



## Comparative Effects of Peer Tutoring and Cooperative Learning Instructional Strategies on Senior Secondary Schools Students' Academic Achievement in Biology

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### Abstract

This study aimed to determine the comparative effects of two instructional strategies on secondary school students' academic achievement in Biology in Nsukka Education Zone, Nigeria. Three research questions and three null hypotheses guided the study. The study adopted a quasi-experimental research design. A sample of 120 students was drawn from four public co-educational schools in Nsukka Education Zone of Enugu state. Four intact classes were selected and were further divided into two experimental groups, two classes were treated using peer tutoring and cooperative learning instructional strategies from each schools respectively. The two experimental groups were exposed to pre-test and post-test respectively. The instrument used for data collection was the Biology Achievement Test (BAT). The research questions were analyzed using mean and standard deviation, while the null hypotheses were tested using analysis of covariance at 0.05 level of significance. Results obtained revealed that there was a significant difference in the mean achievement scores of students taught Biology using peer tutoring and those taught using cooperative learning instructional strategies. The students taught with Cooperative Learning had better academic achievement. The female students performed better than their male counterpart. Also, there was a significant interaction effect of instructional strategies and gender on students' academic achievement in Biology. In line with the study, it was recommended that cooperative learning instructional strategy should be adopted more often than peer tutoring by Biology teachers to improve students' academic achievement in Biology.

**Keywords:** Biology, Peer Tutoring, Cooperative Learning, Achievement.

### Introduction

Biology is one of the science subjects taught in senior secondary schools and is described as the study of life and living organisms. It encompasses the study of the structure, function, growth, origin, evolution, and distribution of living things (Urry, Cain, Wasserman, Minorsky, & Reece, 2020). Obikezie, Okpala, and Amobi (2022) stated that biology covers essential life processes such as movement, respiration, nutrition, irritability, growth, excretion, ecological systems, and reproduction, highlighting its importance and usefulness to humanity. Biology plays a vital role in understanding living things and its surroundings and also effectively equipping students with the necessary knowledge and skills needed in everyday life. In contemporary Nigeria, a sound knowledge of biology is needed in our everyday lives as well as in many fields of study and industries such as medicine, pharmacy, nursing, agriculture, and engineering (Uzoma & Okoli, 2019).

Biology, as a science subject, is very important in nation building as well as scientific and technological development. Opara (2019) stated that the importance of Biology includes helping man in scientific research, developing new tools, exploring new environment and environmental identification such as ecology and techniques needed to improve the quality of lives. Yet students' achievement in Biology has remained low. Studies such as Obioma and Onyemerekeya (2019), Adigun and Akinsolu (2016) highlighted that secondary school students are exhibiting low interest in biology due to the prevalence of teacher-centered strategies and shortage of qualified biology teachers, which has led to poor achievement in the subject in examination. Notwithstanding, in the scientific and technological development, the world needs an effective achievement in Biology. Numbers of factors has been found to contribute to students' inconsistent

achievement in Biology in secondary schools. Moyer (2015) highlighted some factors such as students' lack of interest in the subject, poor study habits, teachers' ineffectiveness, lack of reading skills, lack of qualified Biology teachers, poor learning environment, inadequate supply of teaching and learning resources, poor laboratory equipment, lack of good textbooks and libraries, and methods of teaching among others.

Many Biology teachers adopt teacher-centered strategies, such as lecture-based instruction, which often dominate Biology classrooms and limit student engagement and interactive learning. In Biology classrooms, a more hands-on and student-centered instructional strategy is required to keep students engaged, stimulate interest in learning and ensure that the teaching and learning process is efficient (Alberta Education, 2016; Pearson, 2016; Justus, 2018). Students-centered method of teaching and learning has been seen as the appropriate instructional strategy in which students participate actively in the learning process that can enhance academic achievement especially in science subject like Biology.

Educators who utilize these instructional strategies permit students to have the capacity to make meaningful links between the concepts learned and real-life conditions. They present chances for the learners to express their knowledge and correct themselves when needed. Teachers also benefit from using several instructional strategies that enable them to observe better and measure student performance in the subject (Persaud, 2018). There are several instructional strategies well documented in literature and used by teachers all over the world that have proved effective. These include cooperative learning, collaborative teaching, group discussion, role playing, instructional scaffolding, peer tutoring, self-regulated learning, among others (MmCombs, 2018). For the purpose of this study, peer tutoring and cooperative learning instructional strategies were used.

Peer tutoring is a teaching strategy in which students help each other learn by taking on the roles of tutor and tutee. In peer tutoring, one student plays the role of a tutor and the other a tutee while cooperative learning is a strategy involving small groups of students working together to achieve a common learning goal (Johnson, Johnson & Holubec, 2021; Slavin, & Fashola, 2022). The choice of the two strategies is because very few or no research has been done in this area to investigate the comparative effects of peer tutoring and cooperative learning on senior secondary school students' academic achievement in Biology. Peer tutoring and

cooperative learning instructional strategies share complimentary objectives of engaging students in the learning process thereby promoting higher process and more authentic behaviours required for scientific and technological development. Peer tutoring involves students working in pairs or small groups where one student (the tutor) supports another (the tutee) in learning specific content or skills while Cooperative learning is an instructional approach where students work together in small groups to achieve shared learning goals, emphasizing positive interdependence and individual accountability (Lazarus, 2014). According to Persaud (2018), instructional strategy covers any sort of learning techniques a teacher utilizes to assist students learn or gain a better knowledge of the lesson's fabric. Hence, the researchers want to find out the comparative effects of peer tutoring and cooperative learning instructional strategies on Biology students' achievement in senior secondary school.

Academic achievement refers to the gains in knowledge as a result of participating in a learning activity or program. It reflects the degree to which students have mastered content or skills taught during the instructional process, which they can apply to solve real-life problems (Ali, Toriman, & Gasim 2014). Previous studies by Baye and Monseur (2023) found out that while average achievement levels are important, it is equally critical to examine differences and gender is a variable of interest in the study.

Gender refers to socially and culturally constructed roles, behaviors, expectations, and attributes that societies deem appropriate for men and women. It involves the roles, behaviors, identities, and attributes assigned by culture based on sex, intersecting with other social identities like race, ethnicity, class, and ability, thereby shaping individuals' experiences and opportunities (Suarez et al., 2021).

There have been a lot of controversies among scholars on influence of gender on students' academic achievement. The influence of gender on students' academic outcomes remains a focal point for educators and researchers regarding achievement, while some studies suggest a gender influence, others find minimal or no significant differences (Ružić, Matešić & Štefanec, 2016; Sharma & Lavania, 2022). Watson (2020) argued that females perform better than males in academic achievement as in the reports from National Assessment of Education Progress. Programs for International Student Assessment (PISA) established that female scored higher than males in standardized tests, Reading and Writing. These outlined performance of gender

differences among students in biology achievement have drawn the researcher attention to determine the influence of gender on students' achievement in Biology using cooperative learning and peer tutoring instructional strategies to contribute to this academic achievement.

### Research Questions

The following research questions were posed to guide the study:

1. What are the mean achievement scores of students taught biology using peer tutoring and those taught using cooperative learning instructional strategies?
2. What is the influence of gender on students' academic achievement in Biology?
3. What is the interaction effect of instructional strategies and genders on students' mean achievement scores in Biology?

### Hypotheses

The following null hypotheses were formulated to guide this study and will be tested at 0.05 level of Significance

- Ho<sub>1</sub>:** There is no significant difference in the mean achievement scores of students taught Biology using peer tutoring and those taught using cooperative learning instructional strategies.
- Ho<sub>2</sub>:** There is no significant difference in the mean achievement scores of male and female biology students.
- Ho<sub>3</sub>:** There is no significant difference in the interaction effect of instructional strategies and genders on students' mean achievement scores in biology.

### Methods

The study adopted a quasi-experimental research design, specifically the pre-test, post-test non-equivalent group research design. The population of the study comprised 1529 SSII Biology students in Nsukka Education Zone, Enugu State. The sample size of 120 Biology students from the population was drawn. Simple random sampling technique (balloting without replacement) was used to select two Local Government Area from the 38 public co-educational schools in the area since gender is variable in the study. The Biology Achievement Test (BAT) used was a 30-item multiple choice questions with option A-D was designed to measure the students' academic achievement level. The study adopted multi-stage sampling procedures. This was carried out in three stages; First stage, simple random sampling, second stage, purposive sampling, third stage, simple random sampling, and lastly, two intact classes of SS2 students were sampled from each of the two (2) co-educational public secondary schools giving a total of four intact classes for the study. The students in experiment group 1 received treatment using peer tutoring instructional strategy while those in experimental group 2 received treatment using cooperative learning instructional strategy.

The Biology Achievement Test was subjected to both face and content validation. A reliability coefficient of 0.83 was obtained using (K-R20). The data collected was analyzed using mean and standard deviation to answer research questions 1,2,3,4,5 and 6, while hypotheses 1,2,3,4,5 and 6 were tested using Analysis of Covariance (ANCOVA) at 0.5 level of significance.

### Results

**Table 1:** Mean and standard Deviation on mean achievement scores of students taught biology using peer tutoring and those taught using cooperative learning strategy

Instructional Strategies	n	Pretest		Posttest		Mean Gain
		Mean	Std. D	Mean	Std. D	
Peer Tutoring	57	17.68	3.04	36.81	5.03	19.13
Cooperative Learning	63	17.90	1.73	44.49	7.21	26.59

From Table 1, the result indicates that the students taught Biology using peer tutoring instructional strategy had a pretest mean achievement and standard deviation score of ( $M= 17.68, SD= 3.04$ ) and a posttest mean achievement and standard deviation score of ( $M= 36.81, SD= 5.03$ ). Similarly, the students who were taught Biology using

cooperative learning instructional strategy had a pretest mean achievement and standard deviation score of ( $M= 17.90, SD= 1.73$ ) and a posttest mean achievement and standard deviation score of ( $M= 44.89, SD= 7.21$ ). The mean gain scores of 19.13 and 26.59 for the students taught Biology using peer tutoring and those taught using cooperative learning

instructional strategies respectively. Indicating that the students taught Biology using cooperative learning had higher posttest mean achievement score than the students taught using peer tutoring. However, the posttest standard deviations of 5.03 and

7.21 for the two groups respectively, show that the individual achievement scores of the students taught using cooperative learning varied widely from their group mean than those of the peer tutoring.

**Table 2:** ANCOVA showing significant Difference in the Mean achievement of students taught biology using peer tutoring and those taught using cooperative learning.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	4738.491	4	1184.623	81.796	.000	.740
Intercept	3689.168	1	3689.168	254.731	.000	.689
Pretest	18.642	1	18.642	1.287	.259	.011
Gender	2460.940	1	2460.940	169.924	.000	.596
Instructional Strategies	901.831	1	901.831	62.270	.000	.351
Gender * instructional Strategies	289.113	1	289.113	19.963	.000	.148
Error	1665.500	115	14.483			
Total	206569.00	120				
	0					
Corrected Total	6403.992	119				

Table 2 reveals that there is a significant difference in the mean achievement scores of students taught biology using peer tutoring and those taught using cooperative learning instructional strategies in favour of the students taught using cooperative learning,  $F(1, 96) = 62.270, p = .000$ .

Thus, the null hypothesis is rejected since the associated probability value of .000 is less than the .05 level of significance. Besides, the effect size of .351 implies that 35.1% improvement in achievement of students in Biology is attributed to the effect of cooperative learning instructional strategy.

**Table 3:** Mean and Standard Deviation Achievement Scores of Male and Female students taught biology using peer tutoring and those taught using cooperative learning instructional strategies

Gender	N	Pretest		Posttest		Main Gain
		Mean	Std. D	Mean	Std. D	
Male	55	18.25	2.98	34.98	3.65	16.73
Female	65	17.42	1.78	45.80	5.86	28.38

Table 3 indicates that the male students had a pretest mean achievement score of ( $M = 18.25, SD = 2.98$ ) and a posttest mean achievement score of ( $M = 34.98, SD = 3.6$ ) while the female students had a pretest mean achievement score of ( $M = 17.42, SD = 1.78$ ) and a posttest mean achievement score of ( $M = 45.80, SD = 5.86$ ). Moreover, the mean gain scores of 16.73 and 28.38 for the male and female students respectively indicate that the female students had higher posttest mean achievement score than the male students. However, the posttest standard deviations of 3.65 and 5.86 for the male and female students respectively, show that the individual achievement scores of female students varied widely

from their group mean than those of the male students.

**Ho<sub>2</sub>:** There is no significant difference in mean achievement scores of male and female students in Biology.

Table 2 reveals that there is a significant difference in the mean achievement scores of male and female biology students in favour of the male students' achievement mean score,  $F(1, 96) = 169.924, p = .000$ . Hence, the null hypothesis is rejected ( $p < .05$ ). The inference drawn is that gender significantly influences students' achievement in Biology.

**Table 4: interactive effects of instructional strategies and gender on students mean pre/post Achievement scores in Biology.**

Gender	Instructional Strategies	N	Pretest		Posttest		Mean gain
			Mean	Std. D	Mean	Std. D	
Male	Peer Tutoring	32	18.63	3.69	33.94	3.27	15.31
	Cooperative Learning	23	17.74	1.48	36.43	3.72	18.69
Female	Peer Tutoring	25	16.48	1.12	40.48	4.48	24.00
	Cooperative Learning	40	18.00	1.87	49.13	3.81	31.13

Table 4 indicates that the male students who were taught Biology using peer tutoring had a posttest mean achievement score of ( $M= 33.94, SD= 3.27$ ) while the male students who were taught Biology using cooperative learning had a posttest mean achievement score of ( $M = 36.43, SD = 3.72$ ). On the other hand, the female students who were taught Biology using peer tutoring had a posttest mean achievement score of ( $M = 40.48, SD = 4.48$ ) while the female students who were taught Biology using cooperative learning had a posttest mean achievement score of ( $M = 49.13, SD = 3.81$ ). Thus, both female students who were taught Biology using peer tutoring and those taught using cooperative learning had higher posttest mean achievement score than the male students taught Biology using peer tutoring and those taught using cooperative learning.

**H<sub>03</sub>:** There is no significant interaction effect of instructional strategies and gender on students' means achievement scores in Biology.

Table 2 reveals that there is no significant interaction effect of instructional strategies and gender on students' mean achievement scores in Biology,  $F(1, 96) = 19.963, p = .000$ . Hence, the null hypothesis, was not rejected ( $p < .05$ ). Gender does not significantly influence students' achievement in Biology.

### Discussion

The findings of this study showed that students exposed to cooperative learning had higher post-test academic achievement scores than their counterparts taught using peer tutoring strategies. It was further found that there was a significant difference in the mean academic achievement scores of biology students taught using peer tutoring and those taught using cooperative learning in favour of those taught with cooperative learning. This finding may be attributed to the collaborative nature of cooperative learning, which actively engages

students in discussions, problem-solving, and collective knowledge construction. By requiring students to work together in small groups, cooperative learning fosters critical thinking, shared responsibility, and peer support, which enhances student engagement and achievement. In contrast, while peer tutoring allows for direct one-on-one interactions that reinforce learning and that of groups in some cases, its effectiveness may be limited by the varying levels of competency between tutors and tutees, potentially affecting the overall learning experience. The findings of this study validated the social learning theory which posits that learning occur through social interactions and collaboration.

This finding aligns with previous studies, such as those by Ibrahim and Yusuf (2019), which demonstrated that cooperative learning significantly enhances students' academic achievement in Biology through active participation and structured group interactions. Similarly, Kalu and Ogbonna (2021) found that while peer tutoring improves learning outcomes, it is not as effective as cooperative learning in fostering long-term achievement in complex scientific subjects. Other studies, such as Usman and Abubakar (2020), have also indicated that cooperative learning strategies are more effective in subjects that require collaborative problem-solving and critical thinking, such as Biology. Hence, the overall findings support the assertion that cooperative learning makes a difference in students' learning.

The results showed that female students performed better than their male counterparts. The reason for this finding may be attributed to the learning behaviors and study habits of female students, who often exhibit stronger organizational skills, attentiveness, and engagement in learning activities. Female students may also benefit from increased motivation and a higher tendency to seek collaborative support in learning, which enhances

their academic achievement. In contrast, male students may be more inclined toward independent learning and problem-solving approaches, which, while beneficial, may not always translate into higher achievement scores in a structured academic environment.

This finding aligns with previous studies, such as those by Watson (2020), which demonstrated that female students tend to outperform male students in standardized academic assessments, including Biology. Similarly, Ikwuka and Okoye (2021) reported that male students achieved significantly better than female students in science subjects that require more logical reasoning, such as Physics and Mathematics, whereas female students excelled in subjects involving memorization and conceptual understanding, such as Biology. However, other studies, such as those by Bicer and Lee (2019), suggest that there is no significant difference in Biology achievement based on gender, highlighting the variability of findings across different contexts.

### Conclusion

From the results obtained in the study on the comparative effects of peer tutoring and cooperative learning instructional strategies on senior secondary schools' students' achievement in biology, it was found that students taught biology using cooperative learning performed better than their counterparts taught using peer tutoring instructional strategies. Although both instructional strategies actively involved students in the learning process which improved their critical thinking, problem solving skills and reasoning ability and in turn their academic achievement, cooperative learning had more effect on students' academic achievement than peer tutoring.

### Educational implications

For Biology teachers, the study offers practical strategies for improving classroom instruction.

Curriculum planners are encouraged to design and implement Biology curricula that incorporate structured peer tutoring and cooperative learning activities.

Textbook authors and publishers should consider embedding cooperative tasks and peer-led learning

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activities into Biology instructional materials. Textbooks that include guided peer discussions, group-based problem-solving exercises, and inquiry-based projects can help reinforce classroom learning and support student retention of key biological concepts.

Lastly, for researchers and scholars, this study contributes to the growing body of evidence on learner-centered instructional strategies. It opens up further avenues for exploring the long-term effects of peer collaboration on knowledge and academic performance in science education, and can inform future studies, policies, and interventions aimed at improving Biology teaching and learning.

### Recommendations

With reference to the findings of this study, the following recommendations are made.

1. Biology teachers should adopt the use of cooperative learning in the teaching of Biology which will in turn help to address the problem of students' poor achievement in Biology.
2. Science educators should integrate cooperative learning instructional strategies into the training programs for Biology teachers.
3. Biology teachers should regularly attend conferences, seminars and workshops where instructional strategies such as cooperative learning are taught to update their teaching strategies and skills for effective teaching and learning.
4. Teachers should actively involve the students in the teaching process using student-centered instructional strategies such as cooperative learning CL to promote academic achievement.
5. Government and professional bodies, such as STAN should regularly organize seminars, workshops, and conferences on the importance and implementation of instructional strategies like cooperative learning for science educators.
6. Curriculum planners and developers should incorporate student-centered strategies, such as cooperative learning, into the secondary school Biology curriculum.



## Reference

- Adigun, J. T. & Akinsolu, A. O. (2016). Teacher qualification and academic performance of secondary school students in biology. *African Journal of Science and Education*, 12(4), 103-110.
- Alberta Education. (2016). *Teaching quality standard: Applicable to all certificated teachers in Alberta*. Government of Alberta.
- Ali, A., Toriman, M. E. & Gasim, R. (2014). The role of academic achievement in applying learned skills to real-life problems. *Journal of Educational Research*, 42(3), 201-215.
- Baye, A. & Monseur, C. (2023). Trends in gender gaps: Using 20 years of evidence from TIMSS. *Large-scale Assessments in Education*, 11(1).
- Bicer, A. & Lee, Y. (2019). *Effect of STEM PBL Embedded Informal Learning on Student Interest in STEM Majors and Careers*. *Journal of Mathematics Education*, 12(1), 57-73.
- Ikwuka, O. I., & Okoye, C. C. (2021). Differential effects of flipped classroom and gender on Nigerian federal universities CEP students' academic achievement in Basic Methodology. *African Journal of Educational Management, Teaching and Entrepreneurship Studies*, 2(1), 405-421. Retrieved from <https://ajemates.org/index.php/ajemates/article/view/45>.
- Johnson, D. W., Johnson, R. T. & Holubec, E. J. (2021). *Cooperative learning in the classroom: Putting it into practice*. Interaction Book Company.
- Justus, L. (2018). Effective teaching strategies for biology education. *Journal of Science Education and Technology*, 27(3), 210-220.
- Kalu, A. O. & Ogbonna, E. M. (2021). The effect of peer tutoring instructional strategy on secondary school slow learners' academic achievement and retention in biology. *Journal of Science Education and Practice*, 59(3), 201-212.
- Lazarus, K. U. (2014). Effect of peer tutoring and cooperative learning instructional strategies on mathematics achievement of students with learning disabilities in Oyo State, Nigeria. *African Journal for the Psychological Studies of Social Issues*, 17(1), 96-105.
- McCombs, B. L. (2018). The learner-centered classroom and instructional strategies. *Educational Psychologist*, 53(4), 275-289.
- Moyer, R. H. (2015). *Causes of students' low performance in science subjects*. International Journal of Educational Development, 44(2), 115-123.
- Obikezie, M. C., Okpala, C. C. & Amobi, U. V. (2022). Biology teachers' level of utilization and awareness of innovative teaching strategies in the teaching and learning of biology in secondary schools. *Journal Plus Education*, 30(1), 141-154.
- Obioma, E. O. & Onyemerekeya, M. O. (2019). The prevalence of teacher-centered strategies in Biology classrooms and their impact on student engagement. *Journal of Educational Strategies*, 48(4), 123-134.
- Opara, J. A. (2019). The relevance of biology education in nation building: Implications for science education in Nigeria. *Nigerian Journal of Science Education*, 14(1), 34-41.
- Pearson, P. D. (2016). *The science of learning and the art of teaching*. International Literacy Association.
- Persaud, C. (2018). Evaluating instructional strategies: A teacher's guide. *International Journal of Educational Research*, 90, 125-132.
- Ružić, V., Matešić, K. & Štefanec, A. (2016). Gender differences in achievement motivation of employed adults. *Suvremena psihologija*, 19(1), 81-88.
- Sharma, S. & Lavania, S. (2022). Gender differences in academic achievement among secondary school students in relation to their motivational beliefs. *International Journal of Education and Management Studies*, 12(2), 123-129.
- Slavin, R. E. & Fashola, O. S. (2022). The effectiveness of cooperative learning: A meta-analysis of research studies. *Educational Psychology Review*, 34(1), 165-190.
- Suarez, C. E., Balaji, R. V., & Thomas, J. P. (2021). Gender and intersectionality in global health: Implications for research, policy, and practice. *Global Health Research and Policy*, 6(1), 1-10.
- Urry, L. A., Cain, M. L., Wasserman, S. A., Minorsky, P. V. & Reece, J. B. (2020). *Campbell Biology* (12th ed.). Pearson Education. ISBN: 978013518874 Pages: 1,456
- Uzoma, M. N. & Okoli, I. N. (2019). The importance of biology in everyday life and its applications in various fields. *Journal of Biological Education*, 35(2), 45-52.
- Watson, A. (2020). Gender differences in academic achievement: A comparison of male and female students. *Journal of Educational Psychology*, 112(4), 567-578.