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Effect of Cooperative Learning and Peer Teaching Strategies on Senior Secondary School Students' Academic Achievement of Geometrical Concepts in Mathematics

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The study investigated the effect of the cooperative learning and the peer teaching strategies on students' academic achievement of geometrical concepts in Mathematics in senior secondary schools in Delta State of Nigeria. Three research questions were raised to guide the study and three null hypotheses were formulated and tested at 0.05 level of significance. The pretest posttest control quasi experimental research design was employed in this study. The population of the study was two thousand nine hundred and fifty-four (2 954) SS I students in Oshimilli North Local Government Area of Delta State. The sample consisted of 289 SS1 students which is a 10% representation of the population. They were selected using the multi-stage sampling technique. Three (3) public and three (3) private schools were selected and their intact classes used. The control group was made up of two intact classes of 105 students. The experimental group 1 (cooperative learning strategy) had 91 students in two intact classes while experimental group 2 (peer teaching strategy) had 93 students in two intact classes. The instrument used for data collection was a Geometry Achievement Test (GAT). The reliability of GAT was established using Kudder-Richardson formula 20 which yielded a coefficient of internal consistency of 0.79. Data were collected by administering the GAT as the pretest and the posttest. The data obtained were analyzed using mean. Standard deviation and Analysis of covariance (ANCOVA). The results of the study revealed a significant effect of treatment on students' academic achievement of geometrical concepts in Mathematics. Students in the peer teaching strategy group performed significantly better than those in the cooperative learning strategy group in terms of academic achievement. In addition, in terms of school ownership, students in both private and public schools in the peer teaching strategy group performed significantly better academically than those in the cooperative learning strategy group and the control group respectively. Moreover, there was no significant interaction effect of strategy, school ownership and gender on the academic achievement of students in geometrical concepts in Mathematics. Based on the findings of the study, it was concluded that the peer teaching and the cooperative learning strategies leads to better academic achievement of geometrical concepts in Mathematics for students. Therefore, it is recommended among others, that teachers of Mathematics in senior secondary schools should adopt the cooperative learning and peer teaching strategies in the teaching of Mathematics to enhance students' academic achievement in geometrical concepts specifically, and in Mathematics generally.

Keywords: Academic achievement, Cooperative learning and Peer teaching strategies.

Introduction

The importance of Mathematics for the national building cannot be over emphasized. As a core subject, Mathematics provides a bedrock for other school subjects, it serves as a hub for scientific, technological and industrial development for the society at large. Considering the indispensable nature of Mathematics as tool for nation building, it was spelt out in the National policy of Education as core subject in our secondary school and a requirement for admission into tertiary institutions. However, despite the importance of Mathematics in all facet of everyday life, research has revealed that students continue to experience difficulties in its learning (Asikhia, 2014).

Geometry is one of the core areas in Mathematics encompassing mensuration, plane geometry and circle geometry. It focuses on the measurement and relationship of lines, angles, perimeters, areas and volume of shapes. Geometry enhances students' understanding of other aspects of Mathematics. It does this by bringing the abstract nature of the subject to the visual form so that students can appreciate the virtue of mathematical knowledge. However, studies

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had shown that students continued to experience difficulties in learning the subject. Plane and solid shapes, polygons, and geometrical transformations are the topics generally identified by secondary school teachers and their learners as difficult (Telima cited in Abiam, 2016). The situation may be partly responsible for students' poor achievement in Mathematics at external examinations in Nigeria such as the Secondary School Certificate Examinations (SSCE) conducted by examining bodies such as the National Examinations Council (NECO) and the West African Examinations Council (WAEC). Specifically, in Delta State, the WAEC results of candidates over the years indicate that many students fail to earn at least a credit pass in Mathematics. For example, in the years 2013, 2015, 2016, 2017 and 2018, only 46.53%, 39.10%, 47.58%,64.86% and 51.89% respectively secured a credit pass and above in Mathematics. Moreover, the chief examiner for Mathematics reported for the year 2021 results though there was an encouraging result candidates showed weakness in the following areas among which are: weakness in reading from graphs, weakness in translating word problems into mathematical equation, weakness in solving problem on mensuration and geometry and weakness in finding the volume of a solid generated using integration. Moreover, students' failure in Mathematics has been attributed to teachers' use of conventional teaching method (Blanco & Ademulegun cited in Abiam et al, 2016). The conventional teaching method is where the teacher starts a lesson by introducing the topic, explaining it, solving examples, give exercises and then finally gives assignment to the students. In this kind of learning environment, students find it difficult to construct their own concept since they are not completely taking part in the process of teaching and learning. They are also not able to think innovatively, creatively, and critically since they perceivably received what have been taught to them. Nebo cited in Nbame, (2022) accentuated this by stating that the conventional teaching method does not acknowledge the uniqueness of the inquiry-based nature of mathematics and the learner's individuality. As such, it does not encourage creative and critical thinking in the learner which leads to poor academic achievement and knowledge retention of students. Consequently, educators and scholars have sought more viable methods that would promote academic achievement and knowledge retention of students in Mathematics. Some of these methods include concept mapping, discovery method, cooperative learning, target task approach and peer teaching (Longjohn & Osila, 2022).

The cooperative learning strategy (CLS) is one of the recommended teaching-learning techniques in which students achieve learning goals by helping each other in a social setting through cooperation rather than competition. It is a method of teaching which involves students in small groups working together as a team. It is a learning activity that is carefully structured by the teacher and students are held accountable for their contribution, participation and learning (Eraikhuemen cited in Eraikhuemen & Akpobroka 2023).

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A cooperative learning group usually consists of students of varied ability levels working together to achieve a common goal. The major unique feature of this strategy is that the students help each other to learn successfully. The learning activities that the students work on are pre- prepared by the teacher and given to the students in the course of the lesson. The role of the teacher during the lesson is to act as a guide and facilitator of learning. The teacher does this by moving around to assist the students where they need intervention during lessons and encouraging the members of the group to dialogue and agree on an answer before it is written down.

Peer teaching is a kind of instruction where students help one another comprehend the material and in turn learn by teaching (Wolfe, 2018). Peer- teaching is theoretically based on the conceptions of the cognitive theorists like Vygotsky who proposed the zone of proximal development which points to the learner's ability to profit from interaction with more competent peers. Peer teaching is gaining momentum, and it has become an important part of diverse courses and different disciplines in many countries (Ali, Anwer, & Abbas, 2015). It has been proven to have a lot of positive impacts on students' learning, motivation and socialization (Eisenkopf in Ullah, Tabassum & Kaleem 2018). The peer teachers gain more insight into the content as they must read and prepare for the lessons, and the tutees also gain from the lesson as they feel free to interact with their peers to learn. Scruggs, Mastropieri, and Marshak cited in Ullah, Tabassum & Kaleem (2018) posited that peer teaching is tutorial strategy where students are trained on how to partner with their peers to improve their overall knowledge. They learn to use teaching materials, alternate as the peer teacher and the peer student, ask appropriate questions, and deliver feedback in a very positive manner.

According to Igboanugo cited in Abdul-Raheen, Yusuf and Odutayo (2017) the teacher who adopts the peer teaching strategy will identify the high, middle and low achievers amongst the students and make the high achievers as the peer teachers to teach the middle and low achievers. The teacher prepares the lesson plan and reviews it for the peer teachers in sequential order. He also trains the peer teachers on how to inform, reward and relate to the students.

Although the cooperative learning and peer teaching strategies had attracted the attention of researchers in education globally, only a few studies are available on its use in the teaching of Mathematics (geometry) and in the context of Delta State, Nigeria. The cooperative learning and peer teaching strategies are considered as a veritable tool for shifting the focus of Mathematics teaching and learning from an abstract nature to a problems' solving scenario to improve student academic achievement and knowledge retention (Johnson & Johnson, 2013; Abdul-Raheen, Yusuf & Odutayo 2017).

Furthermore, factors other than teaching strategy may affect students' achievement in of geometrical concepts in Mathematics. These factors include students' school ownership and gender (Eraikhuemen & Akpobroka , 2023). According to these authors, school ownership which is owner of schools

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where teaching and learning takes place is a viable issue in implementation of the curriculum. Some scholars are of the view that students from schools that are owned by private individuals or organizations perform better than their peers in government owned schools (Olaloye &Agbatogun cited in Abiam et al 2016). On the other hand, there are others who disagree with the claim. For example, Lubienski & Lubienski cited in Adeyemi, 2014) argued that private schools may not be as effective in delivering learning outcomes as commonly assumed.

Purpose of the Study

The purpose of this study was to investigate the effects of the cooperative learning and the peer teaching strategies on students' academic achievement of geometrical concepts in Mathematics in Oshimilli North L. G. A. of Delta State. In specific terms, the study sought to determine:

1. the academic achievement level of senior secondary school students in geometrical concepts in Mathematics using the cooperative learning and the peer teaching strategies.
2. the academic achievement level of students in private and public secondary schools in geometrical concepts in Mathematics using the cooperative learning and the peer teaching strategies.
3. whether gender and school ownership interact with the instructional strategies in their effect on student's academic achievement in geometrical concepts in Mathematics.

Research Questions

The following research questions were raised to guide the study.

1. What are the mean achievement scores of students taught geometrical concepts in Mathematics using the cooperative learning strategy, the peer teaching strategy and the traditional teaching method?
2. What are the mean achievement scores of private and public schools' students taught geometrical concepts in Mathematics using the cooperative learning strategy, the peer teaching strategy and the conventional teaching method?
3. What is the interaction effect of teaching strategies, gender and school ownership on students' means achievement scores in geometrical concepts in Mathematics?

Hypotheses

The following hypotheses were tested at 0.05 level of significance.

1. There is no significant difference in the mean achievement scores of students taught geometrical concepts in Mathematics using the cooperative learning strategy, the peer teaching strategy and the conventional teaching method.
2. There is no significant difference in the mean achievement scores of private and public schools' students taught geometrical concepts in Mathematics using the cooperative learning strategy, the peer teaching strategy and the conventional teaching method.
3. The interaction effect of teaching strategies, gender and school ownership on students' achievement in geometrical concepts in Mathematics as measured by their mean achievement scores is not significant.

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Methodology

Design of the Study

This study employed non-randomized pretest posttest control group quasi-experimental design. The independent variable for the study is the instructional strategies at three levels (Cooperative learning strategy, Peer teaching strategy and Conventional teaching method). school ownership with two levels (public and private) serves as the intervening variables. The dependent variable of the study are academic achievement scores in geometrical concepts in Mathematics.

Table 1: Graphical Representation of the Design of the Study

ps	Pretest	Treatment	Posttest
erative Learning Strategy	O_1	X_1	O_2
Teaching Strategy	O_1	X_2	O_2
entional Teaching Method	O_1	X_3	O_2

Where X1 is the Cooperative Learning Strategy, X2 is the Peer Teaching Strategy, X3 is the Conventional Teaching Method; and O1 represent the Pretest and O2 is the Posttest

Population of the Study

The population of the study was Two thousand nine hundred and fifty-four (2,954) (1,397 males and 1,557 females) Senior Secondary I (SS I) students in Oshimilli North Local Government Area of Delta State.

Sample and Sampling Procedure

A sample of 289 senior secondary school one (SS1) students drawn from the population using multistage sampling technique. In the first stage, a list of all the co-educational schools was made. In the second stage, the schools were stratified by ownership - private and public. In the third stage, three schools were randomly selected from each of the private and public schools' stratum, bringing the total number of schools sampled to six. In the fourth stage, one intact class from the various arms of SS I from each of the sampled schools was randomly selected, bringing the total number of classes used to six. Finally, in the fifth stage, two classes, one from each of the stratum of public and private schools, were randomly assigned to the treatment and control groups. Therefore, in total, there were three groups – Experimental Group 1 (The Cooperative Learning Strategy), Experimental Group 2 (The Peer Teaching Strategy) and the Control Group (The Conventional Teaching Method).

Instrument for Data Collection

The researcher developed an instrument used for data collection. The instrument is titled "Geometry Achievement Test" (GAT). The GAT consists of 30 multiple choice items with options A - D. The items are based on the selected topics to be covered as contained in the NERDC (2012) Mathematics curriculum for senior secondary school 1 (SS1).

The instrument GAT was validated by three experts: The chief supervisor, the co-supervisor, and an experienced Mathematics teacher. Copies of the initial draft of GAT were read by the validators. Their corrections were effected before producing the final copy. This

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was to ensure that the instrument contained the appropriate items in term of language and adequacy of content coverage.

The reliability of the instrument was established using the Kuder-Richardson Formula 20 (KR 20). The choice of KR-20 is because the difficulty level of the items is heterogeneous and they are dichotomously scored. Also, KR-20 is suitable for establishing the internal consistency of multiples choice items like achievement tests. Copies of GAT were administered to 20 SSI students who were drawn from a school in the population, but they were excluded from the study sample. The scores obtained were used to determine the coefficient of internal consistency using the KR-20 formula. The coefficient of internal consistency of 0.79 was obtained which indicated that the instrument is reliable.

Data from the study were analysed using mean, standard deviation and analysis of covariance

Presentation of Results

Hypothesis One: There is no significant difference in the mean achievement scores of students taught geometrical concepts in Mathematics using cooperative learning, peer-teaching and conventional teaching methods.

Table 2: Mean and Standard Deviation of Students' Achievement in Geometrical Concepts in Mathematics

Strategies	N	Pretest Mean ($\bar{x}$)	Pretest SD	Posttest Mean ($\bar{x}$)	Posttest SD	Mean Gain
Cooperative Learning	91	5.86	1.72	16.16	1.89	10.30
Peer Teaching	93	4.66	1.15	16.31	2.25	11.65
Conventional Method	105	4.92	1.31	14.10	2.41	9.18

The data in Table 2 shows that students taught geometrical concepts in Mathematics using the Cooperative learning strategy have a mean score of 5.86 and a standard deviation of 1.72 in the pretest. In the posttest, they have a mean score of 16.16 and a standard deviation of 1.89. Hence, there is a pretest-posttest mean gain of 10.30. The Table also shows that students taught using the Peer teaching strategy have a mean score of 4.66 and a standard deviation of 1.15 in the pretest. In the posttest, they have a mean score of 16.31 and a standard deviation of 2.25, which gives a mean gain of 11.65. The Table further shows that students exposed to the Conventional teaching strategy have a mean score of 4.92 and a standard deviation of 1.31 in the pretest while they have a mean score of 14.10 and a standard deviation of 2.41 at the posttest. This yields a mean gain of 9.18.

The results indicated that the students achieved higher scores in the posttest than in the pretest. The results further indicate that the Peer teaching strategy group has the highest mean gain, closely followed by the Cooperative learning strategy and the Conventional strategy. To test if the observed differences were statistically significant, the data was analysed using ANCOVA.

Table 3: ANCOVA of Students' Achievement in Geometrical Concepts in Mathematics

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Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
rrected Model	813.478[a]	3	271.159	87.581	.000	.480
rcept	2255.435	1	2255.435	728.475	.000	.719
test (Covariate)	507.942	1	507.942	164.058	.000	.365
ievement	297.185	2	148.593	47.993	.000	.252
or	882.390	285	3.096			
al	70803.000	289				
rrected Total	1695.869	288				

Squared = .480 (Adjusted R Squared = .474)

The result in Table 3 indicates that F(2, 285) = 47.993, p = .000 significant at 0.05 alpha level. The result also shows that treatment accounts for 25.2% of the variance in the dependent variable. This means that there is a significant difference in the achievement of students taught geometrical concepts in Mathematics using the Cooperative learning strategy, the Peer teaching strategy and the Conventional teaching method in Oshimili North Local Government Area of Delta State. Therefore, the null hypothesis is not accepted. This means that there is a significant difference in the mean achievement scores of students taught geometrical concepts in Mathematics using the Cooperative learning strategy, the peer teaching strategy and the Conventional teaching method. The Peer teaching strategy group achieved significantly higher scores than those in the cooperative learning strategy group and the conventional teaching method group respectively.

Hypothesis Two: There is no significant difference in the mean achievement scores of private and public schools' students taught geometrical concepts in Mathematics using the cooperative learning strategy, the peer-teaching strategy and the conventional teaching method.

Table 4: Mean and Standard Deviation of Students' Achievement in Geometrical Concepts in Mathematics by School Ownership

Groups	School Type	N	Pretest Mean ($\bar{x}$)	Pretest SD	Posttest Mean ($\bar{x}$)	Posttest SD	Mean Gain
Cooperative Learning	Private	38	6.84	1.65	16.76	1.94	9.92
	Public	53	5.15	1.39	15.74	1.75	10.59
Peer Teaching	Private	41	4.41	1.07	16.29	2.34	11.88
	Public	52	4.85	1.19	16.33	2.19	11.48
Conventional method	Private	39	5.18	1.34	14.00	2.71	8.82
	Public	66	4.77	1.29	14.17	2.24	9.40

The result on Table 4 indicates that at pretest, the private schools in the Cooperative group have a mean score of 6.84 and a standard deviation of 1.65 while at posttest, they had a mean score of 16.76 and a standard deviation of 1.94 with a mean gain of 9.92. The students from public schools have a mean score of 5.15 and a standard deviation of 1.39 at pretest while at posttest, they have a mean score of 15.74 and a standard deviation of 1.75 with a mean gain of 10.59.

In the Peer teaching strategy group, students from private schools have a mean score of 4.41 and a standard deviation of 1.07 at pretest while at posttest they have a mean score of 16.29 and a standard deviation of 2.34 with a mean gain of 11.88. For students in public schools, they have a mean score of 4.85 and a standard deviation of 1.19 at pretest while at psottest, they have a mean score of 16.33 and a standard deviation of 2.19 with a mean gain of 11.48. For the Control group, students from private schools have a mean score of 5.18 and a standard deviation of 1.34 in the pretest while

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at posttest they have a mean score of 14.00 and a standard deviation of 2.71 with a mean gain of 8.82. Students from public schools at pretset have a mean score of 4.77 and a standard deviation of 1.29 while at posttest, they have a mean score of 14.17 and a standard deviation of 2.24 with a mean gain of 9.40. Table 5 presents the result of the test of hypothesis three using ANCOVA.

Table 5: ANCOVA of Students' Achievement in Geometrical Concepts in Mathematics by School Ownership

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	833.414[a]	6	138.902	45.417	.000	.491
Intercept	1815.667	1	1815.667	593.676	.000	.678
Pretest (Covariate)	503.813	1	503.813	164.734	.000	.369
School Ownership	317.121	5	63.424	20.738	.000	.269
Error	862.454	282	3.058			
Total	70803.000	289				
Corrected Total	1695.869	288				

a. R Squared = .491 (Adjusted R Squared = .481)

The result on Table 5 indicates that F (5, 282) = 20.738, p = .000 significant at 0.05 alpha level. The result also shows that treatment accounts for 26.9% of the variance in the dependent variable. Therefore, the null hypothesis of not accepted. This means that there is a significant difference in the achievement of students taught geometrical concepts in Mathematics using the Cooperative learning strategy, the Peer teaching strategy and the Conventional teaching method by school type in Oshimili North Local Government Area of Delta State. Students in both private and public schools in the peer teaching strategy group achieved higher scores than those in the cooperative learning strategy group and the conventional teaching method group respectively.

Hypothesis Three: The interaction effect of teaching strategies, gender, and school ownership on students' achievement in geometrical concepts in Mathematics is not significant.

Table 6: Mean and Standard Deviation of the Interaction Effect of Instructional Strategies, School Ownership and Gender on Students' Achievement in Geometric Concepts in Mathematics

Instructional Strategies	School Ownership	Gender	N	Posttest Mean ($\bar{x}$)	Posttest SD
Cooperative Strategy	Private	Male	22	16.18	1.68
		Female	16	17.56	2.03
	Public	Male	32	15.50	2.03
		Female	21	16.10	1.14
Peer Teaching	Private	Male	25	16.52	2.09
		Female	16	16.81	2.01
	Public	Male	31	15.90	1.92
		Female	21	15.52	1.66
Conventional Method	Private	Male	22	16.23	2.07
		Female	17	16.47	1.70
	Public	Male	34	16.38	1.88
		Female	32	15.78	2.47

The result on Table 6 indicated that male students from private schools in the Cooperative learning strategy group have a mean score of 16.18 and a standard deviation of 1.68 while their female counterparts have a mean score of 17.56 and a standard deviation of 2.03. On the other hand, male students from public schools in the Cooperative strategy group have a mean score of 15.50 and a standard deviation of 2.03 while their female counterparts have a mean score of 16.10 and a standard deviation of 1.14.

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For the peer teaching strategy group, male students in private schools have a mean score of 16.52 and a standard deviation of 2.09 while their female counterparts have a mean score of 16.81 and a standard deviation of 2.01. On the other hand, male students from public schools have a mean score of 15.90 and a standard deviation of 1.92, while the females have a mean score of 15.52 and a standard deviation of 1.66.

In the Conventional teaching method group, male students from private schools have a mean score of 16.23 and a standard deviation of 2.07 while the females have a mean score of 16.47 and a standard deviation of 1.70. On the other hand, male students from public schools have a mean score of 16.38 and a standard deviation of 1.88 while their female counterparts have a mean score of 15.78 and a standard deviation of 2.47. Table 7 presents the result of the test of hypothesis four using ANCOVA.

Table 7: ANCOVA for the Interaction of Instructional Strategies, School Ownership and Gender on Students' Achievement in Geometrical Concepts in Mathematics

Source Type III

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	128.857a	12	10.738	2.986	.001	.115
Intercept	3453.002	1	3453.002	960.231	.000	.777
Pretest (Covariate)	54.743	1	54.743	15.223	.000	.052
Strategy	3.677	2	1.838	.511	.600	.004
School Ownership	21.582	1	21.582	6.002	.015	.021
Gender	1.153	1	1.153	.321	.572	.001
Strategy* School Ownership *Gender	40.756	7	5.822	1.619	.130	.039
Error	992.499	276	3.596			
Total	76617.000	289				
Corrected Total	**1121.356**	**288**				

a. R Squared = .115 (Adjusted R Squared = .076)

The result indicates that $F(7, 276) = 1.619$, $p = .130$ significant at 0.05 alpha level. The result also shows that treatment accounts for 3.9% of the variance in the dependent variable. Therefore, the null hypothesis is accepted. This means that there is no significant interaction effect of strategy, school type and gender on the academic achievement of students taught geometrical concepts in Mathematics using the Cooperative learning strategy, the Peer teaching strategy and the Conventional teaching method in Delta State.

Discussion of Findings

Hypothesis one indicated that students in the peer teaching and the cooperative learning strategies group had better achievement scores in geometrical concepts in

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Mathematics than those in the conventional teaching method group. The implication is that both the cooperative learning and the peer teaching strategies, which are child centred in nature, could be applied to the teaching of geometry as an area of Mathematics. The finding corroborates those of Zakaria, Solfitri, Daud & Abidin, 2013; Johnson & Johnson 2013; Okafor in Obiajulu 2014; Abiam, Abonyi, Ugama and Okafor 2016; Hamisu 2017; Longjohn & Osila 2022) who all advocated for a shift from the traditional methods of teaching to innovative strategies in teaching science, technology and Mathematics for effectiveness. The result is also in line with the National Policy on Education which stresses that the teaching of Mathematics should be centred on the learner for maximum self-development and self-fulfilment (FRN, 2013). The abstract nature of most geometrical concepts in Mathematics demands the active participation of the learner, something the traditional teaching method does not usually provide. Therefore, the abstract nature of most geometrical concepts in Mathematics could be made less abstract by the teacher by using more pragmatic and effective teaching strategies such as the cooperative learning and the peer teaching strategies.

Furthermore, the finding revealed that the peer teaching strategy group achieved higher achievement scores than the cooperative learning strategy group. Even though cooperative learning involves the cooperation and full participation of each member of the group in the learning process, the peer teaching strategy involves the use of a brilliant member who takes the lead and teaches others. The implication is suggestive of the fact that the peer teaching strategy should be made use of in teaching geometrical concepts more frequently than the cooperative learning strategy for better results in realizing Mathematics education goals. Each of the cooperative learning and peer-teaching strategies are effective in enhancing students' achievement in geometrical concepts in Mathematics (Longjohn & Osila 2022, Nbame, 2022).

Hypothesis two revealed a significant difference between the mean achievement scores of students in private and public schools' in both the treatment and the control groups. Students from both the public and private schools performed better in the peer teaching strategy group followed by the cooperative learning strategy group and the traditional teaching method group respectively. The findings indicate that the cooperative learning strategy and the peer teaching strategy could be used in any school type to improve students' achievement in geometrical concepts in Mathematics. The findings of the study agree with those of Maliki, Ngban and Ibu (2017) Ewijk and Sleegers (2010), Yadav (2010), Adeyemi (2014), and Ahmed and Butt (2017). Those researchers reported a significant difference between the performance of students in private and public secondary schools with those from private schools performing better than those from public schools. However, the findings of the study contradict that of Mohammed et al (2017) which found no significant difference between students' performance in Mathematics in both private and public secondary schools.

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Journal home page: https://integralresearch.in/
Vol. 03, No. 01, January. 2026

Hypothesis three showed no significant interaction effect of teaching strategies, gender and school ownership on students' achievement. The implication is that each of the three instructional strategies improved students' achievement in geometrical concepts in Mathematics irrespective of their gender or the school ownership. This is in line with Igbo in Igboanugo cited in Abdul-Raheen, Yusuf & Odutayo 2017; Uyim & Nonye 2019; Okereke, Ademiluyi & Adeagbo 2020; Longjohn & Osila) who maintained that instructional approaches do not favour a particular gender in terms of academic achievement. A well applied teaching strategy would lead to improved student academic achievement irrespective of gender and school ownership. That the cooperative learning and peer-teaching strategies made no significant difference in students' achievement irrespective of their gender or school ownership could be a function of the fact that the students reacted favourably to the activities in the teaching strategies. Therefore, both the cooperative learning and the peer teaching strategies, if effectively applied, would enhance students' achievement in geometrical concepts in Mathematics irrespective of their gender and school ownership.

Conclusion

Based on the findings from this study, it is concluded that the cooperative learning strategy and the peer teaching strategy are efficacious in teaching geometrical concepts in Mathematics. However, the peer teaching strategy was more efficacious than the cooperative learning strategy in terms of academic achievement. Peer teaching strategy favoured students from both private and public schools in terms of academic achievement, followed by the cooperative learning strategy. There was no significant interaction effect of teaching strategy, school type and gender on the academic achievement of students taught geometrical concepts in Mathematics using the cooperative learning strategy, the peer teaching strategy and the conventional teaching method.

In essence, the overuse of the conventional teaching method by Mathematics teachers in teaching geometrical concepts in Mathematics is a major factor responsible for the perennial low performance of students in Senior Secondary School Mathematics.

Recommendations

From the findings of this study, the following recommendations are made:

1) Cooperative learning and peer teaching strategies should be emphasized and incorporated into the mathematics teachers' education curriculum in tertiary institutions of learning. The essence is to make the two teaching approaches popular to would-be teachers who would apply them in teaching geometrical concepts in Mathematics when they get to the field. The principles guiding the effective use of the two teaching approaches should be taught to the student-teachers.

2) Stakeholders in Mathematics education like ministries of education, state school management boards, post primary school services commission, education commissions,

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school principals and teachers should organize seminars, workshops and conferences where teachers in the field would be given the opportunity to learn how to make the best use of the cooperative learning and the peer teaching strategies in teaching geometrical concepts in Mathematics.

References:

Abdul-Raheen, I.Y., Yusuf, H.T. & Odutayo, A.O. (2017). Effect of Peer tutoring on Students' Academic Performance in Economics in Ilorin south, Nigeria. Journal of Peer Learning 10(3), 95 – 10

Abiam, P. O., Abonyi, S.O., Ugama J.O. & Okafor, G. (2016). Effects of Ethno-mathematics based Instructional Approach on Primary School Pupils' Achievement in Geometry.Department of Science Education, Ebonyi State University, Abakaliki, Nigeria.Journal of Scientific Research & Reports 9(2): 1-15, www.sciencedomain.org

Abonyi O.S., & Okoli J.N. (2014). Effect of experiential learning strategy on secondary school students' achievement in biology. United State China Education Review 4(2): 96–101

Adeyemi, S. (2014). Comparative study of Pupils' Academic performance between private and public primary schools: World Journal of Education 4 (4) Doi10 5430/wje.v4n4p55

Alegre-Ansuategui, F. J., Moliner, L., Lorenzo, G. & Maroto, A. (2018). Peer tutoring and Academic Achievement in Mathematics: A Meta-Analysis EURASIA Journal of Mathematics, Science and Technology education 14(1) 337-354

Ali, N.; Anwer, M & Abbas J. (2015). Impact of Peer tutoring on Learning of students Journal for studies in Management and Planning http://internationaljournalofresearch.org

Ahmed, S. Z., Ahmed, H. Z. & Butt, M. N. (2017). Comparative study of students' academic Performance between private and public higher secondary school of WahCanttJournal of Education and Practice 8(16)

Akinloye, G. M, Adu, O. & Adu, E. (2017). A comparative analysis of Students' performance in Economics in private and public secondary schools Lagos state. Journal of Social Science 44(2-3).144-151

Asikhia, O. A. (2014). Effect of Cognitive restructuring on the reduction of Mathematics Anxiety among senior secondary school students in Ogun State, Nigeria. International Journal of Education and Research. 2(2), 1-20

Assimonye, A. (2022). Effect of Reciprocal Peer Tutoring Strategy on senior secondary school students' Achievement and Retention in Literary Appreciation in Anambra state. OnlineRepository, Micheal Okpara University of Agriculture Umudike. Retrievedfrom https://repository.mouau.edu.ng/work/view

Charina, C. G. (2015). Mathematical Competence and Performance in Geometry of high School Students. International Journal of Science and Technology http://www.ejournalofsciences.org.

Deutsch, M. (1949). A theory of cooperation and competition. Human Relations, 2, 129-151.

Deutsch, M. (2011). Conflict, interdependence and justice.The intellectual legacy of Deutsch M. Coleman, P. (ed) 18, 327.

Received **05 January 2026**; Accepted **22 January 2026**. Available online: **30 January 2026**. Published by SAFE. (Society for Academic Facilitation and Extension)

http://www.springer.com/978-1-4419-9993-1

Ehirheme, P. E. (2020). Effect of Peer Tutoring on students' Knowledge Retention in OfficeTechnology and Management in Polytechnics in south west, Nigeria. Advances in SocialSciences Research Journal 7(9), 892-900 Doi: 10, 14738/asarj.79.9148.

Eraikhuemen, L. & Akpobroka I. B. (2023). Effect of Cooperative Learning Strategy on Senior Secondary School students' Academic Achievement in Geometry.

Federal Government of Nigeria (2013). National Policy on Education. Lagos: Federal Government Press.

Flores, M., & Duran, D. (2013). Effects of peer tutoring on reading self-concept. International Journal of Education Psychology, 2(3), 297-324.

Francisco, J. A., Lidon, M., Gil, L., & Ana, M. (2018) Peer tutoring and Academic Achievement in Mathematics: A meta-analysis. Journal of Mathematics, Science and Technology Education, 14(1), 337-354.

Ghimire, P. (2017) Cause of Low Achievement in Mathematics. An Unpublished Masters' Thesis, T.U; Kirtipur.

Hamisu, B. T. (2017). Effect of Practical approach in teaching geometrical concepts on students' attitude and Performance among Junior Secondary School students in Katsina metropolis. A thesis summited to the Postgraduate school Ammadu Bello University, Zaria.

Isa, I. M. & Muhammad, B. A. (2019). Cooperative Learning Strategy on student academic Performance in Organic chemistry in Zaria Education zone, Kaduna state, Nigeria Chemistry and Material Research online 11(9)

Isah, A & Hamza B. K. (2022) Impact of Cooperative Learning Strategy on the Performance and retention in Geometry among Junior Secondary Schools in Sokoto metropolis ABACUS Mathematics Education series 47(1)

Itikpo, G., Friday J. & Tabitha K. D. (2021). The use of Model-lead test strategy in enhancing Achievement of Senior Secondary school (SS 2) Students in Organic chemistry in Benue State, Nigeria. British Journal of Education 9(4) 81-92.

Johnson, D. W. & Johnson, R. T. (2013). The impact of cooperative, competition and Individualistic learning environment on achievement in J. Hattie & E. Anderman (Eds), International Handbook of student achievement (pp. 1-10). New York: Routledge Publishers.

Karali, Y. & Aydemir, H. (2018):" The effect of cooperative learning on the academic Academic achievement and attitude of students in mathematics class" Educational Research and Reviews 13(21) 712-722 Doi 10. 5897/ERR 2018. 3636

Khadka, M. L. (2017) Comparative study of Achievement of Private and Public schools student in Pythan District. An unpublished Masters' Theses, T. U. Kirtipur.

Longjohn, I.T. & Osila, K. (2022). Effect of Peer-Teaching on senior secondary school students' academic achievement in mathematics in Ahoada East Local Government Area of Rivers State. Saudi Journal of Humanities and Social Science page 164-169

Obiajulu, O. U. (2014) Application of four mode on student achievement, Retention and Multiple intelligence in Biology

Received **05 January 2026**; Accepted **22 January 2026**. Available online: **30 January 2026**. Published by SAFE. (Society for Academic Facilitation and Extension)

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Vol. 03, No. 01, January. 2026

instructional Unpublished Thesis, University of Nigeria, Nsukka

Maliki, A. E., Ngban, A. N. & Ibu, J. E. (2017). Analysis of Students' Performance in Junior Secondary School Mathematics Examination in Bayelsa state. Studies on Home and Community Science. Vol. 3, 131-134

Mohammed, M., Yakubu, M. Y., Zayyanu, U. & Habu, B. H. (2017). A comparative analysis of the academic performance of private and public senior secondary schools in science in Birninkebbi, kebbi state. www.researchgate.net

Nawaz, A., & Rehman, Z. U. (2017). Strategy of peer tutoring and student's success in Mathematics: An analysis. Journal of research and reflection in education, 11(1), 15-30.

Nbame, L. (2022). Effect of Peer Tutoring on secondary school students' Academic Performance in Mathematics in Tai L. G.A. of River state. International Journal of Innovation Education Research 10 (1): 116-123

Okereke, E. C. L. F. Ademiluyi L. F. & Adeagbo, S. (2020). Effect of Peer Teaching Strategy on the Academic Achievement of Business Studies Students in Oyo State Journal of The Business of Education (JTBE) 3(1) https://www.kwasujtbe.com

Oloja O. A. (2021). Effect of Cooperative Learning and Concept Mapping on senior Secondary school student academic achievement and retention in Mathematics An unpublished theses of Faculty of Education, University of Benin, Benin-city.

Okoye, A. A. (2013) Effect of Peer Tutoring method on secondary school students' Academic Achievement in Home Economics Academic Journal of Interdisciplinary Studies 2(5)193-210.

Oshimili north Local Government Council (2023). Report on students' distribution, Akwukwu-igbo Delta state.

Paul, G., Lisa, F. & Vanesa, T. (2016). Effect of Peer Tutoring Attitude and Personality on Academic Performance of first year introductory programming students. San Diego. Unique publishers.

Peter, I. O. (2017) Effects of Peer tutoring strategy on Academic Achievement of senior secondary school students in technical drawing. British journal of education, society and behavioral sciences.19(1), 1-10.

Ra'ed, A. & Reem, A. (2016). Effect of Peer Tutoring on Mathematics academic Achievement of the undergraduate students in Oman. International Education studies 9(5) 124-132

Ullah, I., Tabassum, R., & Kaleem, M. (2018). Effect of Peer tutoring on the Academic Achievement of students in the subject of Biology at secondary school level.Education sciences 8 (3)

Uyim, A. O. O., & Nonye, A. (2019). Effect of Peer Tutoring on Achievement of Students in Business Studies in Public Junior Secondary Schools in Gassol Education Zone of Taraba State. Middle-East Journal of Scientific Research, 27(3), 188-196.

WAEC (2018). Chief examiner report,Mathematics, Lagos, Nigeria: WAEC

WAEC (2019). Chief examiner report,Mathematics, Lagos, Nigeria: WAEC

WAEC (2020). Chief examiner report,Mathematics, Lagos, Nigeria: WAEC

Received **05 January 2026**; Accepted **22 January 2026**. Available online: **30 January 2026**. Published by SAFE. (Society for Academic Facilitation and Extension)

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Vol. 03, No. 01, January. 2026

WAEC (2021). Chief examiner report, Mathematics, Lagos, Nigeria: WAEC

WAEC (2022). Chief examiner report,Mathematics, Lagos, Nigeria: WAEC

Wolfe, B. (2018). The Impact of a peer-tutoring model on the Academic Performance of Secondary students. (Doctoral dissertation). Retrieved on 30th October, 2019 from https://scholarcommons.sc.edu/etd/4468

Zakaria, E.; Solfitri, T.; Daud, M. Y. & Abidin, Z. Z. (2013) Effect of cooperative learning on Secondary school students' mathematics achievement. Creative Education 4(2), 98-100 Doi: 4236/ce.2013, 42014

Received **05 January 2026**; Accepted **22 January 2026**. Available online: **30 January 2026**. Published by SAFE. (Society for Academic Facilitation and Extension)