

***EFFECT OF COLLABORATIVE LEARNING STYLE ON SECONDARY SCHOOL
STUDENTS' ACADEMIC ACHIEVEMENT IN BIOLOGY IN ORUMBA SOUTH
LOCAL GOVERNMENT AREA***

¹Anazodo Onyinye Stella, ² Prof. Josephine Nwanneka Okoli.

os.anazodo@unizik.edu.ng; jn.okoli@unizik.edu.ng

^{1 & 2} Department of Science Education Nnamdi Azikiwe University Awka

ABSTRACT

The study investigated on effect of collaborative learning style on secondary school students' academic achievement in orumba south local government. Two research questions guided the study and three hypotheses were tested at 0.05 level of significance. Quasi- experimental design was used. Population of the study was 936 Senior Secondary school II students offering Biology in orumba south local government area. A sample of 87 SSII Biology students from two schools was obtained using simple random sampling technique. The instrument used for data collection was Biology Achievement Test (BAT), validated by two lecturers from Departments of Science Education and one lecturer from Educational Foundations all from Nnamdi Azikiwe University, Awka. Reliability was established using Kuder Richardson 20(KR-20) for BAT which yielded coefficient of 0.86. The data collected were analysed using mean and standard deviation for research questions while analysis of covariance was used to test the null hypotheses. Results indicated that collaborative learning improves secondary students' achievement and interest in Biology compared to conventional learning styles. Collaborative learning significantly influences achievement scores and interest levels, with no notable gender differences. While females show a greater increase in interest with collaborative learning, there is no significant interaction effect, suggesting universal benefits. These findings support a wider adoption of collaborative learning to enhance educational outcomes in Biology for all students.

Keywords: Biology Education, Collaborative learning style and Academic Achievement

Introduction

The importance of biology in our daily activities cannot be underestimated, as it has made significant contributions to the advancement of the contemporary world. Biology education is the use of biological principles to solve educational and societal problems. It plays a crucial role in developing scientific literacy, which is essential for individuals to understand and engage with the advancements in biology and related fields. It is common to observe concerns about students' academic achievement in biology examinations. Studies have highlighted various factors that can impact students' academic achievement in science subjects, including biology. These factors may include curriculum design, teaching methodologies, assessment practices, and resource availability (Ozden and Doganay, 2019; Min, Shi and Pan, 2020). Governments and educational institutions worldwide have recognized the need to improve biology education and promote scientific literacy. This includes initiatives such as curriculum reforms, adoption of student centered methods of teaching, teacher professional development programs, and the incorporation of real-world applications of biology into the classroom (Organization for Economic Cooperation and Development, 2016; UNESCO, 2020).

To foster and improve students' academic achievement, it is important to implement appropriate learning methods and strategies. Effective teaching strategies can capture students' attention, stimulate

their curiosity, and make learning more engaging and meaningful. (Onu, Anyaegbunam, and Uzoigwe, 2020). Therefore, there is the need to search for Innovative instructional methods like collaborative learning style that will add meaningful learning and evolve high academic achievement among students in biology.

Achievement is a multifaceted concept that has been characterized in various ways by different authors. It serves as an assessment of student's mastery of specific abilities at the culmination of teaching and learning activities. Academic achievement, in particular, refers to the successful completion of academic tasks, courses, or programs, typically reflecting learning outcomes (Bradford, 2015). Anekwe (2016) views achievement as a measure and comparison of skills across different academic fields. It involves evaluating the level of attainment in individual tasks, courses, or programs to which individuals have been adequately exposed. Students' academic achievement in science can be influenced by various factors, including gender.

Gender as Buba, Banu, and Adamu (2020) established, is the range of characteristics of femininity and masculinity and differentiating between them. However, it is important to note that individual differences within each gender group are significant, and generalizations should be made cautiously. Nwagbo and Obiekwe (2010) found that there may be differences between male and female students' academic performance and the outcomes of their learning efficiency because, whether intentionally or unintentionally, some schools offer a platform for channeling kids into specific gender activities. According to Nwagbo and Obiekwe (2010), examples of such activities include grouping courses in schools in a way that promotes stereotyped subject selection.

As a result of the role of biology in the career of students planning to get into science-related courses, there is always a high enrolment of biology in external examinations like West African School Certificate Examinations (WASSCE) when compared to other subjects (Abdullahi, Jibrin, Dauda and Danjuma, 2021). One would expect to see a high positive performance among the students but on the contrary, the percentage of students that pass the subject at the secondary level has not been satisfactory. A lot of factors have been attributed to the unsatisfactory performances of students in biology which include the nature of the topics, difficulty in understanding some biology concepts, and the use of inadequate teaching methods which are mostly ineffective teacher-centered methods. Hence, the instructional format provided by the teacher seems to be the medium of effective learning because good teaching helps the learners while poor teaching leads to poor learning and poor performance (Adebanjo, 2019). Adebanjo (2019) and Raji, 2017 reported that most biology teachers in secondary schools are using lecture methods which has consistently led to poor academic performance of the students in biology. The conventional lecture method (CLM) of teaching is a teacher-centred instructional approach which is a one-way or unidirectional flow of information from the teacher to the students. Although this method helps the teacher to take full responsibility for the classroom activities, teach a large class, and cover a lot of topics within a short time; There are drawbacks which include inactive participation of the students, inability to construct meaningful knowledge in the teaching and learning processes, inability to communicate and develop critical thinking skills and collaboration being an essential skill in school and life is discouraged.

The shortcomings of these CLM resulted in the persistent search for an effective method of teaching and learning biology which culminated in the discovery and suggestion by some researchers for the use of innovative teaching methods such as field trip/excursion method, project methods, collaborative

learning style and inquiry/discovery methods among others. In innovative teaching methods, teachers are not fully in charge of the classroom activities and hence, they are referred to student centred methods. It is on this note that the researcher tends to find out the effects of collaborative learning style on students' academic achievement in orumba south local government area.

Purpose of the Study

This study determined the effect of collaborative learning style on secondary school students academic achievement in biology in orumba south local government area. Specifically, the study determined;

1. The difference in the mean achievement scores of students taught biology using collaborative learning style and those taught using conventional style?
2. The difference in the mean achievement scores of male and female students taught Biology using collaborative learning style and those taught using conventional styles?

Research Questions

The following three research questions guided this study:

1. What is the difference in the mean achievement scores of students taught biology using collaborative learning style and those taught using conventional lecture method?
2. What is the difference in the mean achievement scores of male and female students taught Biology using collaborative learning style and those taught using conventional lecture method?

Hypotheses

The following null hypotheses were tested at 0.05 alpha level of significance. They are:

1. There is no significant difference in the mean achievement scores of students taught biology using collaborative learning style and those taught using conventional lecture style.
2. There is no significant influence of gender on students' achievement in biology.
3. There is no interaction effect on teaching style and gender on students' achievement in biology.

Methods

This study employed a quasi-experimental design that involves non-equivalent control group design. According to Dinardo (2008), this research design is a type of experimental design that does not provide for full control of extraneous variable. In this case, intact classes were used. The sample consists of sample consist of 87 SS 2 Biology students selected from orumba south local government area. simple random sampling technique was used to draw two co-educational public secondary schools from the thirteen co-educational public secondary schools in Awkaorumba south local Government. Using a flip of coin, the two co-educational schools were selected. Finally using two ballot papers representing each of the two schools, one of the schools was used as the experimental group, while the second was used as control group. The experimental group comprised of 44 (20 males and 24 females) SS II biology students while the control group comprised of 43 (17 males and 26 females). The study covered a period of five weeks. First week was for familiarizing visit and training of the Biology teachers in the selected schools who act as research assistants. First day of the second week was used to administer a pretest achievement test of the Biology students involved in the study. Second day of the second week till the

fifth week was used to administer treatment in the experimental and control school using collaborative learning style and conventional lecture method respectively. The research assistants in the two groups used lesson plan prepared by the researcher for collaborative learning style, and conventional lecture methods. At the end of the fifth week, both experimental groups and control group was post tested base on what they are taught. Marks were awarded to each question prepared for both experiment test groups and control group achievement test which constituted fifty (50) multiple choice questions. If all the questions were answered correctly by the student, his/she is entitled to hundred (100) marks that is two marks per questions. The pretest score as well as post test scores in the groups in each sitting had 100 marks. The pre test scores were recorded as achievement of the students in the two groups. Post test scores were recorded also as achievement of the students when taught with collaborative learning style and conventional lecture methods in the two groups. Data collected were used for analysis.

Instrument

The instrument for data collection was Biology Achievement Test (BAT) which was adopted from West Africa Examination Council (WAEC) past questions.

The BAT was produced base on the topic being taught. To ensure the reliability of the instrument, the fifty (50) objective achievement questions were administered on a group of fourty students in Awka south local government which is outside the place of study. The results were subjected to Kuder-Richardson 20 (KR-20). A mean coefficient of 0.86 was obtained indicating that the instrument was reliable. The data obtained from the pretest and post test were analyzed using mean, standard deviation for research questions and Analysis of Covariance (ANCOVA) to test the null hypotheses.

Results

The result of this study was presented in line with the research questions and the hypotheses as follows.

Research Questions 1

What is the difference between the mean achievement scores of students taught biology using collaborative learning style and those taught using conventional lecture method?

Table 1: Difference between the mean achievement scores of students taught biology using CLS and those taught using CLM:

Variable	Pretest		Posttest	Mean gain Learning Strategy N		
	Mean	SD		Mean	SD	N
Collaborative	44	38.09	11.436	76.5	10.989	38.41
Conventional	43	35.44	6.752	50.88	8.589	15.44

The result presented in Table 1 shows that the students under the CLS had a pretest achievement mean score of 38.09 with a standard deviation of 11.436 and a post-test mean of 76.5 with a standard deviation of 10.989. The difference between the pre-achievement and postachievement mean for the CLS group

was 38.41. The conventional group had a pre-achievement mean of 35.44 with a standard deviation of 6.752 and a post-achievement mean of 50.88 with a standard deviation of 8.589. The difference between the pre-achievement and post-achievement mean for the CLM group was 15.44. However, for each of the groups, the post-achievement mean was greater than the pretest mean with the students taught Biology under a CLS having the highest mean gain. This result shows that the CLS leads to students' higher achievement in Biology than the CLM. This is an indication that the style has some effects on students' achievement in Biology.

Research Question 2: What is the difference between the mean achievement scores of male and female students taught biology using a CLS learning style and those taught using the CLM lecture method?

Table 2: Mean and Standard deviation of achievement test scores of males and females under CLS and CLM

Variable Learning strategy	Gender	Pretest			Posttest		Mean achievement Gain
		N	Mean	SD	Mean	SD	
CLS	Male	20	37.8	11.732	75.5	10.875	37.7
	Female	24	38.33	11.431	77.33	11.247	39
Conventional	Male	17	35.76	8.303	51.06	8.547	15.3
	Female	26	35.23	5.687	50.77	8.783	15.54

The result presented in Table 2 shows that for the students under the CLS, the males had a pretest achievement mean score of 37.8 with a standard deviation of 11.732 and a post-test achievement mean score of 75.5 with a standard deviation of 10.875. The mean gain score for the male group was 37.7. For the females, the pre-test achievement mean score was 38.33 with a standard deviation of 8.303, and the post-test mean was 77.33 with a standard deviation of 11.247, however, the mean gain score was 39.

For the CLM group, the result shows that the males had a pre-test achievement mean score of 35.76 with a standard deviation of 8.303 and a post-test interest mean score of 51.06 with a standard deviation of 8.547, giving a mean gain score of 15.3. For the females, the pre-test achievement mean of 35.23 with a standard deviation of 5.687 and a post-test mean score of 50.77 with a standard deviation of 8.783 was obtained, giving an achievement mean gain score of 15.54. This shows that the female students under CLS and conventional learning strategies achieved higher than their male counterparts. This result shows that gender has some effects on students' achievement in Biology.

Testing Null Hypotheses

H₀₁

There is no significant difference between the mean achievement scores of students taught biology using a CLS learning style and those taught using CLM.

Table 3: Analysis of Covariance (ANCOVA) of Students' Achievement in Biology

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	15669.863a	4	3917.466	46.61	0.00
Intercept	12047.99	1	12047.99	143.348	0.00
Pretest scores	1362.006	1	1362.006	16.205	0.00
SEX	12.617	1	12.617	0.15	0.699
Group	12384.31	1	12384.31	147.349	0.00
SEX * Group	14.732	1	14.732	0.175	0.677
Error	6891.884	82	84.047		
Total	377124	87			
Corrected Total	22561.75	86			

R Squared = .695 (Adjusted R Squared = .680)

The result in Table 3 shows that with respect to the achievement mean scores of students taught Biology under CLS and CLM, an F-ratio of 147.349 was obtained with an associated exact probability value of 0.00. Since the associated probability (0.00) was less than 0.05 set as the level of significance, the null hypothesis (H_{01}) which stated that there is no significant difference in the mean achievement scores of students taught Biology in a CLS learning environment and those taught in the CLM is rejected. Thus, the inference drawn is that there was a significant difference ($p < 0.05$) in the mean achievement scores of students taught Biology using CLS and those taught using CLM with those taught under CLS having a higher mean gain. This seems to indicate that the CLS is superior to the CLM.

H₀₂:

There is no significant difference between the mean achievement scores of male and female students taught biology using CLS and those taught using CLM.

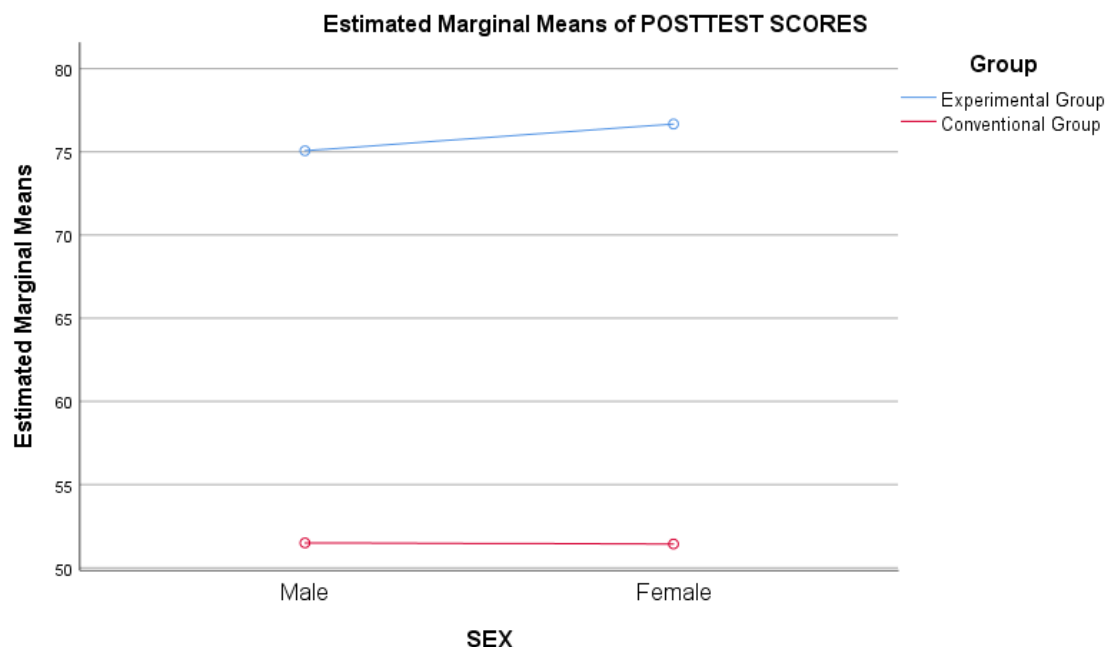
Table 5 shows that with respect to the achievement mean scores of male and female students taught Biology under CLS and CLM, an F-ratio of 0.15 was obtained with an associated probability value of 0.677. Since the associated probability value (0.699) was greater than 0.05 set as a benchmark, the null hypothesis (H_{02}) which stated that gender does not have a significant influence on students' achievement under CLS and CLM was not rejected. Thus, the inference drawn is that male and female students taught under CLS and CLM did not differ significantly in their achievement in Biology. This result showed that gender is not a significant factor affecting students' achievement in Biology when taught under CLS and CLM.

H₀₃:

There is no significant interaction effect of teaching strategy and gender on students' achievement in biology

The result in Table 3 shows that an F-ratio of 0.175 with an associated probability value of 0.677 was obtained for the interaction between learning strategy and gender on students' achievement when taught

Biology under CLS and CLM. Since the associated probability (0.677) was greater than 0.05, the null hypothesis (H_{03}) was not rejected. Thus, there was no significant interaction effect between learning strategy and gender on students' achievement when taught Biology under CLS and CLM.



Covariates appearing in the model are evaluated at the following values: PRETEST SCORES = 36.78

Figure 2: Profile plots of the interaction effect of gender and teaching method (CLS) on students' achievement scores are parallel to each other without any intersect. Hence, there is no interaction effect of gender and teaching method on academic achievement of students in Biology.

Discussion

The result indicates a significant statistical increase in mean achievement scores post-test for those students exposed to CLS learning, with an impressive mean gain of 38.41 compared to a mean gain of 15.44 for the CLM. The null hypothesis (H_{01}) which stated that there is no significant difference in the mean achievement scores of students taught Biology in a CLS learning environment and those taught in the CLM is rejected. Thus, the inference drawn is that there was a significant difference ($p < 0.05$) in the mean achievement scores of students taught Biology using CLS and those taught using CLM with those taught under CLS having a higher mean gain. Onu et al. 2020; Nkechinyere and Ordu, (2018), and Niyonsaba et al. (2022), who suggested that CLS learning environments contribute positively to student achievement. The disparity between the groups is pronounced and suggests that the integration of CLS learning strategies in Biology classes can stimulate academic achievement.

Table 2 provides an understanding of the relationship between gender, learning strategies, and academic achievement. In the CLS learning group, both male and female students exhibited remarkable improvement from pre-test to post-test scores. Male students demonstrated a commendable mean gain score of 37.7, while female students slightly outperformed with a mean gain score of 39. The null

hypothesis (H_{02}) which stated that gender does not have a significant influence on students' achievement under CLS and CLM was not rejected. Thus, the inference drawn is that male and female students taught under CLS and CLM did not differ significantly in their achievement in Biology. Our findings suggest a progressive trend where both genders thrive in CLS settings, challenging the assertions of dominance disparity. In contrast, the CLM resulted in lower mean gain scores among both genders. Male students had a mean gain score of 15.3, with female students showing an even smaller increment of 2.77, highlighting the limited effectiveness of traditional strategies in fostering academic advancement as compared to CLS approaches. More intriguingly, female students outperformed their male counterparts under both strategies, contradicting previous research which often indicates a male advantage in science subjects (Nosek et al. 2009; OECD, 2016).

This suggests that contemporary pedagogical shifts and increased gender sensitisation may be contributing to a positive change in academic achievement patterns.

The study also revealed that both male and female students under the CLS learning strategy exhibited greater mean gains in post-achievement compared to their peers in the CLM. The null hypothesis (H_{03}) was not rejected. Thus, there was no significant interaction effect between learning strategy and gender on students' achievement when taught Biology under CLS and CLM.

Conclusion

The findings of the study revealed that collaborative learning style significantly improved academic achievement of SS 2 students in Biology irrespective of gender. The conclusion is that collaborative learning style is effective for the teaching and learning of Biology. It can also be concluded that when Biology teachers adopt the collaborative learning style, student interaction increases thereby making them to take responsibility for their learning.

Recommendations

Based on the research findings, the following recommendations were made:

1. Schools should incorporate collaborative learning strategies into their Biology curricula to enhance student achievement. Given the clear evidence of improved mean achievement scores, educators should prioritize developing and implementing group-based learning activities.
2. Effective training programs should be developed for Biology teachers to facilitate the transition to collaborative learning methodologies. This will ensure that collaborative learning is employed optimally for the benefit of students.
3. Policymakers and educational leaders must recognize the gender-neutral benefits of collaborative learning and promote its use across all demographics. Given that collaborative learning does not favour one gender over another in improving academic achievement, it should be adopted as a common instructional practice.
4. Further research should focus on implementing collaborative learning strategies across diverse educational settings to evaluate the consistency of outcomes and refine approaches for wider applicability.

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