

**IMPROVING SENIOR SECONDARY SCHOOL STUDENTS'
INTEREST IN MATHEMATICS: A COMPARATIVE STUDY OF
COLLABORATIVE AND TRADITIONAL DISCUSSION
STRATEGIES.**

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Abstract

The study sought to promote senior secondary school students' interest in algebra through collaborative instructional strategy, Kogi State. To achieve this, two research questions and two hypotheses were formulated to guide the study. Quasi-experimental design specifically, the pre-test, post-test, nonequivalent randomized sampling technique was used for the study. The population of the study consisted of 12703 (6,680 male and 6,023 female) Senior Secondary (SSII) students from which 220 students were sampled using multi-stage sampling. The instrument used for data collection was algebra interest inventory using four point likert scale. Mean and standard deviation were used to answer the research questions, while analysis of covariance (ANCOVA) was used to test the hypotheses at 0.5 level of significance. The findings showed that, there was a statistically significant high interest mean scores of students in Algebra when exposed to collaborative learning strategy. The findings further revealed that, there was no statistically significant difference between the interest rating means scores of male and female students taught algebra using collaborative learning strategies. It was recommended that to enhance students' interest in algebra, mathematics teachers should use collaborative learning strategy when teaching algebra and other complex concepts in mathematics. Government should consider revising the time allocated in teaching mathematics using collaborative learning strategy to boost students' interest, and academic

performance in mathematics. Additionally, regular professional development workshops should be provided for teachers to enhance their skills in implementing collaborative learning strategy effectively.

Key words; *collaborative, traditional discussion, interest, mathematics.*

Introduction

Mathematic is a way of settling in the mind of children a habit of reasoning (Malik, 2017). Mathematics may also be described as the study of patterns and relationships between numbers, quantities, shapes, and structures. It involves logical reasoning and precise language to formulate, analyze, and solve problems. This may be through the conducting operations with numbers, quantities, shapes, patterns, and the relationships between them. When national development is mentioned there is a tendency for one to equate it with economic development and this cannot be without the development of mathematics (Achimugu 2000). Mathematical application is a very important, (Mahtab 2018 & Nepal 2016) maintained that mathematics is essential in various careers and professions, including banking, medicine, engineering and technology. Even in creative fields like painting and music, mathematical knowledge is applied. Nigeria as a country realized the usefulness of Mathematics to national socio-economic development thus has made efforts to impart knowledge and skills of Mathematics in all her citizens at all levels of education. Mathematic as stated in the National Policy on Education by the Federal Republic of Nigeria (FRN, 2014) is a core subject for students at the basic and senior secondary school levels of education. To emphasis the importance of Mathematics.

Despite its importance, mathematics remains a difficult subject for many students leading to low interest and performance. In Nigeria, the traditional teacher-centered approach to teaching mathematics has been criticized for its limitations in promoting students engagement and understanding (Abdulhamid et al. 2018). Onah and Anamezie (2022) defined interest as a kind of awareness inclination for understanding the world, acquiring cultural and scientific knowledge. Achimugu et al (2022) defines interest as the feeling or excitement accompanied by special attention to do something, as interest plays a crucial role in students' engagement and motivation. Owora and Chika (2019) noted that there is generally low interest in the study of Mathematics and Mathematics related disciplines at all levels of education in Nigeria.

According to Adeyemo (2015) and Adeyemi & Achimugu (2024), a number of factors can lead to poor interest especially in learning activities. Such poor interest could be as a result of the following: students negative attitude to anything they considered difficult; their perception of other people such as teachers, peers and even parents; their perception about certain concepts vis-à-vis cultural bearing; improper instructional strategy and poor

background in sciences. Adeyemo (2015) believes that the importance of interest in whatever a person does cannot be underestimated when it comes to making choice. This is because interest is of considerable importance. Teachers shy away from using innovative teaching strategy like collaborative learning strategy because it consumes time and may hinder total coverage of the Mathematics syllabus especially algebraic topics.

Collaboration is a structure of interaction designed to facilitate and accomplishment of a specific end product or goal through people working together in groups. Cooperative learning, aimed at getting the students to take almost full responsibility for working together, building knowledge together, changing and evolving together and of course, improving together. Tunde (2014) stated that cooperative learning groups would assume almost total responsibility for answering questions. The students determine if they had enough information to answer the question. If not, they identify other sources, such as journals, books, videos, and the internet, to name a few. The group members would decide how many reasons they could identify which would distribute the work of obtaining the extra source materials among the group members.

Nwafor et al. (2023) showed that Students interest ratings were also higher in collaborative learning strategy group than the conventional group. Mohammed and Sani (2023) reported a significant difference between the experimental and control groups with 106.39 and 64.26 interest means scores respectively in Algebra. finding of Sule (2023) revealed no significant different in the mean interest of conceptual understanding scores, as only 0.8% of the mean conceptual understanding scores was due to gender using 7E learning cycle model in algebra. Ode & Tartenger (2021) emphasized the need to move away from traditional teaching methods, as his study have showed that innovative teaching strategies have more positive impact on students overall performance. From the empirical review of related literature it is clear there is inconsistency in research findings, hence the need to carry out more thorough research work in this area of research interest. Also from the empirical reviews it is clear that the use of learner-centred collaborative strategy where students co-learn and share ideas could help improve students' interest in mathematics. As such, there is a need to investigate the use of collaborative learning strategy in Kogi State. Hence, the researchers sought to find out if the use of collaborative learning strategy could enhance senior secondary school students' academic interest in mathematics in Kogi State.

Gender is determined by biological, sociological and psychological factors (Mazzuca et al., 2024). Gender is a socio-culture constructed concept of ascribing some characteristics and roles to sex such as male and female within the society. Gender is one of the main issues especially among academics all over the world; the case is not different in Nigeria. (Jirgba *et al.*, 2018 &

Ngwoke et al., 2017) revealed that, gender is another relevant issue that could affect students' interest in learning, since the social expectations that prescribe how males and females think, act and feel differs. These authors further stated that, gender differences in students interest has been a major concern in education and science educators seek to provide avenues for achieving gender equity for sustainable development. Obodo (2017) showed that male and female students taught algebra using activity based approach did not significantly differ in interest scores. Which was in line with Rabo (2023) who found no significant difference in the mean interest score of male and female in geometry While Agu and Achimugu (2024) study indicated that there was a notable correlation between gender and the average interest ratings in biology among students, with male showing a higher level of interest. Mutai (2016) also revealed that male students had a higher interest in mathematics. Hence, from this inconsistent results the researchers sought to find out if the use of collaborative learning strategy could enhance gender academic interest in mathematics in Kogi State.

Research Questions

The following research questions guided the study

1. What is the difference between the interest ratings mean scores of students taught mathematics using collaborative learning strategy and those exposed to traditional discussion teaching strategy?
2. What is the difference between the interest ratings mean scores of male and female students taught mathematics using collaborative strategy?

Hypotheses

The following null hypotheses were formulated and tested at an alpha level of 0.05 of significance.

Ho1: There is no significant difference in the interest ratings mean scores of students taught mathematics using collaborative learning strategy and those exposed to traditional discussion teaching strategy

Ho2: There is no significant difference in the interest ratings mean scores of male and female students taught mathematics using collaborative learning strategy

Methodology

The target population for the study consisted of 12703 (6,680 male and 6,023 female) Senior Secondary (SS II) students in 236 public senior secondary schools in Kogi State. The sample consisted of 220 (male 115 female 105) Senior Secondary II students who are offering Mathematics in four intact classes located in four public secondary schools in Kogi State obtained using multi-stage sampling. At the first stage simple random sampling technique will use to select four Educational zones which are Ankpa, Dekina Okene and

Kabba. Secondly, purposive sampling was used to select four senior secondary schools, one in each selected educational zone. This is to ensure uniformity of standard and to ensure that the schools are equidistant from one another. Thirdly random sampling will be utilized to obtain the arm to be used for this study where there are more than one arm, Furthermore, two secondary schools were randomly assigned to experimental group and two to control group using hat and draw method without replacement to avoid bias. This was done to ensure that equal chance were given to each school to be selected as the experimental group. The researcher(s) wrote the first letter of names of the four sampled schools on a piece of paper, folded and dropped them in a hat. The first two schools drawn was registered as experimental group and was not replaced. Then remaining two was registered as the control group. This sample of 220 students consists of 110 students in the experimental group and 110 students in the control group. The instrument used for this study was the Algebra interest inventory (AII) it was developed by the researcher(s) and consisted of thirty (30) items. The instrument was validated by experts in mathematics and in science Education. Vygotsky (1978) Social Constructivist Learning Theory was used to construct the interest inventory to take care of content validity, through his 4 stages learning theory: understanding student perspectives, zone of proximal development, scaffolding and social interaction.

Results

Research question one

What is the difference between the interest ratings mean scores of students taught mathematics using collaborative learning strategy and those exposed to traditional_discussion_ teaching strategy?

Table 1: Mean Interest Scores of Students Taught Algebra Using Collaborative Learning Strategy and Those Taught Using Traditional Discussion Strategy

Strategies	N	Pretest		Post-test		Mean gain
		\bar{X}	SD	\bar{X}	SD	
Collaborative learning strategy.	111	2.400	0.2600	3.760	0.3800	1.360
Traditional Discussion Strategy	109	2.350	0.2900	2.600	0.4100	0.2500

Table 1 showed the mean interest scores of students taught algebra using collaborative learning strategy and those taught using traditional discussion strategy. From the results, students taught algebra using collaborative learning strategy had a mean interest score improvement of 1.360, and students` exposed to traditional discussion strategy had a mean interest score improvement of 0.25. A mean difference of 1.110 was obtained from the result. This is an indication that collaborative learning strategies are

potent in improving the interest scores of students in algebra more than traditional discussion strategy.

Research Question Two:

What is the difference between the interest ratings mean of male and female students taught algebra using collaborative learning strategy?

Table 2: Pretest/Posttest of the Mean Interest Scores of Male and Female Students Taught Algebra Using Collaborative Learning Strategy

Gender	N	Pretest		Posttest		Mean Gain	Mean Difference
		\bar{x}	SD	\bar{x}	SD		
Male	58	2.200	0.210	3.900	0.340	1.700	0.420
Female	53	2.270	0.250	3.550	0.600	1.280	

The result in Table 2 showed the mean and standard deviation on the interest ratings of male and female students taught algebra. The result indicates that male students taught algebra using collaborative learning strategy had an improvement of 1.700 in mean interest rating whilst female students taught algebra using collaborative learning strategy had a mean interest rating gain of 1.280. The result equally showed a mean difference of 0.420 was obtained between male and female. The result means that the interest rating score of male students taught algebra was higher than that of their female colleagues.

Hypothesis

HO₁: There is no significant difference in the interest ratings mean of students taught algebra using collaborative learning strategy and those exposed to traditional discussion teaching strategy.

Table 3: Analysis of Covariance (ANCOVA) of Difference in the Mean Interest Scores of Students in Algebra When Exposed to Collaborative Learning Strategy and Traditional Discussion Strategy

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Squared	Eta	Decision
Corrected Model	8242.011 ^a	1	4121.005	104.676	.000	.380		
Intercept	7412.684	1	7412.684	188.286	.020	.356		
Pretest Interest	439.391	1	439.391	11.161	.004	.032		
Strategies	7547.785	1	7547.785	91.717	.000	.350		S
Error	13424.940	216	39.369					
Total	799623.000	220						

Corrected Total 21666.951 219

Note: S = Significant, NS = Not Significant and η^2_p = partial eta squared

Table 3 presents the ANCOVA results, indicating a significant difference in the mean interest ratings of students taught algebra using collaborative learning strategy and those taught with traditional discussion strategy. The result yields an F-ratio 91.717, $p < 0.000$. The associated exact probability value of 0.000 obtained which is below 0.05 level of significance set for decision making. Consequently, the null hypothesis was rejected. The inference drawn is that, there is a significant difference in the mean interest score of students in algebra when taught using collaborative learning strategy and traditional discussion Strategy in favour of collaborative learning strategy. Furthermore, the partial eta square (η^2_p) of 0.350 reveals that 35% of the variance in mean interest scores can be attributed to collaborative learning strategies effects. This means that 35% of the increase in the mean interest scores of students in algebra was due to the effect of the collaborative learning strategy.

HO₂: There is no significant difference in the interest ratings mean of male and female students taught algebra using collaborative learning strategy.

Table 4: Analysis of Covariance (ANCOVA) of Difference in the Mean Interest Rating Scores of Male and Female Students in Algebra When Exposed to Collaborative Learning Strategy.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared	Decision
Corrected Model	134.759 ^a	2	67.380	.912	.406	.380	
Intercept	6863.610	1	6863.610	92.880	.000	.356	
Pretest Interest	133.496	1	133.496	1.806	.183	.032	
Gender	.114	1	.114	12.002	.969	.030	NS
Error	5690.128	215	73.898				
Total	366689.000	220					
Corrected Total	5824.888	219					

Note: S = Significant, NS = Not Significant and η^2_p = partial eta squared

The result in Table 4 presents the ANCOVA result comparing the interest scores male and female students taught algebra using collaborative learning strategy. The result yielded an F-ratio of 12.200, ($p = 0.969$, $\eta^2_p =$

0.030). However, the associated probability value of 0.969 is greater than 0.05 set as level of significance, the null hypothesis was accepted. Thus, inference drawn is that there was no statistically significant difference between male and female students interest scores when taught algebra using collaborative learning strategy. The result further showed the effect size ($\eta^2_p = 0.030$), which indicates that three percent (3%) of the increase in the mean interest scores of students in algebra was due to the effect of the teaching strategy.

Discussion of Findings

The finding of the study presented in Table 1 indicates that students taught algebra using collaborative learning strategy exhibited higher interest level compared to those taught using traditional discussion strategy. Also, Analysis in Table 1 reveals a significant difference between collaborative learning strategy and traditional discussion teaching strategy on students' interest in algebra in favour of collaborative learning strategy that had higher mean. This implies that the null hypothesis was rejected.

The reason for this result could be due to the fact that collaborative learning strategy is more exciting and interacting, whereby students requires working together toward a common goal. Collaboration are structure of interaction designed to facilitate and accomplishment of a specific end product or goal through people working together in groups. The characteristics of collaborative learning strategy are development of higher-level thinking, oral communication, self-management and leadership skills, Promotion of student-faculty interaction, increase in student retention, self-esteem and responsibility, Exposure to and an increase in understanding of diverse perspectives, Preparation for real life social and employment situations among others. All these characteristics makes students exposed to collaborative learning strategies to develop positive attitude towards mathematics and gaining higher interest than students exposed to traditional discussion strategy. While traditional discussion strategy is a one-way oral communication which is probably one of the oldest strategies of teaching. It involves verbal presentations of the subject matter restrictively and formally. Mohammed (2019) observed that most of the teaching strategy are fact oriented, assigning a passive role to learners. Thus, the need to utilize students-centered teaching strategy becomes imperative, such as collaborative learning strategies. The finding of this study is in agreement with that of Owolabi (2017) who found that Students interest ratings scores were also higher and significant in collaborative learning strategy group than the conventional group. The finding is in line with the finding of Nwafor et al (2023) who found that students who were instructed in geometry through collaborative learning strategy had higher interest in the subject compared to those who were taught using traditional instructional strategies. The study is not in agreement with the finding of Sule (2023) who found no significant different in the mean interest of conceptual understanding scores, and academic performance scores students as only 0.8%

of the mean conceptual understanding scores, and academic performance scores was due to gender using 7E learning cycle model in algebra. From the above discussion, collaborative learning strategy showed a significant result on students' interest towards algebra and this supersedes the conventional discussion strategy.

The result revealed that the male students exhibited a slight increase in interest in algebra compared their female counterparts. However, the hypothesis test indicated no statistically significant difference in the mean interest rating score of male and female students taught algebra using collaborative learning strategy. Consequently, the null hypothesis was accepted. The findings suggest that the effectiveness of the collaborative learning strategies may have contributed to the increased interest in algebra among both male and female students. The interactive and engaging nature of collaborative learning, particularly during constructive argumentation, may have made learning experience more enjoyable and exciting for all students. The finding aligns with those of Obodo (2017) who found that male and female students taught algebra using activity-based approach did not significantly differ in their mean interest rating scores. The study agrees with Nwafor et al (2023) who found that there was no significant difference in the interest ratings between male and female students in the experimental group compared to those who were taught using traditional instructional strategies. The study finding is not in agreement with Rodriguez et al. (2020) who found Gender differences in mathematics interest among male and female students in favour of boys as a result of anxiety. Location (Spain) and educational level may have been the reason for difference in results. From the above discussion, collaborative learning strategy showed a significant result on male and female students' interest towards algebra.

Conclusion

Based on the results and discussion of this study, the following conclusions were made;

There was a statistically significant difference in the mean interest scores of students in algebra when exposed to collaborative learning strategy and discussion strategy in favour of collaborative learning strategy with high mean. The finding shows that, that there was no statistically significant difference in mean interest scores of male and female students in Algebra when exposed to collaborative learning strategy.

Recommendations

The following recommendations were made according to the findings of the study.

1. To enhance students' academic interest in algebra, mathematics teachers should employ the use of collaborative learning strategies when teaching algebra.

2. To enhance students' academic interest in algebra the government through the Federal and State Ministries of Education, should increase the time allocated for the teaching of mathematics using collaborative learning strategies to improve students' interest in Mathematics.
3. Government through the Federal and State Ministry of Education should sponsor Mathematics teachers constantly on in-service training on the use of collaborative learning strategies.

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