



EFFECTS OF ACTIVITY-BASED AND THINK-PAIR-SHARE INSTRUCTIONAL STRATEGIES ON SENIOR SECONDARY SCHOOL STUDENTS' LEARNING OUTCOMES IN MATHEMATICS IN EKITI STATE, NIGERIA

BY

AJIRO Oladele Samuel

oladeleajiro6@gmail.com | (+234) 813 160 5767 | (+234) 708 377 7167

Abstract

The study specifically investigated the effects of activity-based and think-pair-share instructional strategies on students' performance and attitude towards Mathematics. The study further investigated which of the strategies would be more effective. The study used gender and school-location as control variables. The study adopted quasi-experimental research design type. The population for the study comprised SSS II students across the state. The sample for the study consisted of 232 students. The instruments used for the study were Mathematics Performance Test and Students' Attitudinal Questionnaire with the reliability coefficients of 0.82 and 0.80 respectively. The two research questions raised were answered using mean and standard-deviation while the eight hypotheses generated were tested using ANOVA. The findings of the study showed that there were significant differences in performance mean score as well as the attitudinal mean score of students after treatments. The findings also showed that think-pair-share instructional strategy was more effective and that gender and school-location had no effect on students' performance and attitude towards Mathematics. It was concluded that both strategies were effective for the teaching of Mathematics. It was therefore recommended that mathematics teachers should adopt ABIS and TPSIS to teach by allowing students to participate actively in the class.

Keywords: Activity-Based, Think-Pair-Share, learning-outcomes

Introduction:

Mathematics is a science of number, quantity and space. It is the science that deals with the system of counting, measuring and description of shapes and structures. Application of Mathematics in Biology, Chemistry, Physics, among others cannot be over-emphasized. Despite the importance attached to Mathematics, the students' performance and attitude towards the subject were not encouraging due to teaching method. The reports from WAEC statistical data on candidates' performance in Mathematics in the previous years; the outcome of the analysis of Ekiti State Ministry of Education on students' performance in Mathematics in external examinations in the previous years and the researcher's personal observations being a mathematics teacher in public secondary school in Ekiti State, revealed that students developed negative attitude towards mathematics and that failure

characterized their performance in the subject in both internal and external examinations. These observations gave this study an insight to investigate if the strategies would have possible effects on the students' performance and attitude towards Mathematics in both urban and rural schools in the state.

Literature Review

Mathematics had been a relevant subject even from the ages past. Mathematics was incorporated during the conduct of census before the amalgamation of regions that was unanimously named Nigeria. Mathematics is a tool for making numerical interpretation and logical explanation of information, idea and situational issues using terms, rules, formulae, signs and symbols. Upon the relevancies of mathematics, students still consider the subjects so difficult to pass with good grade and therefore exhibited

care-free attitude towards the subject. Performance is the quantitative measure of the extent to which the purpose of teaching mathematics are accomplished. Iji (2010) described performance as the outcome of teaching while attitude is referred to as the state of mind of students towards learning which may be positive or negative (incivility behaviours in class). Teaching method is one of the problems that constituted students' poor performance as well as their negative attitude towards mathematics. Scholars had made researches into the issue of teaching method. Learning by doing/hand-on-activity is the main focus of activity-based and think-pair-share instructional strategies based on a Chinese proverb: "If you tell me, I may forget, If you show me, I may remember, If you involve me, I will understand." Abott, (2012) advocated for problem-solving and activity-based strategies due to learners' recurring failure in mathematics. Similarly, Azuka (2013) and Andrew (2014), activity-based learning strategy was the best for the teaching of mathematics. Ajiro (2017) specifically investigated the effects of practical approach on senior secondary school students' interest and performance in solid geometry and It was hence recommended in the study that mathematics teachers should adopt practically related teaching approach to teach the subject in the class.

Other factors that caused the problems of poor performance and negative attitude in mathematics class as traced in this study were students' gender and school-location. Bichi (2012) investigated gender influence on students' performance and therefore described genders as attributes which differentiate masculine from feminine, the amount of masculinity and femininity traits found in human beings. School-location is referred to in this study as the particular place where teaching and learning processes are being undertaken in the physical space. Essien (2017) recommended that government should brace up to bridge every gap between schools in the rural and urban areas to avoid biasness in terms of academic performance and also embark on adequate and unbiased

staffing of qualified teachers into the geographical areas, this was just for equity in students' academic performance as well as their attitude towards learning. This study therefore wished to consider activity-based and think-pair-share instructional strategies as approachable teaching strategies that could be capable of enhancing students' preferable performance and positive attitude towards mathematics by shifting focus on students' active participation in mathematics class.

Methodology

This study adopted pre-test, post-test control group quasi-experimental research design type. Pre-test was used to ascertain the homogeneity of both groups, while post-test was used to measure the effects of the strategies. The experimental groups were exposed to treatments while, the control group was left to the use of conventional method. The population for this study comprised 12,58 SSSII students in 206 public secondary schools in Ekiti State while the sample for the study consisted of 232 SSS II students in two Local Government Areas selected from the sixteen Local Government Areas in Ekiti State using multistage sampling procedure. The experimental procedure for the study was in three different stages; (pre-treatment, stage, treatment stage and post-treatment stage) and last for eight weeks. The two instruments used for the study (Mathematics Performance Test and Student Attitudinal Questionnaire in Mathematics) were subjected to face, content and construct validities. The reliability co-efficient of 0.8280 was generated for Mathematics Performance Test (MPT) using test and re-test method and Parson Product Moment Correlation analysis while 0.80 was generated for the Student Attitudinal Questionnaire in Mathematics (SAQ) using Cronbach alpha formular. The main purpose of the study was to investigate the effects of the strategies on students' performance and their attitude towards mathematics. The study specifically investigated if school location would have effects on students' performance and attitude towards mathematics using activity-based and think-pair-share instructional strategies.

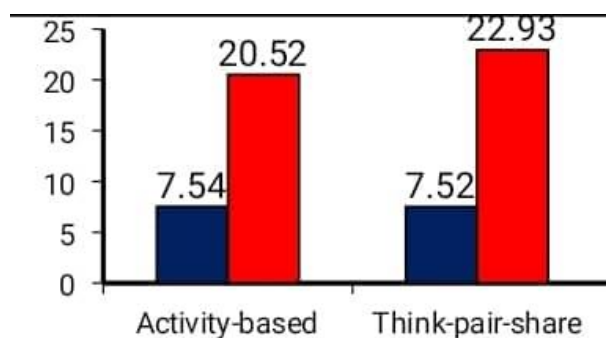
The two research questions raised were answered descriptively using mean and standard deviation while the eight hypotheses generated were tested using inferential statistics. Analysis of Variance. Scheffe Post hoc analysis was used to locate the source of pairwise difference.

Results

Table 1: Mean Scores of Students Before and After Treatments Performance Mean Scores of Students Before and After Treatments in Mathematics

Teaching Method	N	Pretest		Posttest		Mean Difference
		Mean	SD	Mean	SD	
Activity-Based	94	7.54	2.93	20.52	4.21	12.98
Think-Pair-Share	58	7.52	2.74	22.93	4.05	15.41
Control	80	7.68	3.21	10.51	2.86	2.83
Total	232	7.58	2.92	17.67	6.48	

Table 1 implied that there was wide disparity in the performance mean scores of students in the experimental and control groups after treatments in Mathematics with differences of (12.98 - 2.83=10.15) and (15.41-2.83=12.58) respective. This was further depicted in Figure 1



Descriptive Analysis

Question 1: What is the difference in the performance of students in the experimental and control groups before and after treatments in Mathematics?

Figure 1: Performance Mean Scores of Students Before and After Treatments in Mathematics

Question 2: What is the difference in the attitude of students in the experimental and control groups before and after treatments in Mathematics?

Table 2: Attitudinal Mean Scores of Students Before and After Treatments in Mathematics

Teaching Method	N	Pretest		Posttest		Mean Difference
		Mean	SD	Mean	SD	
Activity-Based	94	53.32	8.03	63.79	8.73	10.47
Think-Pair-Share	58	54.03	7.76	67.71	8.87	13.68
Control	80	54.06	8.78	60.58	10.23	6.52
Total	232	53.75	8.20	63.66	9.66	

Table 2 showed that there was wide disparity in the attitudinal mean scores

of students in the experimental and control groups after treatments in

Mathematics with differences of $(10.47 - 6.52=3.95)$ and $(13.68-6.52=7.16)$ respective..

This was further depicted in Figure 2.

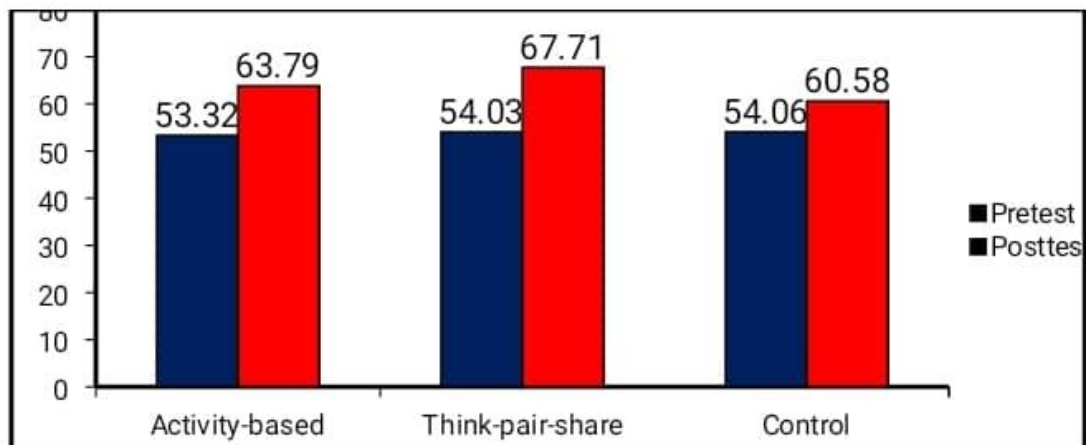


Figure 2: Attitudinal Mean Scores of Students Before and After Treatments in Mathematics

Testing of Hypotheses

Hypothesis 1: There is no significant difference in the performance mean scores of students in the experimental and control groups before treatments in Mathematics.

Table 3: ANOVA of Students' Performance in Mathematics Before Treatments

Source	SS	Df	MS	F	P
Between Groups	1.081	2	0.541	0.061	0.941
Within Groups	2039.363	229	8.906		
Total	2040.444	231			

$P>0.05$

Table 3 indicated that both experimental and control groups were homogenous prior to treatments in terms of their performance in Mathematics with 0.941.

Hypothesis 2: There is no significant difference in the attitudinal mean scores of students in the experimental and control groups before treatments in Mathematics.

Table 4: ANOVA of Students' Attitude towards Mathematics before Treatments

Source	SS	Df	MS	F	P
Between Groups	29.952	2	14.976	0.221	0.802
Within Groups	15519.044	229	67.769		
Total	15548.996	231			

$P>0.05$

Table 4 indicated that both experimental and control groups were homogenous

prior to treatments in terms of their attitude towards Mathematics with 0.802.

Hypothesis 3: There is no significant difference in the performance mean scores of students exposed to activity-

based and think-pair-share instructional strategies and conventional method in Mathematics.

Table 5: ANOVA of Students' Performance in Mathematics After Treatments

Source	SS	Df	MS	F	P
Between Groups	6467.934	2	3233.967	229.198	0.000*
Within Groups	3231.169	229	14.110		
Total	9699.103	231			

P<0.05

The result on Table 5 showed students exposed to activity-based and think-pair-share instructional strategies performed significantly better than the students exposed to conventional method in Mathematics with 0.000*.

In order to locate the sources of pairwise significant difference among the groups, Scheffe Post-Hoc Test was carried out as depicted in Table 6.

Table 6: Scheffe Post-Hoc Analysis of Students' Performance After Treatments in Mathematics

Group	1	2	3	N	Mean
Activity-Based (1)		*	*	94	20.52
Think-Pair-Share (2)			*	58	22.93
Control (3)				80	10.51

P<0.05

Table 6 showed that there was significant difference in the performance mean scores of students exposed to activity-based and think-pair share instructional strategies at 0.05 level of significant.

Hypothesis 4: There is no significant difference in the attitudinal mean scores of students exposed to activity-based and think-pair-share instructional strategies and conventional method in Mathematics.

Table 7: ANOVA of Students' Attitude towards Mathematics after Treatments

Source	SS	Df	MS	F	P
Between Groups	1712.787	2	856.394	9.884	0.000*
Within Groups	19841.312	229	86.643		
Total	21554.099	231			

P<0.05

Table 7 indicated that students exposed to activity-based and think-pair-share instructional strategies had a better change in their attitude towards Mathematics than students exposed to conventional method with 0.000* .

In order to locate the sources of pairwise significant difference among the groups, Scheffe Post-Hoc Test was carried out as depicted in Table 8.

Table 8: Scheffe Post-Hoc Analysis of Students' Attitude After Treatments in Mathematics

Groups	1	2	3	N	Mean
Activity-Based (1)		*		94	63.79
Think-Pair-Share (2)			*	58	67.71
Control (3)				80	60.58

P<0.05

Table 8 there was no significant difference between attitudinal mean scores of students in the activity-based and conventional methods at 0.05 level of significance.

Hypothesis 5: There is no significant difference in the performance mean scores of students exposed to activity-based and think-pair-share instructional strategies and conventional method in urban and rural schools in Mathematics.

Table 9: 2 X 2 ANOVA of Students' Performance in the Experimental Groups and Control Group After Treatments in Mathematics Based on School Location

Source	SS	Df	MS	F	P
Corrected Model	215.923	3	71.974	4.136	0.008
Location	1.181	1	1.181	0.068	0.795
Group	210.078	1	210.078	12.072	0.001
Location * Group	4.774	1	4.774	0.274	0.601
Error	2575.544	148	17.402		
Total	72667.000	152			
Corrected Total	2791.467	151			

P>0.05

Table 9 showed that school location had no effects on students' performance in Mathematics using activity-based and think-pair-share instructional strategies.

of students exposed to activity-based and think-pair-share instructional strategies and conventional method in urban and rural schools in Mathematics.

Hypothesis 6: There is no significant difference in the attitudinal mean scores

Table 10: 2 X 2 ANOVA of Students' Attitude Mathematics in the Experimental Groups After Treatments Based on School Location

Source	SS	Df	MS	F	P
Corrected Model	1119.300	3	373.100	5.018	0.002
Location	458.533	1	458.533	6.167	0.014
Group	518.648	1	518.648	6.976	0.009
Location * Group	22.448	1	22.448	0.302	0.584
Error	11003.536	148	74.348		
Total	659925.000	152			
Corrected Total	12122.836	151			

P>0.05

Table 10 indicated that school location had no effects on students' attitude towards Mathematics using activity-based and think-pair-share instructional strategies.

Hypothesis 7: There is no interaction effects of treatments, gender and school location on students' performance in Mathematics.

Table 11: 3 X 2 X 2 ANOVA of Students' Performance in Mathematics by Treatments, Gender and School Location

Source	SS	Df	MS	F	P
Corrected Model	7048.803	12	587.400	48.538	0.000
Covariate (Pretest)	386.225	1	386.225	31.915	0.000
Group	4556.103	2	2278.051	188.240	0.000
Gender	7.303	1	7.303	0.603	0.438
Location	10.546	1	10.546	0.871	0.352
Group * Gender	41.075	2	20.537	1.697	0.186
Group * Location	35.639	2	17.819	1.472	0.232
Gender * Location	9.443	1	9.443	0.780	0.378
Group * Gender * Location	103.447	2	51.724	4.274	0.015
Error	2650.300	219	12.102		
Total	82156.000	232			
Corrected Total	9699.103	231			

P<0.05 Table 11 showed that the computed $F_{2,219}=4.274$, $P<0.05$ was statistically significant at 0.05 level. The null hypothesis was rejected. This implied that there was interaction effects of treatments, gender and school location on students' performance in Mathematics.

Hypothesis 8: There is no interaction effects of treatments, gender and school location on students' attitude towards Mathematics.

Table 12: 3 X 2 X 2 ANOVA of Students' Attitude Towards Mathematics by Treatments, Gender and School Location

Source	SS	Df	MS	F	P
Corrected Model	6919.213	12	576.601	8.628	0.000
Covariate (Pretest)	2821.894	1	2821.894	42.228	0.000
Group	1516.161	2	758.081	11.344	0.000
Gender	59.948	1	59.948	0.897	0.345
Location	393.924	1	393.924	5.895	0.016
Group * Gender	258.742	2	129.371	1.936	0.147
Group * Location	33.163	2	16.582	0.248	0.780
Gender * Location	14.486	1	14.486	0.217	0.642
Group * Gender * Location	1141.788	2	570.894	8.543	0.000
Error	14634.886	219	66.826		
Total	961741.000	232			
Corrected Total	21554.099	231			

P<0.05

Table 12 depicted that the computed $F_{2,219}=8.543$, $P<0.05$ was statistically significant at 0.05 level. The null hypothesis was therefore rejected. By implication, there was interaction effects of treatments, gender and school location on students' attitude towards Mathematics.

Discussion

The findings of the study established the homogeneity and equity in the three groups in both urban and rural areas before treatments in mathematics. Consequently, the significant differences recorded afterwards were not ascribed to chance, but to the specific treatments applied. The result of the study showed significant differences in the performance and attitudinal mean scores of students in the experimental and control groups after treatment. However, think-pair-share instructional strategy had better effect on students' performance and attitude towards mathematics. The result of the study further showed that school location had no effect on students' performance and attitude towards Mathematics using activity-based and think-pair-share instructional strategies.

Conclusion

Based on the findings, it was concluded that both experimental and control groups were homogenous prior to treatments in Mathematics. It was also concluded that both activity-based and think-pair-share instructional strategies were effective for the teaching of Mathematics in senior secondary schools.

Recommendations

Based on the findings, the following recommendations were made:

- Mathematics teachers should adopt activity-based and think-pair-share instructional strategies to teach the students in both urban and rural senior secondary schools in Ekiti State to encourage self-construction of knowledge;
- Students (male and female) should be encouraged by their Mathematics

teachers by giving them opportunities of having hand-on-activities, personal-thinking, pairing and sharing of ideals to gear up their senses of belongings in Mathematics class;

- The curriculum planners, Ekiti State Ministry of Education, society and Parents should help in implementation of activity-based and think-pair-share instructional strategies to teach Mathematics in schools.

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