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Research Article

EFFECT OF COLLABORATIVE LEARNING STRATEGY ON ACADEMIC ACHIEVEMENT OF STUDENTS WITH MATHEMATICS LEARNING DISABILITY IN ABAKALIKI EDUCATION ZONE

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Abstract

The study investigated the effect of collaborative learning strategy on academic achievement of secondary school students with Mathematics Learning Disability (MLD) in Abakaliki Education Zone, Ebonyi State, Nigeria. Three specific purposes, three research questions and three null hypotheses guided the study. Experimental research design was adopted. The population of the study comprised 4,051 SSI students in Abakaliki Education Zone of Ebonyi State. Sample of the study consisted of the 216 (104 male and 112 female) SSI students in four purposefully drawn public secondary schools in the zone. Mathematics Achievement Test (MAT) in Circle Geometry was used for data collection. The instrument was validated by three subject specialists and was tested for reliability using Kendall's Estimate of Inter-Rater. The coefficient obtained was 0.94. Data were analysed using mean and standard deviation for the research questions and Analysis of Covariance (ANCOVA) to test the null hypotheses at alpha level of 0.05 significance. It was found that collaborative learning strategy was of significant positive effect on the academic achievement of secondary school students with MLD in Abakaliki Education Zone than conventional method and there was no significant location difference on the effect of collaborative learning strategy on the academic achievement of secondary school students with MLD in Abakaliki Education Zone. Based on the findings, it was recommended among others that Secondary school mathematics teachers should reduce their sole reliance on the conventional lecture method and integrate structured *collaborative learning strategies* (such as Think-Pair-Share, Jigsaw, and small heterogeneous peer-tutoring groups) into their daily lessons to support students with mathematics learning disabilities.

Keywords: Collaborative Learning Strategy, Academic Achievement, Mathematics Learning Disability Conventional Lecture Method, Inclusive Education, Peer Scaffolding

Introduction

Learning difficulties are complex issues in teaching and learning. Learning disabilities has been defined as various disorders that affect the use, understanding, organization, and retention of verbal and nonverbal information. According to Chieffo (2023), it is a neurodevelopmental disorder that mitigate against the perceiving and processing verbal and nonverbal data. The National Joint Committee on Learning Disabilities (2018) averred that these disorders are intrinsic to the individual, presumed to be due to central nervous system dysfunction, and may occur across the life span. In a different view, the Individuals with Disabilities Education Act (IDEA), a federal law in Ali and Rafi (2016), defined learning disability as a condition when a child's achievement is substantially below what one might expect from that child.

Learning disabilities do not include problems that are primarily the result of intellectual disabilities, emotional disturbance, or visual, hearing, emotional or intellectual disabilities. Learning disabilities in students can stem from diverse factors including cognitive ability, parental lack of education, insufficient parental support, or cultural challenges experienced by children aged. Casali (2024) stated that learning disabilities encompass a range of disorders related to challenges that include difficulty in reading, pronunciation of words accurately or reading at a slow pace and spelling errors (dyslexia), difficulty in writing or performing other motor skills (dysgraphia) and challenges in mathematics or calculations (dyscalculia). Students with the later (dyscalculia) may develop an aversion to numbers and, unfortunately, a fixed mindset on not being able to do anything related to mathematics. The Learning Disability Association of America (2012) further confirmed that learning disability may manifest itself as an imperfect ability in certain areas of learning, such as reading, written expression, or mathematics and consequently on academic achievement.

Academic achievement reflects performance in learning assessments, such as final examination results and the overall achieved by a student in school. In the assertion of Suleiman (2023), academic achievement refers to performance outcomes that indicate how far a person has progressed in specific goals of activities in instructional settings, such as school, college, and university. Academic achievement encompasses a combination of factors including motivation, study habits, external support and implementing suitable instructional strategies to help students unlock their full potential and pave the way for a successful future.

Academic achievement can be determined in a subject like Mathematics which is study of computation and using reason or ability to think logically. It is designed to transfer learning experience to learners through a series of well-planned activities so that they become competent. Academic achievement may be challenged by various factors. Among them is learning difficulties. Baiti et al. (2024) elucidated that learning difficulties directly affect students' academic performance. By extension, Gerber in Jadhav (2022) viewed the effects of learning difficulties beyond academics to influencing self-esteem, motivation, and future career prospects. The learning difficulties students may face include have difficulty reading, writing, spelling, reasoning and organizing information if left to figure things out by them or if taught in conventional ways (Ali & Rafi 2016).

Helping students to overcome learning difficulties and improve academic achievement especially in mathematics is imperative. To improve the academic achievement and reinforce the holistic development of students to possess the necessary skills for real-life situations, secondary schools should pay more attention to reflective and integrative learning and critical thinking abilities (Althaus, 2021). Baiti et al. (2024) profound solutions such as learning differentiation, additional support programmes, and partnerships with parents as key in helping students overcome learning difficulties and improve their academic performance. Similarly, Michael (2026) advocated modern instructional methods like peer tutoring to usefully rehabilitate children with learning disabilities in mathematics. Gull and Shehzad (2015) applauded cooperative learning activities for having a positive effect on academic achievement of students. Collaborative learning is among the most constructive learning strategies to boost active learning.

Collaborative learning is an instructional method which learners at various performance levels work together in small groups of 2 – 5 towards a common goal. People cannot work together without interaction. From this angle, collaborative learning can be considered as learning that takes place through social interaction. It is an academic relationship or interaction in groups. Collaborative learning requires learners to interact in a group setting and manage their relationships and the knowledge they create, as well as raises their active involvement. In collaborative learning, students gain critical thinking skills when they share their ideas, make decisions, and solve problems.

Collaboration learning involves working with others and carrying them along to accomplish a task. Deysolong (2023) noted that the learning strategy has emerged as a powerful educational

tool, reaping numerous benefits for students and their learning outcomes. It encourages active participation in learning as learners work together, sharing information and ideas to solve a common problem. The fact that collaborative learning promotes voices from multiple lenses that each student brings, it encourages integration of ideas and perspectives to accomplish common goals; therefore, it supports integrative and reflective thinking skills. Cooperative learning is highly desirable in teaching because of its tendency to reduce peer competition and isolation, and to promote academic achievement and positive interrelationships. It provides learning environments that support active learning, classroom discourse that enhance individuals in small-group and whole-group learning. As confirmed by Emeka et al. (2025), students in the collaborative approach group achieved more than the conventional approach group.

Another notable factor that is capable of affecting academic performance in mathematics is location. Location is a particular place in relation to other areas. School location in urban or rural area plays a critical role in shaping educational opportunities and students' learning outcomes. Some studies suggested that students in urban schools perform better in mathematics due to enhanced learning conditions (Salihu et al, 2019). It is argued that learning facilities available in urban schools foster interest and develop positive aptitude to learning mathematics (Okpako & Abraham (2025). Many evidences from different places showed that the location of a school may have a significant effect on the performance of its students in mathematics, especially when taught with instructional materials. For instance, Akissani et al. (2019) found that students from the urban area achieved significantly better than students from the rural area in mathematics in in Katsina educational zone. This was attributed to urban students having better staffed and are exposed to better instructional facilities, good study habits, as well as better learning environment. It is often argued that urban schools have qualified mathematics teachers, instructional materials, laboratories, library, and electricity to support ICT-based learning, while rural schools lack these resulting in disparity in academic achievement. On the other hand, rural students are poorly staffed due to teachers declining posting to rural schools. Also, most rural students are not exposed to good instructional facilities, good study habits and lack good environment that could support learning (Akissani et al, 2019).

Although numerous studies have examined the general effectiveness of cooperative and collaborative learning in Nigerian secondary schools, empirical evidence specifically targeting diagnosed or screened students with mathematics learning disabilities in Abakaliki Education

Zone remains limited. Addressing this gap is crucial for improving inclusive education practices and raising mathematics achievement in the zone. Therefore, this study investigates the effect of collaborative learning strategy on the academic achievement of students with mathematics learning disabilities in Abakaliki Education Zone.

Statement of the Problem

Mathematics is a compulsory subject in Nigerian secondary schools and a critical prerequisite for scientific, technological, and career advancement. Despite its central role in the curriculum, student performance in internal and external mathematics examinations—such as those conducted by the West African Examinations Council (WAEC) and the National Examinations Council (NECO) continues to record high failure rates across Nigeria, including in the Abakaliki Education Zone of Ebonyi State. While general factors like inadequate instructional materials and poor study habits have received wide attention, a major underlying issue is the presence of students with mathematics learning disabilities (MLD) in mainstream classrooms. These learners possess normal intellectual abilities but experience specific cognitive difficulties with number sense, arithmetic operations, and mathematical reasoning. In most public secondary schools in Abakaliki Education Zone, large class sizes and a lack of diagnostic screening cause these students to go unidentified. Consequently, they are left to cope without specialized instructional support, resulting in chronic failure, low self-esteem, and avoidance of mathematics

Compounding this challenge is teachers' heavy reliance on the conventional lecture method. This teacher-centered strategy emphasizes passive listening, rapid board demonstrations, and individual seatwork, which rarely meets the cognitive needs of students with mathematics learning disabilities. Without opportunities for step-by-step peer explanation, immediate feedback, or active engagement, these students easily experience cognitive overload and fall further behind their classmates.

Although educational researchers have proposed learner-centered approaches like the collaborative learning strategy to boost classroom engagement and problem-solving, most existing studies in Ebonyi State have focused on general student populations rather than learners with specific mathematical disabilities. There is a noticeable dearth of empirical evidence regarding how structured peer collaboration based on location affects the achievement of with mathematics learning disabilities in Abakaliki Education Zone. If this instructional gap persists, students with learning difficulties will continue to experience academic exclusion and poor

outcomes in mathematics. Therefore, the problem of this study, put in a question form, is: What is the effect of collaborative learning strategy on the academic achievement of students with mathematics learning disabilities in Abakaliki Education Zone?

Purpose of the Study

The main purpose of the study was to investigate the effect of collaborative learning strategy on academic achievements of secondary school students with learning disability in Mathematics. Specifically, the study sought to:

1. Determine the difference in the mean academic achievement scores of MLD students taught mathematics using the collaborative learning strategy and those taught using the conventional lecture method.
2. Ascertain the difference in the mean academic achievement scores of MLD students in the urban and rural areas taught mathematics using the collaborative learning strategy
3. Examine the interaction effect of instructional strategy and location on the academic achievement of students with mathematics learning disabilities in Abakaliki Education Zone.

Research Questions

The following research questions guided the study:

1. What is the difference in the mean academic achievement scores of MLD students taught mathematics using the collaborative learning strategy and those taught using the conventional lecture method?
2. What is the difference in the mean academic achievement scores of MLD students in the urban and rural areas taught mathematics using the collaborative learning strategy?
3. What is the interaction effect of instructional strategy and location on the academic achievement of students with mathematics learning disabilities in Abakaliki Education Zone?

Hypotheses

The following null hypotheses tested at0.05levelofsignificance guided the study:

1. There is no significant difference in the mean achievement scores of students taught Mathematics using collaborative learning strategy and those taught using traditional method.
2. There is no significant difference in the mean achievement scores of students in urban and rural areas taught Mathematics using collaborative learning strategy.
3. There is no significant difference in the interaction effect of teaching methods and location on students' mean achievement scores in Mathematics.

Methodology

Experimental research design was adopted. The population of the study comprised 4,051 SS I students in Abakaliki Education Zone, Ebonyi State. Sample of the study consist of the 216 (male 104 and female 112) SSI students in four purposefully drawn public secondary schools in the zone. Mathematics Achievement Test (MAT) in circle geometry was used for data collection. The instrument was validated by two subject specialists and was tested for reliability using Kendall's Estimate of Inter-Rater. The coefficient obtained was 0.94. Data were analysed using mean and standard deviation for the research questions and Analysis of Covariance ANCOVA to test the null hypotheses at alpha level of 0.05 significance. For any of the hypotheses to be accepted, the alpha level (0.05) must be equal or less than the calculated-P value otherwise it was rejected.

Results

The results of data analyses are presented below in tables based on the research questions and hypotheses that guided the study.

Table 1: Descriptive Statistics on the mean achievement scores of students taught Mathematics using collaborative learning strategy and those taught using traditional method

Group	**N**	**Mean**	**Std. Deviation**
Experimental	95	61.7895	11.89573
Control	121	50.2727	15.16080
Total	**216**	55.3380	14.93277

Table 1 reveals that students in the experimental group taught mathematics using collaborative learning strategy have mean score of approximately 61.79 and standard deviation of 11.90. Those in the control group taught using traditional method have mean score of approximately 50.27 and standard deviation of 15.16. This indicates that collaborative learning strategy is superior in enhancing students' achievement in mathematics than the conventional method.

Table 2: Descriptive Statistics on the mean achievement scores of students in urban and rural areas taught Mathematics using collaborative learning strategy

Location	**N**	**Mean**	**Std. Deviation**
Urban	47	61.6458	11.43434
Rural	48	61.9362	12.47154
Total	**95**	**61.7895**	**11.89573**

Table 2 reveals that students in urban taught mathematics using collaborative learning strategy have mean score of approximately 61.64 and standard deviation of 11.43. Those in the rural area have mean score of approximately 61.94 and standard deviation of 12.47. This indicates that collaborative learning strategy is not influenced by location.

Table 3: Descriptive Statistics on the interaction effect of teaching methods and location on students' mean achievement scores in Mathematics

Group	**Location**	**Mean**	**Std. Deviation**	**N**
	Urban	61.6458	11.43434	48
Experimental	Rural	61.9362	12.47154	47
	Total	**61.7895**	**11.89573**	**95**
	Urban	51.7931	14.90997	58
Control	Rural	48.8730	15.37330	63
	Total	**50.2727**	**15.16080**	**121**
	Urban	56.2547	14.26488	106
	Rural	54.4545	15.56321	110
	Total	**55.3380**	**14.93277**	**216**

Table 3 reveals that urban and rural students in the Experimental group respectively outperformed their counterparts in the control group. In total, the experimental group have a mean of approximately 61.78 against their counterparts in the control group with a total mean of 50.27. This indicates that there is no interaction effect between teaching methods and location.

Table 4: Analysis of Covariance (ANCOVA) on the mean achievement scores of students taught Mathematics using collaborative learning strategy and those taught using traditional method

Source	**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**P-Val**	**Partial Eta Squared**
Corrected Model	7337.172[a]	2	3668.586	19.244	.000	.153
Intercept	81031.988	1	81031.988	425.065	.000	.666
PRETEST	278.633	1	278.633	1.462	.228	.007
GROUP	6860.274	1	6860.274	35.987	.000	.145
Error	40605.156	213	190.635			
Total	709397.000	216				
Corrected Total	47942.329	215				

a. R Squared = .153 (Adjusted R Squared = .145)

Table 4 shows that the calculated P-value of 0.00 is less than the alpha significance value of 0.05. Based on the decision rule to reject a null hypothesis if the P-value is less than the alpha significant value, null hypothesis one is rejected. Therefore, there is a significant difference in the mean achievement scores of students taught Mathematics using collaborative learning strategy and those taught using traditional method.

Table 5: Analysis of Covariance (ANCOVA) on the mean achievement scores of students in urban and rural areas taught Mathematics using collaborative learning strategy

Source	Type III Sum of Squares	Df	Mean Square	F	P-val.	Partial Eta Squared
Corrected Model	2.050[a]	2	1.025	.007	.993	.000
Intercept	44372.805	1	44372.805	306.946	.000	.769
PRETEST	.048	1	.048	.000	.986	.000
LOCATION	1.946	1	1.946	.013	.908	.000
Error	13299.740	92	144.562			
Total	376006.000	95				
Corrected Total	13301.789	94				

a. R Squared = .000 (Adjusted R Squared = -.022)

Table 5 shows that the calculated P-value of 0.91 is greater than the alpha significance value of 0.05. Based on the decision rule to accept a null hypothesis if the P-value is greater than the alpha significant value, null hypothesis three is accepted. Therefore, there is no significant difference in the mean achievement scores of students in urban and rural areas taught Mathematics using collaborative learning.

Table 6: Analysis of Covariance (ANCOVA) on the interaction effect of teaching methods and location on students' mean achievement scores in Mathematics

Source		Type III Sum of Squares	Df	Mean Square	F	P-val
Intercept	Hypothesis	80806.680	1	80806.680	451.914	.000
	Error	27715.763	155.01	178.810[a]		
PRETEST	Hypothesis	272.120	1	272.120	1.423	.234
	Error	40352.169	211	191.243[b]		
GROUP	Hypothesis	6788.907	1	6788.907	46.055	.092
	Error	148.564	1.008	147.408[c]		
LOCATION	Hypothesis	76.412	1	76.412	.519	.602
	Error	148.074	1.005	147.358[d]		
GROUPS * LOCATION	Hypothesis	147.276	1	147.276	.770	.381
	Error	40352.169	211	191.243[b]		

Table 6 indicates that the calculated P-value of 0.77 is greater than the alpha significance value of 0.05. Based on the decision rule to accept a null hypothesis if the P-value is greater than the alpha significant value, null hypothesis three is accepted. Therefore, there is no significant difference in the interaction effect of teaching methods and location on students' mean achievement scores in Mathematics.

Discussion

Finding in table one indicated that collaborative learning strategy is superior in enhancing students' achievement in mathematics than the conventional method. The finding amplifies the efficacy of collaborative learning strategy which promotes positive interdependence, individual accountability, promotive interaction, collaborative skills development that ensure each member is responsible for learning and helping group members learn through peer explanation at one's level. The finding is consistent and well supported by previous studies in Nigeria, and international, and explained by sociocultural, social interdependence, cognitive load and self-efficacy theories. It has practical significance with large effect size. At the international level, the finding agrees with Cassel and Reid (2017) who investigated effects of Fast Draw strategy, a form of collaborative learning, in developing mathematical skills of two students with learning disabilities. Results revealed problem solving skills of both students improved significantly from baseline to intervention phases.

In Nigerian context, Nwoke et al. (2023) found that collaborative learning strategy enhanced problem-solving ability $F = 188.485$, $p = 0.000 < 0.05$. There was no significant difference between low and high achievers, implying that collaborative learning strategy bridged ability gaps and is effective for low achievers including those with MLD. The finding also agrees with Emeka et al. (2025) that students in the collaborative approach group achieved more than the conventional approach group.

Finding in table 4 further indicated that there is a significant difference in the mean achievement scores of students taught Mathematics using collaborative learning strategy and those taught using traditional method. This means that there is no parity between collaborative learning strategy and convention teaching method. The finding further strengthens the superiority of collaboration over conventional approach to teaching. In simply words, collaborative learning strategy is better as it enhanced better academic achievement of students in mathematics than the

conventional method. Collaborative learning is highly desirable in teaching because of its tendency to reduce peer competition and isolation, and to promote academic achievement and positive interrelationships. The finding aligns with Emeka et al. (2025) that students in the collaborative group achieved better than their counterparts in conventional approach group.

Finding in Table 2 indicated that collaborative learning strategy is not influenced by location. Similarly, Table 5 illustrated that there is no significant difference in the mean achievement scores of students with Mathematic Learning Difficulties (MLD) in urban and rural areas taught Mathematics using collaborative learning strategy. This implies that collaborative learning strategy promotes rural-urban parity and its effectiveness is not influenced by location. Both urban and rural students with learning disability benefit equally, indicating that collaborative learning strategy can close urban-rural gap. Collaborative learning strategy is not influenced by location because it is low-cost, resource-independent, compensates for teacher quality gap, equalizes cognitive load, promotes academic discourse, increases motivation, culturally congruent with rural communal values, and addresses double disadvantage of MLD students in rural areas. The finding is supported by Afolabi and Adebayo (2021) who noted that rural students can close the gap with their urban peers when provided with supportive learning environments and effective teaching strategies. Collaborative learning strategy has proven to close urban-rural gap in academic achievement in mathematics. However, the finding failed to agree with Akissani et al. (2019) that students from the urban area achieved significantly better than students from the rural area in mathematics in in Katsina educational zone. Changes in time and geographical difference may have contributed to the variation.

The findings indicated there is no interaction effect between teaching methods and location and there is no significant difference in the interaction effect of teaching methods and location on students' mean achievement scores in Mathematics in Tables 3 and 6 respectively suggests the effect of teaching methods on achievement does not depend on location; collaborative learning strategy works equally well for both urban and rural students with learning disability, and conventional method works equally poorly for both urban and rural. Graphically, if interaction graph is plotted with teaching methods on X-axis and mean achievement on Y-axis, with two lines representing urban and rural, the two lines are almost parallel, both rising sharply from conventional to collaborative, with no crossing, indicating no interaction. This is a desirable pattern for equity. From theoretical perspective, the finding is in line with Johnson and Johnson's

Social Interdependence Theory, that positive interdependence increases achievement regardless of location. Rural communities are more communal and collective, culturally congruent with collaborative learning strategy which emphasizes communal work. Urban students also benefit from cooperation over competition. Therefore, both locations benefit equally, no interaction.

Furthermore, no interaction means lines for urban and rural across methods are parallel. Present study, Table 5, urban collaborative 61.65, rural collaborative 61.94 both high and close difference ± 0.29; urban conventional 51.79, rural conventional 48.87 both low and close difference ± 9.92. Both lines rise sharply from conventional to collaborative with almost same slope, indicating method effect same in both locations. If interaction significant, lines would cross or diverge, e.g., collaborative much better in urban than rural, or rural better. Parallel lines indicate no interaction and support generalizability of collaborative across locations. This pattern desirable for policy because it means collaborative can be scaled across Abakaliki Education Zone without need for location-specific adaptation. The findings align with several studies which found no interaction between method and location when innovative strategies are used, though it contrasts with older studies under conventional method where interaction was significant.

The finding is in contrast with Owoeye (2009) that rural schools receive inadequate staffing due to teachers rejecting rural postings, leading to use of non-qualified PTA teachers, affecting achievement indicating that conventional method depends heavily on teacher quality and physical resources, so it interacts with location. It is effective in urban with resources, ineffective in rural without resources, producing interaction. The argument was strengthened by Alordiah et al. (2015) that there was significant interaction between method and location under conventional lecture method, urban high SES performed better than rural low SES, but interaction disappeared under collaborative. The contrast proves that collaborative learning strategy neutralizes interaction effect between method and location that exists under conventional method. Collaborative learning strategy does not depend on sophisticated facilities or electricity. It uses peer resources, manila cards, marker, group formation which are available in both urban and rural at low cost. It reduces dependence on teacher as sole source of knowledge, shifting to peer-mediated learning. Therefore, lack of qualified teacher and facilities in rural is compensated by peer tutoring, making method effective in both locations equally, hence no interaction.

Conclusion

Based on the literature, theoretical framework, and empirical patterns examined in this study, it is concluded that the collaborative learning strategy is a highly effective instructional approach for improving the academic achievement of students with mathematics learning disabilities in the Abakaliki Education Zone of Ebonyi State. Unlike the conventional lecture method which relies on passive listening and individual seatwork that often overwhelm struggling learners collaborative learning fosters peer scaffolding, active problem-solving, immediate feedback, and reduced mathematics anxiety. Furthermore, structured peer collaboration promotes an inclusive classroom environment where both students with mathematics learning disabilities in urban and rural areas can participate actively and achieve equitable academic gains without significant location disparity. Adopting collaborative learning strategies alongside early diagnostic screening in secondary schools within Abakaliki Education Zone will significantly bridge learning gaps, strengthen inclusive education practices, and improve overall student performance in mathematics.

Recommendations

Based on the findings and conclusions of this study, the following recommendations are made for relevant educational stakeholders in Abakaliki Education Zone and Ebonyi State at large:

1. Secondary school mathematics teachers should reduce their sole reliance on the conventional lecture method and integrate structured collaborative learning strategies (such as Think-Pair-Share, Jigsaw, and small heterogeneous peer-tutoring groups) into their daily lessons to support students with mathematics learning disabilities.
2. Teachers and school guidance counselors should collaborate to conduct early diagnostic screenings using simple numeracy checklists and academic record reviews to identify students with mathematics learning disabilities early, rather than labeling them as lazy or unintelligent
3. Educational authorities should organize regular in-service workshops, seminars, and continuous professional development programs to train mathematics teachers on inclusive pedagogy, collaborative learning techniques, and instructional accommodations for learners with dyscalculia.

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