning strategies. From the Table, it can be observed that the significant value of 0.000 is less than the set alpha value of 0.05 at 1 degree of freedom. This implies that the test is significant. This means that there is a statistically significant difference in achievement mean scores between students taught Biology using a collaborative learning strategy and those taught using conventional learning. This further indicates that there was a greater improvement in the achievement mean scores of students in the experimental groups than those in the control groups. Hence, the null hypothesis was also rejected.

Hypothesis 2: There is no significant difference in mean achievement scores of male and female students taught Biology using a collaborative instructional strategy. The result of this hypothesis is presented in Table 4.

Table 4: Summary of Analysis of Covariance (ANCOVA) of the Achievement Scores of Male and Female Students in the Experimental Group and Control Groups in Biology.

Source of Variance	Sums of Squares	df	Mean Square	F	Sig.
Corrected Model	564.210 ^a	2	282.105	3.025	.000
Intercept	6685.520	1	6685.520	71.697	.000
Pre-test	361.708	1	361.708	3.879	.0284
Group	234.736	1	234.736	2.517	.114
Error	19488.715	209	93.247		
Total	1427558.000	212			
Corrected Total	20052.925	211			

Table 4 shows the ANCOVA analysis of the achievement scores of male and female students taught Biology using a collaborative instructional strategy. From the Table, it can be observed that the significant value of 0.000 is less than the set alpha value of 0.05 at 1 degree of freedom. This implies that the test is not significant. This means that there

is no statistically significant difference in mean achievement scores of male and female students taught Biology. This further indicates that male and female students had almost equal improvement in their achievement scores when taught Biology using a collaborative instructional strategy. Hence, the null hypothesis was also rejected.

Summary of Major Findings

Based on the analysis of data from the study, the following major findings were made from the study

1. The achievement scores of students in the experimental group who were taught Biology using a collaborative instructional strategy were seen to be higher than those in the control group taught Biology using a conventional strategy. This was also statistically significant.
2. There was no statistically significant difference in the achievement scores of male and female students taught Biology using a Collaborative instructional strategy.

Discussion of Findings

Table 1 reveals that the collaborative instructional strategy helped in the improvement of students' achievement in Biology. From the test of hypothesis results in Table 3, the p-value of 0.00 further indicates that there was a significant difference in the mean achievement scores of experimental and control groups. This improvement in achievement rates may not be unconnected with the interest shown towards Biology by the experimental group, which was improved as a result of the use of a collaborative instructional strategy for teaching. Also, when responsibilities are shared between individuals in a group and each member is required to contribute to the achievement of the group objective, it makes students stand on their toes to ensure that they deliver and fulfill their respective obligations to achieve the group aim. This consequently results in higher achievement.

Analysis of research question 1 showed that the achievement scores of students differed from the entry level after being taught Biology using a Collaborative instructional strategy. However, the test of the hypothesis in Table 7 indicates that there was a higher improvement in the achievement mean scores of students in the experimental group than those in the control group.

The results of the study are in line with those of Al-Hassan (2017) ^[18], who also conducted a study on the impact of collaborative instruction on the academic achievement of students in chemistry. In his study, he found that the use of a collaborative instructional strategy while teaching resulted in significant improvement in students' achievement scores when compared to other students who were allowed to use a conventional teaching strategy

Analysis of research question 2, showed that the achievement scores of male and female students differed only slightly after being taught Biology using a Collaborative instructional strategy. However, the test of the hypothesis in Table 4 shows a p-value of 0.114; thus, the difference in the mean achievement scores of male and female students taught Biology using a collaborative instructional strategy was not statistically significant.

The results presented in this study are in line with those of Asly and Erlinda (2024) ^[21], who also conducted a study to determine the level of learners' collaborative learning and academic performance of students. In their studies, they found that the use of a collaborative instructional strategy

while teaching resulted in significant improvement in students' collaborative interaction that led to improvement in academic achievement scores when compared to other students who were allowed to use conventional teaching strategies. Victor (2024) ^[58] particularly stressed that the strategy was efficient due to its collaborative nature, which allows students to learn from the teachers as well as from themselves. Asly and Erlinda (2024) ^[58] thus asserted that students learn better when being taught by their fellow students than when taught by their teachers because students understand themselves better and know how best to make each other understand what is being taught. They also stressed that the adoption of the instructional strategy poses a challenge to students when they are being taught by their fellow students. On the issue of gender, all three studies found that the collaborative instructional strategy was irrespective of gender.

Summary

The study investigated the effect of a collaborative instructional strategy on students' interest and academic achievement in Biology. In addition, the study also sought to determine the effect of the strategy on male and female students' interest and achievement in Biology. Four research questions were answered by the study, and four hypotheses were tested at the 0.05 level of significance.

The theoretical framework of the study was anchored on Jerome Saymon Bruner's psychological/cognitive constructivism theory and Vygotsky's socio-cultural theory. Also, various strategies such as collaborative instructional strategy, guidelines for structuring collaborative models, the usefulness of collaborative instructional strategy, and the achievement of students in science. The achievement of students based on gender in science, interest, nature of Biology, and the concept of gender was discussed. Finally, the review of related literature to the study under investigation shows that when appropriate instructional strategies are adopted in the teaching and learning processes, it improves students' interest as well as achievement in science, particularly Biology.

The research design adopted for the study was Quasi-experimental design of a non-equivalent group, and multistage sampling was used to obtain the sample for the study, comprising purposive and random sampling, although intact classes were used in the study for data collection. Research questions were answered using descriptive statistics, particularly mean and standard deviation, while the research hypothesis was tested using ANCOVA at a 0.05 level of significance.

The result of the study showed that students who were taught Biology using a collaborative instructional strategy improved significantly in both interest and achievement when compared to their counterparts who were taught Biology using a conventional teaching strategy. The study also found that male and female students taught Biology using a collaborative instructional strategy improved unequally in their interest ratings, with the females having higher interest improvements than the males, while both genders improved almost equally in achievement.

Conclusion

Conclusively, this study found that the collaborative instructional strategy promotes higher interest and academic achievement of secondary school students in Biology as

compared to the conventional teaching strategy. While using this strategy, there were no significant differences in the academic achievement in Biology due to the gender of secondary school students, and therefore, the strategy is deemed effective and appropriate for both male and female students.

Recommendations

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

1. Biology teachers should be encouraged to use collaborative instructional strategies in presenting some Biology concepts to students to enhance their interest and academic achievement in Biology and other science-related subjects.
2. Collaborative instructional strategy should be adopted as a learning strategy for Biology in secondary schools to improve and sustain students' interest in the subject, which consequently leads to improvement in their achievement in the subject and other areas of science.
3. Stakeholders such as the Science Teachers Association of Nigeria (STAN) should popularize this strategy through workshops and conferences.
4. In-service training should be given to Biology teachers on the application of the collaborative instructional strategy as a strategy by which students can learn Biology effectively.
5. If the total overhauling of traditional instructional strategies to adopt innovative methods, such as collaborative strategy, in the teaching and learning of science, particularly Biology, is to be considered, then the time and periods allocated for each learning experience should also be looked into by all stakeholders of education to successfully achieve the objectives of the lessons

Limitations of the Study

The limitations of this study include:

1. non-randomization of the sample due to school administration
2. a few periods allocated to Biology on the school timetable constituted some limitations.

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