EFFECTS OF COOPERATIVE LEARNING STRATEGY ON SCIENCE ACHIEVEMENT AMONG SENIOR SECONDARY SCHOOL STUDENTS IN ONDO STATE, NIGERIA.

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Abstract
This study examined the effects of cooperative learning strategy on the academic performance of senior secondary school science students in Ondo State, Nigeria, with gender and school location as moderating variables. A quasi-experimental pre-test–post-test control group design was adopted. The population comprised 49,260 Senior Secondary School II science students in public secondary schools across Ondo State. Using a multistage sampling procedure, 137 students were selected from four public secondary schools and assigned to experimental and control groups. Data were collected using a Science Performance Test (SPT) developed from past West African Senior School Certificate Examination questions and validated by experts in science education. The reliability of the instrument was established using the test–retest method, yielding a coefficient of 0.81. Mean, standard deviation, independent samples t-test, and Analysis of Variance (ANOVA) were employed for data analysis at the 0.05 level of significance. Results revealed that students taught using cooperative learning strategy performed significantly better than those taught using the conventional teaching method. A significant gender difference in performance was observed in favour of male students, while school location had no significant effect on students' academic performance. The study concludes that cooperative learning strategy is an effective instructional approach for improving science achievement and recommends its integration into secondary school science teaching.

Keywords: Cooperative learning, science achievement, gender, school location, secondary education

Introduction

Science education plays a pivotal role in national development by equipping learners with scientific knowledge, skills, and attitudes required for technological advancement and problem-solving in contemporary society. In Nigeria, science subjects occupy a central position in the secondary school curriculum, as reflected in the National Policy on Education, which emphasizes the teaching and learning of science as a means of fostering self-reliance and sustainable development (Federal Ministry of Education [FME], 2014).

Despite the recognized importance of science education, students' academic performance in science subjects at the senior secondary school level has remained persistently low, as evidenced by reports from the West African Examinations Council. Several studies have attributed this poor performance to factors such as inadequate instructional strategies, limited student engagement, and overreliance on teacher-centred methods of instruction (Harbour, 2011; Obodo, 2017). Conventional teaching methods often position students as passive recipients of information, thereby limiting opportunities for interaction, collaboration, and meaningful learning.

Contemporary educational research emphasizes the effectiveness of student-centred instructional strategies that actively engage learners in the construction of knowledge. One such strategy is cooperative learning, which involves students working together in small groups to achieve shared learning goals. Cooperative learning promotes positive interdependence, individual accountability, and collaborative problem-solving, thereby enhancing both academic and social outcomes (Johnson & Johnson, 2019). Empirical studies have consistently shown that cooperative learning can improve students' academic achievement, motivation, and retention of knowledge in science subjects (Gull, 2015; Are, 2014).

In addition to instructional strategies, learner-related variables such as gender and contextual factors such as school location have been reported to influence students' academic performance in science. While some studies suggest that male students outperform their

female counterparts in science subjects, others report no significant gender differences (Agommuoh & Nzewi, 2017; Ogunleye & Babajide, 2015). Similarly, findings on the influence of school location on students' academic performance remain inconclusive, with some studies favouring urban schools and others reporting no significant differences between urban and rural students (Ajayi & Ogunyemi, 2015; Onah, 2016).

Given these inconsistencies in the literature, there is a need for empirical studies that simultaneously examine the effects of cooperative learning strategy and moderating variables such as gender and school location on science achievement. This study addresses this gap by investigating the effects of cooperative learning strategy on the academic performance of senior secondary school science students in Ondo State, Nigeria.

Statement of the Problem

The persistent low academic performance of senior secondary school students in science subjects in external examinations has become a major concern to educators, parents, and policymakers in Nigeria. Reports from the West African Senior School Certificate Examination indicate that a significant proportion of candidates fail to obtain credit passes in core science subjects. Classroom observations and interactions with students suggest that many learners experience difficulties in understanding scientific concepts, which often results in poor academic outcomes.

Several factors have been identified as contributors to this problem, including inadequate laboratory facilities, insufficiently trained teachers, and ineffective instructional strategies. Among these, the continued reliance on conventional, teacher-centred teaching methods has been identified as a major impediment to effective science learning. Although cooperative learning has been recommended as an alternative instructional strategy capable of enhancing students' engagement and achievement, empirical evidence on its effectiveness within the context of Ondo State, particularly with respect to gender and school location, remains limited. This study therefore seeks to determine whether cooperative learning strategy can significantly improve science students' academic performance and whether gender and school location moderate its effectiveness.

Purpose of the Study

The main purpose of this study was to investigate the effects of cooperative learning strategy on the academic performance of senior secondary school science students in Ondo State, Nigeria. Specifically, the study sought to:

i. examine the effect of cooperative learning strategy on students' academic performance in science;
ii. determine the influence of gender on the academic performance of students taught using cooperative learning strategy; and
iii. examine the effect of school location on the academic performance of students taught using cooperative learning strategy.

Research Question

What difference exists between the pre-test and post-test academic performance of science students taught using cooperative learning strategy and those taught using the conventional method?

Research Hypotheses

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

H_1 : There is no significant difference in the pre-test mean scores of students taught science using cooperative learning strategy and those taught using the conventional method.

H_2 : There is no significant difference in the academic performance of male and female students taught science using cooperative learning strategy.

H_3 : There is no significant difference in the academic performance of students taught science using cooperative learning strategy based on school location.

Methodology

Research Design

The study adopted a quasi-experimental pre-test–post-test control group design. Two groups,

experimental and control were used, with the experimental group exposed to cooperative learning strategy while the control group was taught using the conventional teaching method.

Population and Sample

The population comprised 49,260 Senior Secondary School II science students in 308 public secondary schools across the 18 Local Government Areas of Ondo State. A sample of 137 students was selected using a multistage sampling technique. First, four public secondary schools were randomly selected from urban and rural locations. Intact classes were then randomly assigned to experimental and control groups.

Instrument for Data Collection

Data were collected using a Science Performance Test (SPT) consisting of 25 multiple-choice items drawn from past WAEC and NECO examination questions in Biology, Chemistry, and Physics. The instrument was validated by experts in science education and measurement and evaluation.

Validity and Reliability of the Instrument

The face and content validity of the SPT were established through expert review. The reliability of the instrument was determined using the test–retest method, yielding a reliability coefficient of 0.81.

Experimental Procedure

The experiment was conducted in three stages: pre-treatment, treatment, and post-treatment. The treatment lasted six weeks, during which students in the experimental group were taught using cooperative learning strategy, while the control group received instruction using the conventional method. Both groups were taught the same content by trained teachers.

Method of Data Analysis

Mean and standard deviation were used to answer the research question, while independent samples t-test and Analysis of Variance (ANOVA) were used to test the hypotheses at the 0.05 level of significance.

Results

Research Question: What difference exists between the pre-test and post-test academic performance of science students taught using cooperative learning strategy and those taught using the conventional method?

Table 1: Mean and Standard Deviation of Students' Scores by Instructional Strategy

Strategy	N	Pre test Mean	SD	Post test Mean	SD	Mean Gain
Cooperative Learning	68	13.68	3.03	21.38	2.69	7.70
Conventional Method	69	13.36	2.97	14.23	2.72	0.87

Table 1 presents the mean and standard deviation of students' pre-test and post-test scores in the experimental (cooperative learning) and control (conventional method) groups. The results indicate that both groups were comparable at the pre-test stage with mean scores of 13.68 and 13.36 respectively. However, students exposed to cooperative learning strategy recorded a substantially higher mean gain, 21.38, than those taught using the conventional method, 14.23.

H_1 : There is no significant difference in the pre-test mean scores of students taught science using cooperative learning strategy and those taught using the conventional method.

A one-way Analysis of Variance (ANOVA) was conducted to determine whether a significant difference existed between the pre-test scores of the two groups.

Table 2: ANOVA Summary of Pre -test Scores of Experimental and Control Groups

Source	Sum of Squares	df	Mean Square	F	p-value
Between Groups	36.85	1	36.85	2.28	0.106
Within Groups	1081.68	135	8.01		
Total	1118.53	136			

Since ($F_{2, 135}$ = 2.283, p = 0.106), the null hypothesis was not rejected. This indicates that there was no significant difference between the pre-test mean scores of students in the experimental and control groups, confirming group homogeneity prior to treatment.

H_2 : There is no significant difference in the academic performance of male and female students taught science using cooperative learning strategy.

An independent samples t-test was used to compare the post-test mean scores of male and female students in the experimental group.

Table 3: Independent Samples t-test of Post-test Scores by Gender (Experimental Group)

Gender	N	Mean	SD	df	t	p-value	Cohen's d
Female	34	20.68	2.47	66	-2.22	0.030	0.54
Male	34	22.09	2.76				

Reject H_0 Since p-value < 0.05

From the table above, the female had an average score of 20.68 while the average score of the male was 22.09. The results show a statistically significant difference in favour of male students (t = -2.224, p-value = 0.030). The effect size (Cohen's d = 0.54) indicates a moderate practical effect.

H_3 : There is no significant difference in the academic performance of students taught science using cooperative learning strategy based on school location.

An independent samples t-test was conducted to compare the post-test mean scores of students from urban and rural schools in the experimental group.

Table 4: Independent Samples t-test of Post - test Scores by School Location (Experimental Group)

Location		Mean	SD	df	t	p-value	Cohen's d
Rural	27	21.30	2.3866		-0.21	0.833	0.05
Urban	41	21.44	2.91				

Accept H_0 Since p-value > 0.05

The result indicates no statistically significant difference in academic performance based on school location (t = -0.212, p-value = 0.833). Hence, the null hypotheses is not rejected. The effect size (Cohen's d = 0.05) suggests a negligible practical effect.

Discussion

The findings of this study demonstrate that cooperative learning strategy significantly enhances students' academic performance in science. This result aligns with Olugbuyi et.al. (2025) that reported the superiority of cooperative learning over conventional teaching methods in promoting students' understanding and achievement in science subjects. Male science students performed

better than their female colleagues. This finding is contrary to Linda's (2017) submission that there is no significant difference in student performance based on their gender. This finding however confirms the findings of Ogungbesan (2012) that male science students perform better than female science students. This finding is also confirmed by the findings of Dyke (2018). The observed gender difference may be attributed to sociocultural factors and differential participation patterns within cooperative groups. However, the absence of a significant school location effect suggests that cooperative learning strategy is effective across both urban and rural school settings. This corroborated the findings of Alokan and Arijesuyo (2013) that states that the rural school students have no disadvantage in terms of the quality of education.

Conclusion

The study concludes that cooperative learning strategy is an effective instructional approach for improving the academic performance of senior secondary school science students. While gender differences in performance were observed, school location did not significantly influence students' achievement when cooperative learning strategy was employed.

Recommendations

Based on the findings of this study, it is recommended that cooperative learning strategy be incorporated into secondary school science teaching. Teachers should be provided with adequate training through workshops and seminars to enhance their competence in implementing cooperative learning. Curriculum planners and policymakers should also support the integration of student-centred instructional strategies into science education curricula.

References

Adedayo, J. O., & Owolabi, O. T. (2021). Effect of teachers' qualification on the performance of senior secondary school physics students: Implications for technology in Nigeria. *English Language Teaching*, 14(3), 45–54. https://doi.org/10.5539/elt.v14n3p45

Adu, E. T. (2016). Students' outcomes and school factors as determinants of secondary school effectiveness in Ekiti State. *Journal of Research in Science Education*, 1(1), 23–34.

Agboghoroma, T. E., & Oyovwi, E. O. (2015). Evaluating the effect of students' academic achievement on identified difficult concepts in senior secondary school biology in Delta State. *Journal of Education and Practice*, 6(30), 117–124.

Agommuoh, P. C., & Nzewi, U. M. (2017). Effects of cooperative learning strategy on students' achievement in biology. *International Journal of Science Education*, 39(5), 1–15. https://doi.org/10.1080/09500693.2017.1286592

Ajayi, O. V., & Ogunyemi, B. (2015). Effects of school location on students' achievement in science subjects. *Journal of Educational Research and Reviews*, 10(5), 56–63.

Alokan, F. B., & Arijesuyo, A. E. (2013). Rural and urban differential in students' academic performance. *Journal of Educational and Social Research*, 3(3), 213–218. https://doi.org/10.5901/jesr.2013.v3n3p213

Are, A. A. (2014). Cooperative learning strategy as a tool for effective classroom interaction. *African Journal of Educational Studies*, 7(2), 89–102.

Borich, G. D. (2015). *Effective teaching methods: Research-based practice* (7th ed.). Pearson Education.

Edekor, L. K., & Agbornu, S. (2020). Cooperative learning strategy and students' performance in mathematics in high schools in Hohoe Municipality, Ghana. *American Journal of Educational Research*, 8(9), 693–697. https://doi.org/10.12691/education-8-9-8

Federal Ministry of Education. (2014). *National policy on education* (6th ed.). NERDC Press.

Gull, F. (2015). The use of cooperative learning to enhance students' achievement. *Journal of Education and Learning*, 9(1), 1–11.

https://doi.org/10.5539/jel.v9n1p1

Harbour, K. E. (2011). Active learning strategies and academic performance in science classrooms. *Journal of Science Education*, 12(4), 34–41.

Johnson, D. W., & Johnson, R. T. (2019). *Joining together: Group theory and group skills* (12th ed.). Pearson Education.

Madu, B. C. (2014). Gender differences in science learning outcomes. *Journal of Educational Psychology*, 6(2), 77–85.

Ndayambaje, J. B., Bikorimana, E., & Nsanganwimana, F. (2021). Factors contributing to students' poor performance in biology: A case study of rural secondary schools. *GSC Biological and Pharmaceutical Sciences*, 15(3), 249–261. https://doi.org/10.30574/gscbps.2021.15.3.0209

Obodo, G. C. (2017). *Principles and practice of education in Nigeria*. University Press.

Ogunleye, B. O., & Babajide, V. F. (2015). Gender and students' achievement in science: A Nigerian perspective. *Journal of Educational Research*, 18(2), 45–58.

Onah, F. O. (2016). School location and academic achievement of secondary school students. *International Journal of Educational Development*, 4(1), 101–109.

Olugbuyi, P. O., Ishiaq, A. D., Folorunsho, M. D., Odunola, A. O., Emeribe, C. E., & Abiola, K. B. (2025). Cooperative learning and academic achievement of chemistry students in secondary schools in Ekiti State, Nigeria. *Open Journal of Educational Development*, 6(2), 24–34. https://doi.org/10.52417/ojed.v6i2.865

West African Examinations Council. (2018). *Chief examiners' report on students' p*