

Effects of Reciprocal Peer Tutoring and Competitive Strategies on Academic Performance of Ekiti State Students in Mathematics

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ABSTRACT: *This study investigated the effects of reciprocal peer tutoring and competitive strategies on academic performance of Ekiti State students in mathematics in order to find out the probable best learning strategy and interactive effects of gender and location. The sample of the study was 107 Senior Secondary Schools II, Mathematics students selected from six local government areas in Ekiti State using multi stage sampling technique. Quasi experimental design was adopted for the study. Achievement Test in Mathematics (ATM) was used to collect data. The students in the three groups were homogeneous at the commencement of the study. The data collected in this study were subjected to Analysis of Variance, Multiple Classification Analysis and Scheffe Post-hoc analysis at $\alpha = 0.05$ level of significance. The findings revealed that students in the reciprocal peer tutoring group performed better than those in competitive and conventional groups while students in competitive group performed better than their counterparts in the conventional group. Also, there were no interactive effects of gender on academic performance of students exposed to Reciprocal peer tutoring, Competitive and Conventional strategies of teaching Mathematics. Based on the findings, it was recommended among others that mathematics teachers should adopt reciprocal peer tutoring and competitive strategies as effective learning strategies in order to improve student's performance, social inter-action skills and foster meta-cognition in students.*

Key Words: *Senior Secondary Schools, Reciprocal peer tutoring, Competitive, Conventional and Academic performance*

INTRODUCTION

Mathematics is an important subject and a day – to – day activity that every human being practices in one way or the other. Mathematics helps one to develop ability in creative thinking, seeing things with the inner eye and deep focusing. The importance of Mathematics to the society at large cannot be overemphasized because it is one of the essential subjects of modern technology.

According to Kolawole & Popoola (2009), Mathematics is an instrument that facilitates the learning of all subjects. No wonder Plato (a philosopher and mathematician) opined Mathematics is the bedrock of all other subjects and that is the reason why he said “let no man make destitute of mathematics”. Due to the uniqueness of mathematics, it is classified as a compulsory subject right from the primary school to the secondary school and a subject that must be passed in the first school leaving certificate examination and Senior School Certificate Examination. Mathematics is one of the compulsory subjects both in the primary and secondary school level, not because the students are expected to become a mathematician but because of its application in day to day activities.

The performance of students keeps declining in Senior School Certificate Examination (SSCE) in mathematics. The performance of students in 2014 SSCE in Mathematics as announced by West African Examination Council testified to this claim. WAEC recorded a mass failure in Mathematics where more than 67% of the candidates who sat for the examination failed Mathematics (Vanguard Newspaper, 14th August, 2014). This unfortunate trend should agitate the minds of Mathematics educators in Nigeria. Therefore, there is a need to investigate this national problem from other perspective such as teaching strategies and students' personal perspectives. Hence, in this study we examined whether teaching Mathematics via reciprocal peer tutoring and competitive strategies will enhance students' academic performance in Mathematics

Reciprocal Peer Tutoring (RPT) is a collaborative technique of instruction where students of the same class and age bracket alternate between the role of student (tutees) and teachers (tutors) and may follow a structural format to help team members make academic progress. Students alternate roles while in their groups or pairs. RPT enables each member in a group to participate in the group as a tutor and tutee. In RPT, students gain from the preparation and instruction in which the tutors engage in, and also from the instructions that the tutees receive. RPT has a structured format where students teach, monitor, evaluate and encourage each other. Students are part of the educational process and are able to prepare instructional

materials and receive feedback from peers. The alternating structure is designed to increase student choice and participation in the management of group's interdependent teaching. RPT has been known to be very influential in the development of behaviour patterns and learning outcomes (Uwameiye & Aduwa-Ogiegbean, 2006).

Since RPT consists of recurrent instructional processes applicable to various types of subject matter and usable by more than one teacher, it could be used for teaching Mathematics. It is a pattern of interaction between the tutor and the tutee, with the experience intended to lead to a change in learning outcomes. Interaction here refers to the verbal and non-verbal communication, which forms the basis of any teaching method (Uwameiye & Aduwa-Ogiegbean, 2006).

RPT provides a non-judgment acceptance, care and support, opportunities to give and receive from others and creates a non-competitive, empowering environment. It introduces the much needed balance between cooperation and competition in the socialization process of students. The socialization experiences that occur during reciprocal peer tutoring can benefit both the tutor and tutee by motivating students to learn and increasing their social standing among peers (Fuchs, Fuchs, Mathes & Martiniez, 2002).

Competitive instructional strategy is motivated by participation in a competition. In competitive strategy, when one student's goal is achieved, all other students fail to reach that goal; there is always a winner and a loser in competitive learning. According to Kolawole (2007) our current educational system is based upon competition among students for grades, social recognition, scholarship and admission to top schools. He stated that in our society and current educational framework competition is valued over cooperation. In a traditional competitive classroom students are concerned with their individual grades and where they fit into grade curve. Competition fosters in a win-lose situation where superior students reap all rewards and recognition and low achieving students reap none. Typical teaching paradigms consist of individual student's effort, characterized by competitive testing to assess student competence and create an evaluation hierarchy based upon grades.

This approach leads to a performance goal as the desired outcome of the educational experience. Competitive learning is most appropriate when student need to view learned materials. It can be interpersonal (between individuals) or inter-group (between groups) (Kolawole, 2007). However, in this study, the competition was between group learners. When competition occurs between well-matched competitors, is done in the absence of a norm-referenced grading system, and is not used too frequently, it can be an effective way of motivating students to cooperate with each other.

Reciprocal peer tutoring and competitive strategies appear to be critical to students' school achievement in Mathematics, which seems to be cost effective. Therefore, the present study investigates the effect of reciprocal peer tutoring and competitive on the academic performance of Ekiti State students in Mathematics.

Statement of the Problem

The problem of low academic achievement among the students in Mathematics has been plaguing our educational system completely right from the primary to the tertiary levels. This problem is responsible for the tremendous wastage of human potential and facilities for education apart from the financial wastage, which a developing country like ours can ill afford.

Mass failure of students in Mathematics has been a source of concern to parents, students, teachers and the society at large. The mass failure has been attributed to teachers' methodology, non-availability of teaching materials and parental factors. All of these appeared to have been investigated yet the problems seem to have remained persistent going by the recurring mass failure in Mathematics external examinations in the state. If performance in Mathematics continues to be poor as it is now, Nigeria may never attain her goal of developing modern technology using her own human resources and may have to continue to rely on manpower from other countries. Therefore, there is the need for students to perform well to achieve the required degree of accuracy and utilization of Mathematics for both personal and national development.

Purpose of the Study

The purpose of the study was to investigate the effects of reciprocal peer tutoring and competitive strategies on the academic performance of Ekiti state students in Mathematics. It also determined the probable best and as well as most effective strategy out of reciprocal peer tutoring, competitive and conventional strategies in teaching Mathematics. It further examined gender difference in the academic performance of students taught Mathematics using reciprocal peer tutoring, competitive and conventional strategies.

Research Hypotheses

Based on the aforementioned questions, the following hypotheses were generated:

1. There is no significant difference in the pre-test mean scores of students exposed to reciprocal peer tutoring, competitive and conventional strategies.
2. There is no significant difference in the post-test mean scores of students exposed to reciprocal peer tutoring, competitive and conventional strategies.
3. There is no significant gender difference in the academic performance of students exposed to reciprocal peer tutoring strategy.
4. There is no significant gender difference in the academic performance of students exposed to competitive strategy.
5. There is no significant gender difference in the academic performance of students exposed to conventional strategy.

METHODOLOGY

Research Design

The research design adopted for this study is quasi – experimental pre-test and post-test three group design (two experimental groups and one control group).

The pattern of the design is as shown below.

O_1	X_1	O_2 :	Experimental group (i) (Reciprocal peer tutoring)
O_3	X_2	O_4 :	Experimental group (ii) (Competitive)
O_5	-	O_6 :	Control group (Conventional)

Where

O_1, O_3, O_5 ,- Pre-test (Performance before treatment)

O_2, O_4, O_6 ,- Post-test (Performance after treatment)

X_1 – Treatment via Reciprocal peer tutoring strategy

X_2 – Treatment via Competitive strategy

- – Control group: Conventional strategy

The study consisted of three independent variables. These include: Reciprocal peer tutoring, Competitive and conventional strategies. The dependent variable was the learning outcome which was the students' performance in Mathematics. The intervening variable consisted of gender (male and female).

Population

All Senior Secondary Two (SS II) Mathematics Students in all the Senior Secondary Schools in Ekiti State.

Sample and sampling techniques

The sample of this study is made up of one hundred and Seven (107) from three public secondary schools in Ekiti State, Nigeria. The sample was selected using multistage sampling technique. One Senatorial district was randomly selected from the three senatorial districts in Ekiti. Three Local Government Areas were randomly selected from the senatorial district earlier selected. One public secondary school was purposively selected from each of the three local government areas chosen for the study. The class intact size of each of the three schools was used for the study. Purposive Sampling technique was used to group the schools into different experimental and control groups.

Graduate Mathematics teachers in each school were purposively selected and employed as research assistant. All the teachers used in this study were professional teachers as well as WAEC markers. They were given detailed instructions with lesson packages on how to teach each group on all the topics under consideration.

Instrumentation

The instrument used for this study is Achievement Test in Mathematics (ATM). The researcher constructed the instrument; the instrument was used for pre-test and post-test. The pre-test was designed to test the homogeneity of the three groups (reciprocal peer tutoring, competitive and control groups). The content of ATM used for pre-test was reshuffled for the post-test in order to prevent carry-over effect and test-wiseness.

Validity and reliability of the instrument

The instrument was validated by content, criterion relative (concurrent) and face validity methods. It was given to three mathematics teachers teaching Senior Secondary Schools who were also team leaders in West Africa Examination Council (WAEC) marking exercise. The unified examination conducted by Ekiti State Ministry of Education was used as a criterion test to validate ATM. The validity coefficient obtained was 0.91. Fulon formula was used to establish the reliability coefficient of 0.89 for ATM.

Experimental Procedure

A purposive sampling technique was used to divide the sample into three groups (reciprocal peer tutoring, competitive and control groups). The Achievement Test in Mathematics (ATM) was administered to all groups as Pre-test in order to ascertain the homogeneity of the three groups and the entry point of each group. To ascertain the homogeneity of the three groups, data of the Pre-test was subjected to Analysis of Variance which resulted to $F_{cal} < F_{table}$ (i.e. $P > 0.05$). Thus, the null hypothesis is not rejected. Hence the three groups was homogeneous at the commencement of the study. The reshuffled Achievement Test in Mathematics which served as post-test was administered to the three groups after teaching the groups for a term (11 weeks) using the same scheme of work. The experimental plan was as follows:

Duration	Activities
1st week	Training of research assistants and administering of pre-test
2nd – 12th week	Teaching of the students via reciprocal peer tutoring, competitive and conventional strategies
13th week	Post-test

After treatment, the scores in pre-test and post-test in the three groups were collated and subjected to appropriate statistical analysis. The five hypotheses were analyzed by Analysis of Variance (ANOVA), Post-hoc Analysis (Scheffe) and t-test analysis at $\alpha = 0.05$ level of significance.

RESULTS AND DISCUSSIONS

Hypothesis 1: There is no significant difference in the pre-test mean scores of students exposed to reciprocal peer tutoring, competitive and conventional strategies.

Table 1: Analysis of Variance (ANOVA) for pre – test mean scores of students under the groups

Groups	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	.105	2	.053	0.036	0.964
Within Groups	151.054	104	1.452		
Total	151.159	106			

$P > 0.05$

The result presented in table 1 showed that there is no significant difference in the pre-test mean scores of students exposed to reciprocal peer tutoring, competitive and conventional method as $P = 0.964 > 0.05$. There is a strong evidence not to reject the null hypothesis. This makes hypothesis 1 to be non-rejected. Hence, there was no significant difference in the pre-test mean scores of students exposed to reciprocal peer tutoring, competitive and conventional strategies. The students in three groups are homogeneous at the beginning of this study.

Hypothesis 2: There is no significant difference in the post-test mean scores of students exposed to reciprocal peer tutoring, competitive and conventional strategies.

Table 2: Analysis of Variance (ANOVA) for post – test mean scores of students under the groups

Groups	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	4954.605	2	2477.302	397.458*	.000
Within Groups	648.218	104	6.233		
Total	5602.822	106			

* $P < 0.05$

The result presented in table 2 showed that there is significant difference in the post-test mean scores of students exposed to reciprocal peer tutoring, competitive and conventional method as $P = 0.000 < 0.01 < 0.05$. There is a strong evidence to reject the null hypothesis. This makes hypothesis 2 to be rejected. Hence, there was significant difference in the post-test mean scores of students exposed to reciprocal peer tutoring, competitive and conventional strategies. In order to investigate the source of the differences observed, Post – hoc analysis (Scheffe) with mean difference was carried out.

Table 3: Scheffe Post – hoc test and mean for observed difference in students' performance in the groups

Groups	Mean	Reciprocal peer tutoring	Competitive	Conventional
Reciprocal peer tutoring	41.12	41.12	32.66	23.78
Competitive	32.66	8.4591*		
Conventional	23.78	17.3364*	8.8772*	

* P < 0.05

In table 3, a significant difference was found between reciprocal peer tutoring and competitive in favour of reciprocal peer tutoring. Also there was significant difference between reciprocal peer tutoring and control in favour of reciprocal peer tutoring. There was difference between competitive and control in favour of competitive. The result of post – hoc test also showed that students exposed to reciprocal peer tutoring performed best. They performed significantly better than their counterparts in other two groups. Moreso, those exposed to competitive performed better than those in conventional strategy, which indicate the conventional strategy group performed worst.

Hypothesis 3: There is no significant gender difference in the academic performance of students exposed to reciprocal peer tutoring strategy.

Table 4: t-test analysis for gender difference in the academic performance of students exposed to reciprocal peer tutoring strategy

Variations	N	Mean(\bar{X})	SD	df	t _{cal}	P (Sig)	Rem.
Male	16	41.25	1.69	32	0.469	0.642	Not Significant
Female	18	41.00	1.41				

P<0.05

Table 4 shows that the t-cal value of 0.469 is not significant because the P value (0.642) > 0.05 level of significance, this implies that null hypothesis is not rejected. Hence, there is no significant gender difference in the academic performance of students exposed to reciprocal peer tutoring strategy.

Hypothesis 4: There is no significant gender difference in the academic performance of students exposed to competitive strategy.

Table 5: t-test analysis for gender difference in the academic performance of students exposed to competitive strategy

Variations	N	Mean(\bar{X})	SD	df	t _{cal}	P (Sig)	Rem.
Male	23	32.61	3.35	39	0.114	0.910	Not Significant
Female	18	32.72	2.92				

P<0.05

Table 5 shows that the t-cal value of 0.114 is not significant because the P value (0.910) > 0.05 level of significance, this implies that null hypothesis is not rejected. Hence, there is no significant gender difference in the academic performance of students exposed to competitive strategy.

Hypothesis 5: There is no significant gender difference in the academic performance of students exposed to conventional strategy.

Table 6: t-test analysis for gender difference in the academic performance of students exposed to conventional strategy

Variations	N	Mean(\bar{X})	SD	df	t _{cal}	P (Sig)	Rem.
Male	15	23.00	1.93	30	1.796	0.083	Not Significant
Female	17	24.47	2.60				

P<0.05

Table 6 shows that the t-cal value of 1.796 is not significant because the P value (0.083) > 0.05 level of significance, this implies that null hypothesis is not rejected. Hence, there is no significant gender difference in the academic performance of students exposed to conventional strategy.

Discussion

Table 1 revealed a no difference in the pre-test scores of students in Mathematics among the groups showing that the groups were homogenous at the commencement of the study. Findings from Table 2 revealed that a significant difference exists in the post – test mean scores of students in Mathematics among the three groups (reciprocal peer tutoring, competitive and conventional method). This is evident from the fact that students’ performance varies from reciprocal peer tutoring, competitive and conventional method. Table 4 further revealed a significant difference between reciprocal peer tutoring and competitive; reciprocal peer tutoring and conventional method; and between competitive and conventional method. The findings showed that students in the reciprocal peer tutoring group performed better than those in competitive and conventional methods while students in competitive group performed better than their counterparts in the conventional method. This agrees with Seweje (2010) & Kolawole (2007) that good teaching strategies have the potent to improve cognition of students. This also justifies the earlier postulate of this study that reciprocal peer tutoring and competitive could facilitate meaningful learning of Mathematics.

The results also aligned with that of Thomas (2007) and Griffin and Griffin (1997) who observed that reciprocal peer tutoring strategy proved more effective than conventional method in enhancing students' academic achievement in Mathematics. The reason for this may not be farfetched for example Kolawole & Oginni (2009) observed that conventional method involves the teacher giving out all the facts expected of the students, with little care on whether or not the students are actively participating and contributing to the success of the lesson.

The findings from hypotheses on gender difference in the three groups showed no significant difference. This means that gender has nothing to do with students response to the use of any of the instructional strategy i.e. reciprocal peer tutoring, competitive and conventional. The findings agreed with that of Kolawole (2012) & Kolawole (2007) who observed that gender has no interactive effect on students' academic performance exposed to reciprocal peer tutoring. But the findings contradicted the report of Adebule (2004) & Smith (2007) who stated that male perform better than female in Mathematics when exposed to reciprocal peer tutoring.

Findings

The findings of this study are as follows:

- 1 There was no significant difference in the pre-test mean scores of students in the three groups at the commencement of the study.
- 2 There was significant difference in the post-test mean scores of students exposed to reciprocal peer tutoring, competitive and conventional strategies.
- 3 Students exposed to reciprocal peer tutoring had the highest adjusted mean score than their counterparts in competitive and the conventional strategy.
- 4 There was significant difference between reciprocal peer tutoring and competitive, reciprocal peer tutoring and conventional, and between competitive and conventional strategies.
- 5 There was no significant gender difference in the academic performance of students exposed to reciprocal peer tutoring strategy.
- 6 There was no significant gender difference on the academic performance of students exposed to competitive strategy.
- 7 There was no significant gender difference on the academic performance of students exposed to conventional strategy.

Conclusion

It can be concluded from the findings of this study are as follows:

- [1] The students in the three groups are homogeneous at the beginning of this study.
- [2] Reciprocal peer tutoring strategy is the most effective strategy, followed by competitive strategy and conventional strategy being the worst
- [3] Reciprocal peer tutoring and competitive strategies have impact on the academic performance of students in Mathematics.
- [4] The students exposed to Mathematics through reciprocal peer tutoring strategy performed best followed by competitive and conventional strategies respectively.
- [5] Gender of the students has no influence on the academic performance of students exposed to Mathematics through reciprocal peer tutoring, competitive and conventional strategies

Recommendations

Based on the following findings, it is hereby recommended that: Mathematics teachers should adopt reciprocal peer tutoring and competitive strategy as an effective learning strategy in order to improve student's performance, social inter-action skills and foster meta-cognition in students. Mathematics teachers should be given adequate orientation through workshops and seminars to update their knowledge in the use of Reciprocal peer tutoring and Competitive strategies in teaching.

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