Performance and Location Difference on the Effect of Students Team Achievement – Division (STAD) and Inquiry Methods in Geometry among Junior Secondary School Students in Sokoto State Nigeria

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Abstract: *This study examined the Performance, Location, Geometry, STAD, and Inquiry Methods' Difference On The Effect Of Students Team Achievement – Division (STAD) And Inquiry Methods In Geometry Among Junior Secondary School Students In Sokoto State Nigeria. Two Research question and two hypotheses were tested at 0.05 level of significant. Quasy experimental research design with pre-test, and post-test was used. JSS III students in the year 2019 51,024; 20,259male and 30,765 female formed the target population of the study. Multi-stage simple random sampling was used to select 501 students. An instrument was developed for the data collection as Geometry Performance Test (GPT) with 60 multiple choice objective test. Descriptive statistics was used to answer research questions and ANOVA was used to analyse hypotheses at 0.05 level of significant, Tukey's procedure confirmed where the significant difference lies. The results indicate that students who were taught using STAD and Inquiry methods performed not significantly better than students who were taught with lecture method. Based on these the researcher recommends that STAD and Inquiry methods in teaching Geometry in schools base on location should not be encouraged by stake holders, particularly in Sokoto State, since the teaching methods did not improve student academic performance in Geometry in Sokoto State based on Location.*

Key words: *Performance, Location, STAD, Inquiry Methods. Geometry.*

Introduction

Studies of mathematics education show that in teaching and learning process, the only subject that cuts across allsciences subjects is Mathematics. According to Tella (2007) knowledge of Mathematics today pervades every field of human endeavour and plays fundamental role in economic development of every country. He continuously states that, in our march towards scientific and technological advancement, we need nothing short of good performance in Mathematics at all levels of schooling.In the other hand, mathematics education researches indicate that performance of students in Mathematics at the end of secondary education has not improved in the past decade (Umoinyang, 1999). Studies have it that many students find it difficult to study Mathematical problems, however, so many issues have been attributed to this trend. According to   Peter (2001) '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 (Benjamin & Agwagah, 2006).According to Korau and Kauru (2010), the low academic performance of pupils in Mathematics has become a concern in mathematics education.

Considering these reports, studies have it that high performance in Mathematics seems to be an indication of high performance in Geometry in particular, the reverse may be true.

However, many reasons have been deduced for poor performance of students' in Mathematics (Undeinya and Okabiah (1991), Peter (2001); Chianson, Krumeh & Obida (2011); Isah, 2015). Among the reasons of poor performance in mathematics according to Isah (2015) is the methods of teaching the subject. This is sported by Chianson, Krumeh and Obida (2011); Isah (2015) and Silver (2017) who started that strategy of teaching is one of the contributing factors to poor performance of students in Geometry. This is why the issues of powerful and appropriate methods of teaching that is capable of arousing students' attention and improve students' academic performance in learning Mathematics today become issues of concern among Mathematics educationists in Nigeria. According

These are among the tenets of constructivist. No wonder, Gialamas, Keller, Cherif, and Hansen (2000), stated that "in order to [improve] performance and capture the students' attention and interest, a teacher needs to actively engage students in a discovery activities that demonstrate the Mathematical concepts. Teachers design instruction that goes beyond rote learning to meaningful learning that is more likely to lead to deeper, longer and lasting understanding. Peterson and Hittie (2003) said "traditional practices of teaching based on 20th century factory model that encouraged students to sit in straight rows, listen to lectures, fill out worksheets, read from text under the watchful eyes of the teacher, no longer meet the diverse needs of today's students. In this regard, some scholars such as: John Dewey who contested this model back in early 1900's, Dewey believed that "rote study promote shallow thinking and a dislike for learning. In view of this, Dewey agrees that learning should be socially constructed. This is also agrees with the word of Kiernan (2015), who says "I believe in active, in-depth learning in the science classroom. This was supported by the old Chinese proverb that says "I hear and I forget; I see and I remember; I do and I understand".

This study therefore, explored avenues through which teaching of Geometry in public junior secondary schools in Sokoto State can be made more effective. This implies the use of STAD and Inquiry methods of teaching, which according to some scholars such as: Gialamas and Kelle (2000); Chin, Lin, Chuan and Tuan (2007); Kolawole (2008); Akinbobola (2009) Chianson et al (2011); Farzaneth and Nejadansari (2014); Isah (2015), STAD and Inquiry methods are one among many teaching methods which improve academic performance of students in learning Geometry,in this study lecture, Inquiry and STAD methods are to be used to see if they could improve students' academic performance of junior secondary school students in geometry of JSS III, base on location.

The theoretical basis of this study is collaborative learning of: STAD and Inquiry methods as proposed by Vygotsky. Their roots therefore lie deep in learning theories. STAD and Inquiry methods are developed by Social Constructivists. Social Constructivist theory is a learning

approach which argues that individuals can learn best when they actively construct knowledge and understanding through interaction with others (Cam, 1995; Santrock, 2004). The proponents of Social Constructivist theory are many, among them that are related to this study are: Piaget and Vygotsky.

STAD In the 1900s Kurt Koffa a founder of the Gestals school of psychology, categorically proposed that group work is cohesive and vital that interdependence among group members trigger changes individuals to the whole group and vice versa (Johnson, Johnson & Stanne, 2000).STAD is define as a small group of 4 heterogenic learners working together to achieve common educational objectives within six weeks.

Inquiry-based learning or inquiry-based science describes a range of philosophical, curricular and pedagogical approaches to teaching. Its core premises include the requirement that learning should be based around student questions. Pedagogy and curriculum requires students to work independently to solve problems rather than receiving direct instructions on what to do from the teacher. In Inquiry method, teachers are viewed as facilitators of learning rather than vessels of knowledge. Empirical studies show that the teachers' job in an inquiry learning environment is therefore not to provide knowledge, but instead to help students along the process of discovering knowledge themselves. Following on this argument, IBL undertaken within this study refers to a small group of heterogeneous inquirers working together to achieve common educational objective within 6 weeks. Inquirers, students become immersed in asking questions, committing with constructing, exploring and explaining Geometry meanings around a task set by the teacher or a question originating from the students. The task need not necessarily be open-ended but it has to provide students with an achievable challenge offer exploration, encourage creativity and support decision-making. In this study Inquiry is define as a learning method, where the learner with the support of More Knowledgeable Others (MKOS) discover solution to a give problem within 6 weeks.

Academic performance in a planned program, teachers usually have objectives set out to be achieved by the students. Such achievement could be ascertained through test evaluation or performances assessment (Nguuma, 2010). For this study, achievement is used in the context of test performance. Achievement in the teaching/learning process has to do with set objectives of instruction (Nabi, 2007). In science and mathematics, instruction for instance, if a learner accomplishes a task successfully and attains the specified goals for a particular learning experience, he is said to have achieved (Igboegwu, 2012). Performance could be seen as procured ability. They farther described ability as demonstrative knowledge or skill. Performance as one can see in this context is the feedback derived from the program of curriculum and instruction. The most determinant phase in the curriculum process which reviews the extent the learner has mastered the objectives set by the teacher, in any lesson is evaluation.Performance is defined in this study as the result obtained from the test administered immediately after the   treatment.

School Location and Students Academic Performance

According to Ntibi and Edoho (2017) School location refers to the particular place, in relation to other areas in the physical environment (rural or urban), where the school is sited. In Nigeria, rural life is uniform, homogenous and less complex than that of urban centers, with

cultural diversity, which often suspected to affect students' academic achievement. This is because urban centers are better favored with respect to distribution of social amenities such as pipe borne water, electricity, healthcare facilities while the rural areas are less favored. This is also true in the distribution of educational facilities and teachers. These prevailing conditions imply that learning opportunities in Nigerian schools differ from school to school. It would appear therefore that students in Nigerian urban schools have more educational opportunities than their counterparts in rural schools have. While some studies have shown positive influence, others have shown negative influence of school location on the students' learning outcome or achievement. In this, Nwogu (2010) found that location was significant in learning aspects of mathematics and basic science that involve angles, with rural students exhibiting more learning difficulties than their urban counterparts do. Ahiaba and Igweonwu (2003) investigated the influence of school location on the performance of mathematics and basic science students in rural and urban schools at the SSC examination and found that mathematics and basic science students in urban schools performed better with superior grades, than their rural counterparts while failure rate was higher in the rural schools. Some studies (Bosede, 2010; Ezeh, 1998) showed no difference in academic achievement of students because of location. Others showed that rural students performed better on practical skills in mathematics and basic science than their urban counterparts did.

Bosede (2010) showed that there is no difference in performance of students because of location. Location here is in terms of whether the place of study or school is sited in rural or urban community. Obe (2004) observed a significant difference in urban-rural performance of 480 primary six school finalist on the aptitude sub-tests of the (Nigeria) National Common Entrance Examination (NCEE) into secondary schools. In his study tagged scholastic aptitude test, he concluded that children from urban schools were superior to their rural counterparts.

Also others observed a significant positive relationship between size and location of school and performances in examination. Some researchers concluded that large schools in urban areas tend to perform better in mathematics and basic science examinations than small schools in rural areas. According to Axtel and Bowers (2002) students from the rural areas perform significantly better than their urban counterpart in verbal aptitude, English Language and total score using the National Common Entrance as a base. In another development, a research team at University of Aston recorded that it had received several well founded reports that secondary schools have found (pupils from small rural schools) not only as well prepared academically as pupils from other schools, but they generally had a better attitude to work. Having been accustomed to working most of the time on their own, they could be given more responsibility for the organization of their work (Ntibi and Edoho, 2017).

Gana (2007) when in his study on the effect of using designed visual teaching models on the learning of Mathematics and basic science at Junior Secondary level of Niger State, found that there was no significant difference in Mathematics and basic science achievement scores of students in urban and rural locations. From the various review of literature on location influence on academic are not the same. While some maintain that urban students perform better in examinations than their rural counterparts, other has found that rural students (in spite of all odds) perform better. Some have submitted in their findings and concluded that no particularset up (urban or rural) can claim superiority over the other because their performances are thesame.

Objectives of the Study

The purpose of this study was to determine the Performance and Location Difference on the Effect of Students' Team Achievement – Division (Stad) And Inquiry Methods in Geometry Among Junior Secondary School Students in Sokoto State Nigeria. The specific objectives of the study were to:

1. Compare students' location, STAD, Inquiry methods and lecture method on academic performance in Geometry of JSS III in Sokoto State.
2. assess whether location, STAD, Inquiry learning and lecture method improve academic performance of male and female students in Geometry of JSS III.

Research Questions

The following research questions were guided the conduct of this study:

1) What is the affect of location, STAD and Inquiry teaching on the performance in Geometry of JSS III students in Sokoto State?
2) How can girls and boys taught geometry with STAD and Inquiry perform equally with those taught using lecture methods in Sokoto State base on location?
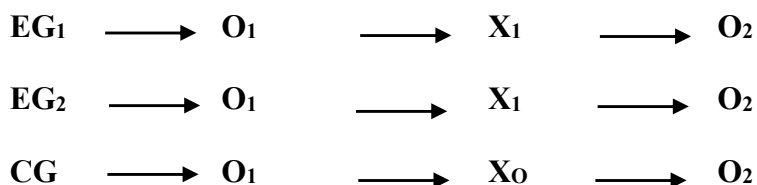
Null Hypotheses

Based on the aforementioned research questions, the following null hypotheses were formulated, and were tested at 0.05 level of significance:

H_{01}: There is no significant difference among the mean Geometry performance scores of two experimental groups (STAD, Inquiry methods and lecture method) base on location.

H_{02}: There is no significant difference among the mean Geometry performance scores of male and female of two experimental groups (STAD, Inquiry methods and lecture method) base on location.

Research Design

The design for this study was Quasi-experimental research designed with experimental and control groups design adopting Pre-test, post-test, and post- post-test. The study used three groups namely: Experimental group I with STAD, experimental group II with Inquiry method; and Control groups with lecture method. The three groups (Experimental I and II and Control) were pretested (O_1) academic performance to ensure the homogeneity among the groups before the treatment. The two groups were taught for a period of six weeks and then post-tested (O_2), in order to see the effect of location, STAD, Inquiry and Lecture methods on the students' performance on Geometry of JSS III students.

$$EG_1 \longrightarrow O_1 \longrightarrow X_1 \longrightarrow O_2$$

$$EG_2 \longrightarrow O_1 \longrightarrow X_1 \longrightarrow O_2$$

$$CG \longrightarrow O_1 \longrightarrow X_0 \longrightarrow O_2$$

Population of the Study

There are six educational zones in Sokoto State with one hundred and forty nine (149) junior secondary schools distributed among twenty three (23) local governments in the state in the year 2018/2019 academic session. The target population is all JSS III students with fifty one thousand twenty four (51,024) students. Twenty thousand two hundred and fifty nine (20,259) male and thirty thousand, seven hundred and sixty five (30,765) female. Sample and Sampling ProcedureMulti-stage random sampling and simple random sampling techniques were applied. In the first stage one local government was randomly selected from each of the six educational zones of the state. From each local government, one school was randomly selected. Simple random procedure was used to select four schools as the experimental groups and two schools as the control groups. This is for the convenience of the researcher.

Proportionate sampling technique was used to select five hundred and one (501) students based on the population of each zone, as suggested by Roscoe (1975) who states that "the appropriate sample size for a study ranged from 30-500. Intact classes were used to avoid disrupting schools programme.

Instrumentation, the instrument used in this study isGeometry Performance Test (GPT)which was developed by the researcher.GPT is a 60 items multiple choice objective test with four options (A,B,C and D), each to determine academic performance of students in geometry of JSS III students. The GPT was pilot tested using two schools that were not included in the study sampled but with similar characteristics to ascertain the reliability of the instrument using Pearson's Product Moment Coefficient (PPMC) formula. The contents used in the class instruction were developed based on the revised NERDC 2013 mathematics syllabus. The reliability of the instruments was 0.699.

Results

H$_0$: **There was no significant difference in the mean academic performance scores of JSS III students taught geometry using STAD and Inquiry methods and those taught with the lecture method based on location in Sokoto State.**

Table 1 ANOVA Analysis of Mean Academic Performance Scores of JSS III Students Exposed to STAD, Inquiry and Lecture methods on Geometry Based on Location in Sokoto State

Groups	N	$\overline{X}$	SD	DF	F	P	Decision
Urban	55	18.09	9.78				
				1			
Rural	147	25.16	11.91		1.21	0.71	
Treatment	202			1	36.01	0.00	Accepted
Treatment Location	202			2	1.21	0.89	

- Significant at P ≤ 0.05

Table 1 shows that the mean and standard deviation of students in Urban and Rural areas were 18.09, and 25.16, and standard deviation as 9.78, and 11.91 respectively. At p=0.89>α = 0.05, at df=2, F=1.21, the analysis showed that there was no significant interaction effect on academic performance scores of students in the Urban and Rural areas exposed to STAD, Inquiry and Lecture methods in learning geometry of JSS III in Sokoto State. Hence, the null hypothesis of no significant effect would be accepted. This shows that location in learning geometry of JSS III in Sokoto state is immaterial. But there was a significant main effect of treatment type at p=0.00 <α = 0.05. This calls for Tukey's HSD to see where the significant effect lies. Table 2 presented the analysis and it results.

Table 2

Treatment	Treatment	Mean Difference	Std. Erro	Sig
STAD	Inquiry	1.62	1.891	.667
	Lecture	-10.40	1.734	.000
Inquiry	STAD	-1.62	1.891	.667
	Lecture	-12.03	1.853	.000
Lecture	STAD	10.40	1.734	.000
	Inquiry	12.03	1.853	.000

- Significant at $P \le 0.05$

The Tukey's HSD test showed that there was a significant main effect of treatment type at p=0.00 $<\alpha = 0.05$; and the actual significant effect in treatment type lies between STAD and Lecture methods and between Inquiry and Lecture method.

Table 3 ANOVA Analysis of Mean Academic Performance Scores of Male and Female JSS III Students Exposed to STAD, Inquiry and Lecture methods on Geometry Based on Location in Sokoto State

Groups	N	$\overline{X}$	SD	Df	F	P	Decision
Urban	55	18.09	9.78				
Rural	147	25.16	11.91	1	7.18	0.008	
Gender	202			1	5.96	0.01	Accepted
Gender Location	202			2	1.21	0.32	

- Significant at $P \le 0.05$

Table 3 shows that the mean and standard deviation of students in Urban and Rural areas were 18.09, and 25.16, and standard deviation as 9.78, and 11.91 respectively. At p=0.32>$\alpha = 0.05$, at df=2, F=1.21, the analysis showed that there was no significant interaction effect on academic performance scores of male and female students in the Urban and Rural areas exposed to STAD, Inquiry and Lecture methods in learning geometry of JSS III in Sokoto State. Hence, the null hypothesis of no significant effect would be accepted. This shows that location in learning geometry of JSS III male and female students in Sokoto state is immaterial. But there was a significant main effect of treatment type at p=0.00 $<\alpha = 0.05$.

Summary of the Major Findings

The following are the major findings of the study:

1. Using STAD and Lecture and Inquiry and Lecture did not improve JSS III students' academic performance in learning Geometry in Sokoto State based on location. It is not significant
2. Using STAD and Lecture and Inquiry and Lecture did not improve JSS III male and female students' academic performance in learning Geometry in Sokoto State based on location. It is not significant

Conclusion

Based on the discussion and findings of this study, the researcher concluded that using STAD, and Inquiry method did not improve students' academic performance in geometry base on

location, therefore, the old practice of traditional lecture method should continue to be used in the teaching and learning of geometry in particular and mathematics in general in Sokoto State. When STAD , and Inquiry were used in teaching boys and girls in terms of performance also, there was no significant difference, this shows that it is not gender friendly in Sokoto State.

Finally, the analysis indicates that treatments of STAD and Inquiry do not have the potentiality of enhancing academic performance irrespective of location and gender in Geometry among JSS III students in Sokoto State.

Recommendations

Based on the finding of the study, the following points are recommended:

1. The use of STAD and Inquiry methods in teaching Geometry in schools base on location should be discouraged by stake holders in the education industries, such as Federal ministry of education, State ministry of education, NERDC, among others.
2. Sokoto State government is hereby advised to discourage the use of STAD and Inquiry methods base on location, as the results of the study showed that location is immaterial in teaching and learning of geometry in Sokoto State.

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