



Effectiveness of Students Team Achievement Division Strategy on Students' Academic Achievement in Mathematics Among Secondary Schools in Borno State

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Abstract

This study explored the effectiveness of the STAD strategy in enhancing mathematics learning for secondary school students. The research is guided by two research questions and hypotheses. It employed a quasi-experimental design, meaning participants weren't randomly assigned to groups. The study involved a population of 50,947 students, but the data was collected from a sample of four co-educational schools with four existing classes. Two classes assigned as experimental and two control groups. The instrument used was Mathematics Achievement test with reliability of 0.87. The study compared two groups: one where students learned math using the STAD strategy (experimental group) and another where they learned with a traditional method (control group). Researchers analyzed the data using descriptive and inferential statistics. Their findings showed that students in the STAD group achieved significantly higher scores in math compared to the control group. Additionally, there were no significant differences in math achievement scores between boys and girls who learned with the STAD strategy. The study concludes that, STAD strategy has influence on students' performance in mathematics of both males and females. Thus it was recommended that, STAD strategy should be used in teaching mathematics at any level.

Introduction

Education is an effort to make a plan to create a conducive atmosphere of teaching and learning process that can make students actively and potentially to develop their learning physical strength, self-discipline, intelligence, noble character, skills as well as the self-esteem required by them (Simamora, 2017). Aspects of Education cannot be discussed fully without touching parts of Science Education. Science education is refers to as process or technique of imparting knowledge, skills and understanding of Scientific concept within the various scientific disciplines such as; physics, chemistry, biology, astronomy an others (Kelley & Kuwalets, 2016). Mathematics education and science education which are interrelated and cannot be separated in field of study, but many failed to understand that, the two subjects in classroom activities are important and have the same functions (Adesoji & Ibraheem, 2009). Mathematics education is a fundamental part of Sciences, Technologies and

Information and Communications Technology (ICTs). Moreover, Science Education is the back bone of studying sciences and science-related courses in which teachers are expected to select appropriate method to be used when teaching the subjects (Byrd & Alexander, 2020) and Mathematics inclusive. Mathematics has importance, despite the importance of Mathematics in day to day activities in, there has been an unpleasant and uncertain in the outcomes of students' performance in their exams (internal and external) periodically due to so many factors that attributed to that effect, such as. Teaching method, students background, interest in the subject, lack of qualified teacher and so on (Udonsa, 2015).

Students' Academic achievement is the outcome showing the level of learner in which one can achieve an exact goal in Schools (Balgon, Renchin & Ojgoosh, 2022). Genders' achievement in mathematics: Right from the word go till today many research has



been done in gender, such as; the concept of gender difference and disparity in schools mathematics are conspicuous things on discussion by researchers, but in their conclusions it revealed that, gender achievement in mathematics among the male and female students is argumentative Wadley (2002). Thus, to understand the phenomenon and academic achievement in mathematics of gender, this study intended to find out the clear picture using Students Team Achievement Division (STAD) Strategy. According to Kajuru and Kauru (2010), the low academic achievement of pupils in Mathematics has become a concern in mathematics education, to many well-meaning individuals, institutions and organizations as well as various levels of governments. According to Isah (2015) and Silver (2017) who stated that, the methods or strategy of teaching the subject is one of the contributing factors to poor performance of students in mathematics (Aminu, 2023).

Cooperative Learning (CL) is defining as “an instructional strategy in which students work together in small groups to enhance both their own and their teammates learning”. The following are some of the common strategies. Such as Think-Pair-Share, group discussions, and activities like STAD (Student Teams-Achievement Divisions) and Jigsaw II. There are also methods for brainstorming and quick reviews (Abrami, Poulsen & Chambers, 2004).

STAD, which stands for Student Teams-Achievement Divisions, is a cooperative learning method created by Robert Slavin and his colleagues at Johns Hopkins University in 1978. Originally called student team learning, it was revised in 2009. (Sharan, 2012). According to Slavin (2010) three things distinguished STAD strategy from other group classroom work, these include; positive interdependency, individual accountability and equal opportunity for success. And categorically supported by Kurt the founder of the Gestalts school of psychology in the year 1900 (Johnson, Johnson & Stanne, 2000 in Aminu, 2023). One of the most importance aspects in teaching that can improve students’ performance in science education is the application of appropriate teaching method, such as STAD strategy in cooperative learning because, cooperative learning gives priority to students’ centered, thus, to increase students’ performance in mathematics, the best option is to use Cooperative learning (CL) method, particularly, STAD strategy to teach the students.

Gupta, Jain and Pasrija (2014) conducted a research on Effects of Cooperative Learning Strategies (STAD and TAI) on Mathematics Achievement in Rohtak, Haryana and outcome of the findings shows that, STAD approach found more operative instructional standard for teaching mathematics when associated with traditional method of teaching. Enu, Amuah and In 2013, a study by Danso investigated how using the STAD (Student Teams-Achievement Divisions) cooperative learning strategy impacted the test scores of boys and girls in Ghana. The results indicated that there was no gender difference in students’ mathematics achievement after being taught with STAD Strategy. Michael (2013) investigated on examined an article on the impact of Student Teams Achievement Divisions (STAD) strategy as a cooperative learning teaching method in building economic knowledge of secondary school learners in South Africa. The findings revealed that STAD as a teaching strategy increased learners’ knowledge of contemporary economics in South Africa. In consonant with the studies of Gupta, Jain and Pasrija (2014), Michael (2013) and Enu, Amuah and Danso (2013) whose worked on STAD strategy in Bongabong Campus and Rohtak, Haryana respectively. This study intended to work on similar strategy (STAD) on Students’ achievement in mathematics, in Maiduguri, after decant to see if there is new development.

Statement of the Problem

Mathematics education researches indicated that, students’ performance in Mathematics at the level of post-primary has not added any value to the educational system for the past long period of time. Studies have shown that, many students find it difficult to study mathematical problems; however, so many issues have been attributed to this trend. According to Kyei, Apam, and Nokoe (2011) ‘the issue of poor performance in Mathematics examination was due to the problem of teaching methods. In Nigeria, there is ample evidence of continue poor performance of students in both standardized and non-standardized examinations (Cole, 2022).

The record from West African Examination Council (WAEC) between the year 2017-2021 result of Borno State revealed that, students’ performance in Mathematics were very low and poor, thus, many well-meaning individuals and educational stakeholders in the State were seriously worried and sat about the situation (ERC, 2022).

Table 1: Borno State Students’ performance in Mathematics in WAEC from 2017-2021

YEARS	Registered students	No of Passed Students	% of passed Students	No of Failed Students	% of failed Students
2017	9052	3197	35.3	5855	64.7
2018	5898	2205	37.4	3693	62.6
2019	7895	3513	44.5	4382	55.5
2020	6949	2825	40.7	4124	59.3
2021	9725	3023	31.1	6702	68.9

Source: Education Resource Centre, Borno State (ERCBOS, 2022)

Table 1 exposed that, majority 6702(65.9%) of the students out of 9725 in the year 2021 failed, while 3023(31.1%) passed, which indicates that, the Students’ Achievement in Mathematics was very poor (ERC, 2022).

Research Questions

Based on the stated objectives, the following RQs were formulated to guide the study:

- 1) What are the mean scores of students’ achievement in mathematics when exposed to STAD teaching method and conventional strategy?
- 2) What are the mean scores of males and females students’ achievement in mathematics taught using STAD teaching method?

Research Hypotheses

Based on the stated objectives, null hypothesis was formulated and to be tested at alpha ($\alpha = 0.05$) level of significance to guide the study.

1. **H₀₁:** There is no significant difference in the mean scores of students’ achievement in mathematics taught using STAD teaching method and those taught with conventional.
2. **H₀₂:** There is no significant difference in the mean scores of male and female students’ achievement in mathematics taught using STAD teaching method.

Methods

This research used a quasi-experimental design. Unlike a true experiment where participants are randomly assigned to groups, a quasi-experiment assigns subjects based on existing characteristics. Although it can't guarantee random assignment, this design still aims to understand the cause-and-effect relationship between two variables (usually an

independent and a dependent variable) (Stuart & Rubin, 2008). Thus, it involved Pretest and post-test and intact class. In the design, there are two groups called experimental group and control group which can be tested before the treatment. The targeted population of eighteen (18) public secondary schools in Maiduguri, Borno State with the total (50,947), consisting of (29,358) males and (21,589) female. The study randomly selected four (4) schools as its sample size from heterogeneous (mixed) Schools. Four intact classes were selected from each school, two schools were assigned as experimental and other two schools were control, see details in table 2. The experimental classes were taught mathematics using STAD method whereas, the control classes with the used of conventional method, both for six (6) weeks.

The instrument used was Mathematics Achievement Test (MAT) which involves section A, that elicited personal information (type of school and gender) of the student and the section B consists of thirty five (35) objective test questions of four options lettered A-D were selected from the topics: Simple algebra, trigonometry. Plan geometry, simple statistics and probability, adapted from SSS Mathematics text books, passed WAEC question papers, teacher’s guide for SSS Mathematics and prepared based on Bloom Taxonomy of Cognitive Domain. The content validation of the instrument was done using test blue print by the group of professionals and pilot testing was conducted in another school with 40 students with the used of Split-Half (Spearman Brown) method, the reliability coefficient index was calculated to obtained 0.87. The descriptive statistics (Freq, Pie-chat, Mean and SD) were used in answering the research questions and inferential statistics, such as Z-test was used in testing the hypothesis at alpha ($\alpha = 0.05$) level of significance. The Statistical Package used was SPSS 16.0 version.

Results

Table 2: Distribution of the Experimental and Control groups based on schools

Schools	Classes	No of boys	No of girls	No. of Respondents	Percentage
School A	Experimental	37	33	70	25.55
School B	Control	35	34	69	25.18
School C	Experimental	33	37	70	25.55
School D	Control	35	30	65	23.72
Total		140	134	274	100

Sources: Borno State Ministry of Education (BSME), 2022.

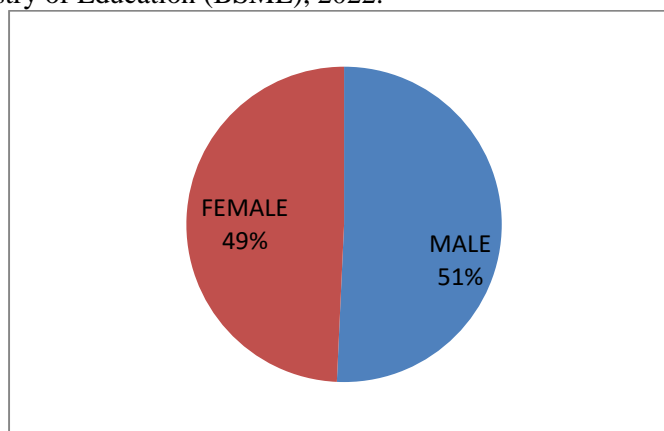


Fig. one: Pie-chart showing the population in percentage of male and female students

Figure 1: the pie-chart of the population publicized that, the male with 140 respondents representing (51%) has higher number of the respondents than the female counterparts with 134 respondents representing (49%).

Data analysis

The marks scored by the experimental and control groups from the pre-test is presented in the Table 3.

Table 3: The Pre-test marks scored by the Experimental group and Control Group

Groups	F	Pre – Test		Mean diff.	Remarks
		Mean (\bar{x})	SD		
Experimental	140	56.64	8.83	2.19	Equal in ability
Control	134	54.45	7.27		
TOTAL	274				

Result from table 3 shows that, the mean and standard deviations marks scored in the pre-test by the students of the experimental group were 56.64 and 8.83 whereas that of control group was 54.45 and 7.27. The mean difference of the pre-test was 2.19. This indicates that, the performances of the two groups from the beginning are the same with no difference.

The Mathematics Achievement Test (MAT) was used in gathering the information in order to answer **RQ1**, the post-test marks scored by the students of the two groups (experimental and control) were analysed using descriptive statistics (Mean and SD) and the summary is presented in Table 4.



Table 4: The Post-test marks scored by the Experimental group and Control Group

Groups	F	Mean (\bar{x})	Post – Test		Remarks
			S.D	Mean diff.	
Experimental	140	72.01	5.86	25.57	Mean diff. is high
Control	134	46.44	6.20		
TOTAL	274				

Result from Table 4 showed that, the mean and standard deviation marks scored by the students of experimental group in post-test were 72.01 and 5.86 and that of the control group were 46.44 and 6.20, with the mean difference of 25.57 and SD ± 0.36 respectively, with small range of the mean difference as reference point. This indicates that the two groups had different in academic achievement. Therefore, STAD teaching method is effective in mathematics.

The Mathematics Achievement Test (MAT) was used in gathering the information in order to answer RQ2, the post-test marks scored by male and female students in the groups (experimental) were analysed using descriptive statistics (Mean and SD), the summary is presented in Table 5

Table 5: The Post-test marks scored by male and female in the Experimental Groups

Groups	F	Mean (\bar{x})	Post – Test		Remarks
			S.D	Mean diff.	
Male (Experimental)	70	72.18	4.48	2.02	Mean diff. very small
Female (Experimental)	70	70.16	6.08		
Total	140				

Results from Table 5 showed that, the Mean and SD of marks scored by the male students in the post-test were 72.18 and 4.48 while that of the female students were 70.16 and 6.08 with the mean difference of 2.02 which is very small and SD ± 1.6 respectively

with the wider range of the mean difference as reference point. This indicates that, the boys and girls exposed to mathematics with the used of STAD strategy had no difference in their academic achievement.

The Mathematics Achievement Test (MAT) was used in data collection of the post-test of the two groups and analyzed using Z – test, the summary is presented in Table 6.

Table 6: The post-test marks scored by Expt. and cont. groups after the treatment

Group	F	Mean (\bar{x})	POST-TEST				Remarks
			SD	Df	Z-test	P-value	
Experimental	140	72.01	5.86	272	24.35	0.00	Significant
Control	134	46.44	6.20				
Total	274						

Results from Table 6 of the post-test result revealed that, there was significant difference between the groups (experimental and the control) with p-value 0.00 which is less than the 0.05 (level of significant). Based on this, null hypothesis one (1) was rejected. This indicates that, STAD teaching method has significant influence in mathematics in Experimental group.

The Mathematics Achievement Test (MAT) was used to collect the data on academic achievement of male and female students taught mathematics using STAD strategy and the summary of the analyses are presented in Table 7 using Z - test.

Table 7: The independent sample Z-test of the post-test marks scored by Male and Female students in Experimental groups

Gender	F	Mean	SD	Df	Z-test	p-value	Remarks
Male	70	72.18	4.48	138	1.35	0.13	Not Significant
Female	70	70.16	6.08				
Total	140						

Result from Table 7 shown that, the p-value obtained is 0.13 and is greater than the alpha value of 0.05, thus, the null hypothesis accepted. This indicated that, both male and female achieved significantly in mathematics without difference.

Discussions

The study engaged with many methods in findings of the effects of STAD (Students Team Achievement Division) strategy compared with traditional teaching approach in teaching mathematics. The study used Pie-chart, Freq., Mean & SD that is descriptive statistics to answer the research questions and Z-test the inferential statistics to test the null hypotheses both for the data collected from Mathematics Achievement Test (MAT) and the results revealed that;

For RQ1, the mean scores of the pre-test and post-test on the students’ academic achievement in mathematics between experimental group and control group were analyzed, the result from table 4 established a significant difference in the post-test scores of the experimental group, demonstrating an affirmative impact of the Students Team Achievement Division strategy in teaching mathematics. Additionally, the result from table 6 on the independent sample Z-test buttressed this, displaying a significant difference in mean scores of post-test between the two groups (experimental and control).

For RQ2, investigating the differences between the male and female students academic achievement in mathematics taught using STAD strategy. Result from table 5 revealed minor differences in mean scores from both the pre-test and the post-test of male and female students. The result from table 7 of the independent sample Z-test also indicated that, no significant gender differences in both the pre-test and the post-test of students’ academic achievement as p-values were non-significant after taught the mathematics using STAD strategy.

Consequently, the findings of this study come up with concrete results showing the efficacy of the Students Team Achievement Division strategy in

improving students’ academic achievement in mathematics, best on the results obtained from the post-test mean scores between the experimental and control groups. The study contributes appreciated understandings of STAD strategies in teaching mathematics in the field of science education.

Conclusion

In conclusion, the study examined the effectiveness of the STAD strategy compared with traditional teaching methods on Students’ academic achievement in mathematics. The outcome of the findings best on shown that, reliably it was established the effectiveness of the STAD strategy in teaching mathematics, to improves students' understanding and achievement in the mathematics. The significant increase in mean scores of post-test of the students taught using STAD strategy compared to those using conventional method, emphasized the effectiveness of the STAD strategy. Moreover, the study reconnoitered and established no significant gender difference in students’ academic achievement after exposed to mathematics using the STAD strategy. The study contributes appreciated perceptions on effectiveness of the STAD strategy in mathematics education, stressing the reputation of cooperative learning in general and STAD strategy in particular in promotion the students’ academic achievement.

Recommendations

1. The research suggests that the STAD teaching method can significantly improve students' math achievement. Given these findings, teachers are encouraged to incorporate STAD into their math lessons. The following; FME, SME, NCM, MAN and STAN are urged to organize workshops frequently on STAD strategy.
2. To promote gender equality and improve math learning, the Federal Ministry of Education (FME) and State Ministry of Education (SME) should encourage teachers to utilize the STAD strategy when teaching mathematical concepts.



3. The Mathematics Curriculum Development (MCD) should incorporate STAD strategy into curriculum design as method of teaching mathematics to reduce difficulties faced in teaching and learning of the mathematics.
4. Authors should stress much on the uses of STAD and Rally table or Round table in teaching mathematics in secondary schools.

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