EFFECTS OF STUDENT TEAMS ACHIEVEMENT DIVISIONS (STAD) LEARNING STRATEGY ON STUDENTS' PERFORMANCE IN MATHEMATICS IN SOUTH-WEST, NIGERIA

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Abstract
The study investigated the effects of Student Teams Achievement Divisions (STAD) learning Strategy on students' performance in Mathematics in secondary school in south-west, Nigeria. A pretest, posttest control group quasi-experimental research design was employed for the study. A sample size of 168 SSS II students was selected from intact classes of four Public Secondary schools in south-western Nigeria using stratified random sampling technique. A validated research instrument, Mathematics Performance Test (MPT) was used for data collection. The MPT was administered to 40 students outside the study area for the reliability test of the instrument. The data gathered was analyzed using the Kudar-Richardson 20 (KR-20) formula, which yielded a reliability coefficient of 0.71. The experiment lasted for ten weeks. The experimental group was exposed to STAD learning strategy, while the control group was taught with the conventional learning strategy. The research instrument was administered to the students before and after treatment. The data gathered were analyzed using inferential statistics (ANCOVA). Three research hypotheses were generated and tested at a 0.05 level of significance. The study's finding revealed no significant gender effect on students' academic performance exposed to STAD and conventional learning strategy [F(1,163=0.459, p>0.05]. It also showed no significant location effect on students' academic performance exposed to STAD [F(1,163=0.335, p>0.05]. A significant ability level effect was found on students' academic performance when exposed to STAD [F(1,163=5.392, p<0.05]. As a recommendation, teachers are advised to embrace STAD learning strategies to break barriers to learning and enhance students' performance in Mathematics.

Keywords: *Gender, Location, Ability Level, STAD, Performance, Mathematics.*

Introduction

Mathematics teaching and learning aim to provide every child irrespective of gender, or social, cultural, religious and ethnic background with the basic skills in logical thinking and later on developing precise, logical and abstract thinking. For cost-effective, administrative, social, and learning activities, Mathematics' value cannot be put aside. Any effort to put Mathematics on the back burner would mean that development will become impractical in economic, scientific, and technical terms. Therefore, in the school curriculum and the growth of individuals and society, Mathematics remains a strong influence. The importance of Mathematics lies in its effects on scientific and technological progress and its impact on day-to-day interactions and activities by literate and illiterate, young and old, male and female members of the society at home, place of work, market, schools, and anywhere else. It remains imperative for economic survival, business transactions, preparation, productive learning, and relevant contributions; each person needs some Mathematics knowledge. For students, success in Mathematics is required to make

academic progress particularly for moving from one level of education to another in Nigeria (Haliru, 2015).

In early childhood, male and female learners are viewed with equal Mathematics capability; better performance is not traced to one particular gender than the other. After advancement to middle childhood through adolescence, gender performance in Mathematics is one-sided as female inferiority in Mathematics becomes noticeable (Popoola & Falebita, 2016). Gender, particularly in Mathematics, has become an established variable influencing student's learning outcomes. It was one of the identified visible factors affecting students' success and approach to Mathematics. Serious attention has been paid to gender disparities in Mathematics over the years, particularly at the secondary school level, with little or no way out to bridge the gap.

School location is the geographic position where a school is situated, related to other physical environments, which could either be rural or urban. Social services such as electricity, pipe-borne water, and health facilities are best available to urban centers, whereas they are less available in rural areas. This has made rural life in Nigeria identical and not as lively as that of urban centres where cultural diversity is accused of playing a major role in influencing students' academic performance (Ntibi & Edoho, 2017). Also, in the dispersion of facilities that promote learning and teachers, urban schools attract larger portions and the best than rural schools. These prevailing circumstances suggest that learning opportunities vary from school to school in Nigeria (Ntibi & Edoho, 2017).

Everyone has the potential to learn Mathematics, though some learn and make connections more quickly than others. Everyone has some mathematical skills, but some learners have Mathematics ability beyond what most individuals are willing to believe. Mathematical abilities are unnoticed even when dominant in early childhood by the learner and teacher, but it becomes obvious as learners grow older. This Mathematical potential can be lost forever if it is not discovered and supported appropriately; inappropriate classroom and outside classroom experiences may undermine it. Mathematical ability is the capacity to use or manipulate numbers efficiently in areas of numerical applications (Mankili & Umaru, 2011). The mathematical ability can be low, medium/moderate, or high. Some students could be having excellent performances in non-Mathematics-related subjects but have an abysmal performance in Mathematics and thus classified as low Mathematics ability students.

Outside academic context, learners, particularly teenagers, enjoy discussing social and personal issues with colleagues and trusting their judgment when making decisions that their parents shouldn't know of. It is observed that most social vices found among children and teenagers are learned or copied from colleagues or observing people around them. If coming together and gaining ideas from colleagues will help to cooperatively solve some social challenges faced by individual learners, this could also help take care of some challenges associated with learning in an academic context. Cooperative learning is a form of pedagogical strategy that permits students to work together within small-group to accomplish a learning task and improve their understating of a concept or subject. There are various forms of cooperative learning, and among all, Student Team Achievement Divisions (STAD) remain unique due to its three main features, which are "Team rewards, individual accountability, and equal opportunities for success" (Slavin, 1995).

In STAD based class, the teacher divides the class into small heterogeneous groups with three to five students, considering the gender and ability level. The teacher introduces the content or topic to the learners before presenting them with the task to be carried out within the group.

The learners are also informed on the team reward, which is expected to be a motivation and collaboration source. After the time allotted for completing the given task, the entire class comes together to share the group solution to the given task. Questions on the concept learned are given to individual learners as a test. Every team member works individually for the team reward; the individual performance put together determines the group performance. The group with improved performance are rewarded accordingly.

Despite the significance of Mathematics, there has been a wavering students' performance in external exams year after year and many factors are attributed to the poor performance (Udonsa, 2015). Mathematics has been perceived as a subject where female students struggle to succeed while their male counterparts are recognized as higher achievers (Popoola, 2009; Oloyede, 2004); disadvantaged students struggle to perform well in Mathematics (Rearson, 2011). Amid these difficulties related to student performance and learning in Mathematics, STAD may be a very useful tool to bridge students' academic performance gap and carry the students along in the learning activities irrespective of their gender, school location or ability level.

STAD is a form of cooperative learning strategy which is model for the purpose of removing the learning gaps among learners. Several studies have been carried out on the potency of STAD in providing learner with equal opportunity to learn academic contents; some of which indicated that STAD learning experiences have the tendency to yield better results for all age levels, subjects and for completion and retention of tasks carried out, categorization and problem solving ability (Johnson & Johnson, 2009, Gambari & Yusuf, 2014). Slavin (1995) enumerated the three main characteristics of STAD as, Team rewards; individual accountability; and equal opportunities for success. The rewards for the team that perform above a predetermined level are prizes or gifts, these are given to the STAD group at the end of the lesson to enhance positive competition; individual accountability explains the learning of individual group members as the determinant of the team success; equal opportunities for success is the contributions of individual students' improvement to the group success, which make individual improvement a must within the group (Slavin, 1995).

Nwaubami, Ogbueghu, Adeniyi and Eze (2016), who examined the effectiveness of STAD, revealed that STAD is a form of cooperative learning strategy improves students' performance in Mathematics. Also, Tarim and Akdeniz (2008) compared the effectiveness of STAD and some other cooperative learning strategies on students' performance in Mathematics, found out that STAD is effective than other cooperative learning strategies examined. Also, Nwaubami, Ogbueghu, Adeniyi and Eze (2016), revealed no significant difference in the effectiveness of the STAD and other form of cooperative learning examined. Their study results contradicted the fact that STAD could improve the academic performance of the learners.

Examining cooperative learning in relation to students' gender, Gambari and Yusuf (2014) revealed that students' gender does not affect their academic performance. On the other hand, Adeyemi (2008) and Olson (2002) showed a gender difference in students' academic performance when exposed to cooperative learning favoring male and female students, respectively. In studies conducted on the effect of school location on students' performance when exposed to cooperative learning, Haliru (2015) reported school location to contribute to students' performance when exposed to cooperative learning and this was found to be in favour of students from urban school. On the other hand, Yaduvanshi and Singh (2018) found no significant difference in students' performance from rural and urban schools when exposed to

STAD. In relating the performance in cooperative learning circumstances of students with low, moderate and high ability levels, Gambari and Yusuf (2014) revealed that, the high ability level learners perform better than moderate and low ability learners. Conversely, Yusuf (2004) found no substantial difference between students with moderate and high ability levels and between students with moderate and low ability levels when exposed to cooperative learning strategy. Yusuf (2004) concluded that ability levels did not contribute to the learners' academic performance when exposed to cooperative learning.

Purpose of the Study

The study's purpose was to examine the effects of Student Team Achievement Division (STAD) learning strategy on students' performance in Mathematics in South-West, Nigeria. Specifically, the study examined:

i. gender effect of STAD and conventional learning strategy on students' performance;
ii. location effect of STAD and conventional learning strategy on students' performance and;
iii. ability level effect of STAD and conventional learning strategy on students' performance.

Research Hypotheses

The following null hypotheses were postulated for this study.

1) There is no significant gender effect of STAD and conventional learning strategy on students' performance.
2) There is no significant location effect of STAD and conventional learning strategy on students' performance.
3) There is no significant ability level effect of STAD and conventional learning strategy on students' performance.

Methodology

A quasi-experimental pretest, posttest, and control group design was employed in the study. The array of the experimental design is as shown below.

E_1: O_1 X_1 O_2: STAD (Experimental group)
C: O_3 X_c O_4: Conventional (Control group)
Where
O_1, O_3– Observations before treatment (Pretest)
O_2, O_4 – Observations after treatment (Posttest)
X_1 – Treatment via STAD strategy
X_c – Treatment via Conventional learning Strategy

The study's population is the Senior Secondary School (S.S.S.) two students in public secondary schools in South-western Nigeria, while the sample comprises of 168 S.S.S. 2 students selected from intact classes of four co-educational public secondary schools. The sample was selected using stratified random sampling technique. Two schools (one urban and one rural) were assigned experimental groups, and two schools (one urban and one rural) were also assigned, control groups. The experimental group (n=82; urban=47, rural=35) was exposed STAD cooperative learning strategy while the control group (n=86; urban=49, rural=37) was exposed to conventional learning strategy.

Mathematics Performance Test (MPT) was designed and used to measure students' academic performance in Mathematics. MPT consisted of section A and B; section A sought for the respondents' bio-data while Section B consisted of 50-multiple-choice questions optioned A to E, which are based on the topics taught from the school syllabus. The instrument's face and content validity was certified by experts; two Mathematics teachers who are WAEC examiners and one expert in Tests and Measurement. The instrument was administered to 40 students outside the sampled area to test its reliability. The data gathered was collated and analyzed using Kudar-Richardson (KR-20) formula, which yielded a reliability coefficient of 0.71.

The study was carried out in three (pre-treatment, treatment, and post-treatment) stages. At the pre-treatment stage, the Mathematics teachers who serve as research assistants were trained; teachers of the experimental group were trained on using the STAD learning strategy while the teachers in the conventional group were trained on how to coordinate their lessons. The teachers of both groups administered the instruments to the students before treatment. At the treatment stage, the experimental group was exposed to the STAD learning strategy while the control group was exposed to the conventional learning strategy. The treatment was administered to the groups for eight weeks. The students in the experimental (STAD) group were divided into heterogeneous groups consisting of four to five members with different gender (minimum of two male and two female) and ability levels (minimum of one low, one moderate, and one high). Each group member was given different responsibilities such as group leader, group secretary, organizer, time-keeper, and PRO. Each group is presented with a learning task or content by the teacher who serves as the facilitator, and the group members perform the tasks together in a well-coordinated atmosphere. The teacher later gives students individual task, which was marked and recorded as group scores. At the end of a lesson, students are presented with quiz and they were solved as a team, after which a team submits one answer sheet. After being marked, the team with the highest score is rewarded and recognized in the classroom. Students are also encouraged to work together on assignments outside the classroom. The teacher monitors the group with the leader's report and corrects any unwanted behaviour among the students. At the post-treatment stage, the teacher administered the instrument to the students.

The data gathered were analyzed using ANCOVA at 0.05 level of significance.

Results

Testing of Hypotheses

Hypothesis One: There is no significant gender effect on the academic performance of students exposed to STAD and conventional learning strategy.

The male and female students' performance scores in the STAD and CLS groups were computed and compared for statistical significance using Analysis of Covariance (ANCOVA) at 0.05 level. The result is presented in Table 1.

Table 1: ANCOVA result of male and female students in STAD and Conventional (CLS) group

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	22659.108[a]	4	5664.777	348.897	.000
Intercept	1494.313	1	1494.313	92.036	.000
PRETEST	7.808	1	7.808	.481	.489
GROUP	11776.175	1	11776.175	725.301	.000*
GENDER	7.453	1	7.453	.459	.499
GROUP * GENDER	1.443	1	1.443	.089	.766
STAD * GENDER	.807	1	.807	.116	.734
CLS * GENDER	7.471	1	7.471	.296	.588
Error	2646.511	163	16.236		
Total	151916.000	168			
Corrected Total	25305.619	167			

a. R Squared = .895 (Adjusted R Squared = .893)

Table 1 shows that the main effect of treatment on the performance yielded $F(1,163)=725.301$, $p<0.05$ is significant. Gender effect of treatment on performance indicated $F(1,163) = 0.459$, $p>0.05$ which is not significant. Also, the gender effect of STAD on performance shows that $F(1,163) = 0.116$, $p>0.05$ is not significant and the gender effect of CLS on performance indicated that $F(1,163) = 0.296$, $p>0.05$. The hypothesis is not rejected. Hence, there no significant gender effect on the academic performance of students exposed to STAD and conventional learning strategy.

Hypothesis Two: There is no significant location effect on the academic performance of students exposed to STAD and conventional learning strategy.

To determine the location effect of treatments, students' performance scores from urban and rural schools in the STAD and CLS groups were computed and compared for statistical significance at 0.05 level using ANCOVA.

Table 2: ANCOVA result of students from Urban and Rural schools in STAD and Conventional (CLS) group

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	22910.726[a]	4	5727.681	389.835	.000
Intercept	1556.346	1	1556.346	105.927	.000
PRETEST	4.093	1	4.093	.279	.598
GROUP	12208.649	1	12208.649	830.939	.000*
LOCATION	150.672	1	150.672	10.255	.002*
GROUP * LOCATION	103.675	1	103.675	7.056	.009*
STAD * LOCATION	2.311	1	2.311	.335	.565
CLS * LOCATION	255.222	1	255.222	11.469	.001*
Error	2394.893	163	14.693		
Total	151916.000	168			
Corrected Total	25305.619	167			

a. R Squared = .905 (Adjusted R Squared = .903)

The result on Table 2 reveals for the location effect of treatment that $F(1,163) = 7.056$, $p<0.05$ is significant. The table also shows for the location effect of STAD that $F(1,163) = 0.335$, $p>0.05$ is not significant. It was also indicated on the table for CLS's location effect that $F(1,163) = 11.469$, $p<0.05$ is significant. The hypothesis is rejected. Hence, there is significant location effect on the academic performance of students when exposed to STAD and conventional learning strategy. The significant location effect is found in the CLS group while there is no significant location effect on students' performance when exposed to STAD.

Hypothesis Three: There is no significant ability level effect on the academic performance of students exposed to STAD and conventional learning strategy.

To determine the effect of ability level, the performances of students exposed to STAD and CLS were analysed for statistical significance at 0.05 level using ANCOVA.

Table 3: ANCOVA result of high, moderate and low achievers in STAD and Conventional (CLS) group

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	23892.268[a]	6	3982.045	453.609	.000
Intercept	1590.263	1	1590.263	181.153	.000
PRETEST	1.705	1	1.705	.194	.660
GROUP	10896.809	1	10896.809	1241.295	.000*
ABILITY_LEVEL	883.758	2	441.879	50.336	.000*
GROUP * ABILITY_LEVEL	357.141	2	178.571	20.342	.000*
STAD * ABILITY_LEVEL	66.551	2	33.276	5.392	.006*
CLS * ABILITY_LEVEL	1170.544	2	585.272	51.513	.000*
Error	1413.351	161	8.779		
Total	151916.000	168			
Corrected Total	25305.619	167			

a. R Squared = .944 (Adjusted R Squared = .942)

Table 3 shows that for the ability level effect of treatment, $F(1,163) = 20.342$, $p<0.05$ is significant. The table also indicates that for STAD's ability level effect, that $F(1,163) = 5.392$, $p<0.05$ is significant. As shown on the table, for the ability level effect of CLS $F(1,163) = 51.513$, $p<0.05$ is significant. This indicates that the null hypothesis is rejected. Hence, there is a significant ability level effect on the academic performance of high, moderate and low achievers exposed to STAD and conventional learning strategy. To determine the course of effect, Scheffe post-hoc analysis was carried out. The result is shown in Table 4.

Table 4: Scheffe's Post-hoc Analysis of the low, moderate and higher achievers' Scores in STAD and CLS Group

	Groups	N	Mean Scores	Low	Moderate	High
STAD	Low	16	37.69	-	.075	.007*
	Moderate	38	39.39	.075	-	.417
	High	28	40.21	.007*	.417	-
CLS	Low	22	11.77	-	.001*	.000*
	Moderate	41	15.27	.001*	-	.000*
	High	23	21.78	.000*	.000*	-

*. The mean difference is significant at the 0.05 level.

The result in Table 4 shows that the posttest mean scores of low, moderate and high achievers are 37.69, 39.39, and 40.21, respectively. It was revealed that there was no significant difference between the posttest mean scores of students with low and moderate ability level when exposed to STAD. The table also indicates that there is no significant difference between the posttest mean scores of students with moderate and high ability level when exposed to STAD. Significant differences were revealed between the posttest mean scores of students with high and low ability levels when exposed to STAD.

Table 4 shows that the mean posttest scores of low, moderate, and high achievers in the conventional learning strategy group are 11.77, 15.27 and 21.78. It further reveals a significant difference between the posttest mean scores of low and moderate achievers, moderate and high achievers, and low and high achievers in the CLS group.

Discussion

The result obtained from the study reveals no significant gender effect on the academic performance of students exposed to STAD and conventional learning strategy in Mathematics. This supports the findings of Gambari and Yusuf (2014) who revealed that students' gender does not affect their performance in a cooperative learning class. The finding of this study on the other hand contradict the findings of Adeyemi (2008) and Olson (2002) who reported a gender difference in students' academic performance when exposed to cooperative learning. This is an indication that the learning or performance in Mathematics is not gender centered or biased; Mathematics is a subject that can be understood equally by both male and female learners when taught with appropriate teaching or learning method. It also implies that STAD learning strategy helps both male and female learners learn Mathematical content equally.

The result of the study also shows significant location effect on the performance of students when exposed to STAD and conventional learning strategy in Mathematics. The observed significant location effect on the performance of students was found among those exposed to conventional learning strategy while there is no significant location effect on the performance of students when exposed to STAD learning strategy in Mathematics. This is in line with the findings of Yaduvanshi and Singh (2018) who found no significant difference in the performance of students' from urban and rural schools. Conversely, the finding contradicts the report of Haliru (2015) who revealed significant location effect of cooperative learning on students' performance. This study's finding is an indication that STAD learning strategy is not location biased; it is capable of enhancing the performance of students in Mathematics irrespective of their school location. Therefore, students' school location does not influence their performance when exposed to STAD learning strategy.

The finding also revealed that there is a significant ability level effect on the academic performance of students exposed to STAD and conventional learning strategy in Mathematics. A significant difference in students' performance was observed between the three levels of achievers for those exposed to conventional learning strategy. A significant difference was found between the high and low achievers with no significant difference between low and moderate achievers and moderate and high achievers when exposed to STAD learning strategy in Mathematics. This corroborates the findings of Gambari and Yusuf (2014) and Yusuf (2004). This is indicates that STAD is influential tool in improving students' ability level.

Conclusion

It was concluded grounded on the study's findings, that students' gender is never a barrier to Mathematics learning and does not influence students' performance in Mathematics. When taught with STAD, male and female students have equal chances of acquiring Mathematics knowledge. It was also concluded that STAD is a learning strategy that is potent in enhancing students' performance regardless of their schools' location. Also, STAD is capable of improving the performance of low, moderate and high achievers in Mathematics. It can turn low achievers to moderate achievers and moderate achievers to high achievers in Mathematics due to its interactive, engaging and rewarding features.

Recommendation

It was recommended upon the findings of the study that, teachers should adopt STAD learning strategy in teaching Mathematics or any science subject to break the barriers to learning among students. Also, students should actively participate in STAD group activities and learn academic content from colleagues outside the classroom settings. Concerned authorities should organize and encourage teachers to attend conferences, seminars or workshops on STAD and other cooperative learning strategies regularly.

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