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Full Length Research Paper

Effects of competitive and cooperative learning strategies on academic performance of Nigerian students in mathematics

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This study investigated the effects of the cooperative and competitive learning on academic performance of students in mathematics in order to find out which one of them is the more effective learning strategy. The sample of the study was 400 Senior Secondary Schools III, Mathematics students made up of 240 boys and 160 girls randomly selected from four out of five States in South West Nigeria. Quasi experimental design was adopted for the study. Two instruments were used namely Mathematics Pre-Test Achievement Test (PTAT) and Post-Test Achievement Test (PAT) to collect data. The data collected in this study were subjected to Z-test analysis at α = 0.05 level of significance. The findings revealed that cooperative learning strategy is more effective than competitive learning strategy and that boys performed significantly better than girls in both learning strategies. Based on the findings, cooperative learning strategy should be introduced in our secondary schools in Nigeria.

Key words: Mathematics, Senior Secondary Schools, Nigeria Cooperative, Competitive, Learning strategies and performance

INTRODUCTION

Evaluation activities chart the progress of students toward the objectives outlined for them by the teachers and by themselves, therefore evaluation is an essential aspect of instruction at all levels. It is a means whereby the quality of tasks can be constantly maintained and improved (Kolawole, 2005).

Evaluating a student's achievement is a primary duty of a teacher. It is a time-consuming and cumbersome task because of the clerical work involved. At the same time, it requires a highly technical proficiency and it involves teacher's professional value-judgement. Despite its enormity, evaluation is an indispensable task and a task that must be done at the end or during any instructional activities in order to ascertain the level of understanding of the concept taught. Teachers usually use several approaches to influence effective teaching and learning processes. In typical classes, students are given lecture, complete assignments outside of class and take an examination to demonstrate their degree of understanding and retention of the subject matter. The examinations are returned and new material is covered, repeating the process over and over. There is little time for reflection and discussion of students' errors and misconceptions.

According to Akinbobola (2006) 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. (Stahle, 1986) opined that emphasis is placed on doing better than everyone else. Competition fosters in a win-lose situation where superior students reap all rewards and recognition and mediocre or low-achieving students reap none (Johnson and Johnson,

1989). 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), (Johnson et al., 1986). 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 (Cohen, 1994). Cooperative learning is a mode of learning in which students of different levels of ability work together in small groups to achieve a purpose (Akinbobola, 2006). It involves the use of a variety of learning activities to improve their understanding of a subject (Slavin, 1992). Students in a group interact with each other, share ideas and information, seek additional information, make decisions about their findings to the entire class (Kort, 1992). Cooperative learning is student centred versus teacher centred leading to a stronger emphasis on the goal of learning instead ofa performance goals. It encourages teachers to use alternative assessment techniques further reducing the emphasis on competitive examinations (Slavin, 1992). Pressel (1992), opined that cooperative learning helps to improve student achievement and retention, increase self-esteem and intrinsic motivation and develop more positive attitude towards learning skills and social skills.

STATEMENT OF THE PROBLEM

Most of our current educational system is based upon competition among students for grades, social recognition, scholarship and admissions to schools. On the other hand, the cooperative learning strategies are sparsely used in our educational system. But researchers support the use of cooperative learning as increasing retention, fostering team building and developing higher-level thinking skills. The main problem which the study investigated is which of these learning strategies will bring out better achievement of the students in Mathematics and to what extent do these learning strategies affect gender in learning outcomes?

Research questions

The following questions were postulated:
* Will those taught with cooperative learning strategy and those taught with competitive learning strategy perform equally in Mathematics?
* Will girls and boys taught with cooperative learning strategies perform equally in Mathematics?
* Will girls and boys taught with competition learning strategies perform equally in Mathematics?
* Will there be any gender difference between those taught with competitive and cooperative learning strategies in Mathematics?

Research hypotheses

Based on the aforementioned questions the following hypotheses were generated
1. There is no significant difference between the mean academic performance of mathematics students taught with competitive learning strategy and those taught with cooperative learning strategy
2. There is no significant difference between the mean academic performance of boys and girls taught mathematics with competitive learning strategy.
3. There is no significant difference between the mean academic performance of boys and girls taught mathematics with cooperative learning strategy.
4. There is no significant difference between the mean academic performance of boys and girls taught with cooperative and competitive learning strategies

Purpose of the study

The purpose of the study includes the following:
* To compare the academic performance of mathematics students taught with cooperative learning strategy and those taught with competitive learning strategy.
* To compare the academic performance of girls and boys mathematics students taught with cooperative and competitive learning strategies.

Research design

The research design adopted for this study is quasi experiment. In other words the design is a one short experimental design.

Population

All Senior Secondary Three (SS III) Mathematics Students in all the Senior Secondary Schools in South West, Nigeria.

Sample and sampling techniques

The sample of this study is made up of Four hundred students randomly chosen from four out of five states in the South West, Nigeria. Five schools were randomly selected from each of the four States. Twenty (20) students of which 12 were boys and 8 were girls, were chosen from the selected schools. On the whole there were 240 boys and 160 girls.

Instrumentation

The instruments used for this study are Pre-test Mathe-

Table 1. Z-test analysis of Post-test scores of those taught with cooperative and competitive learning strategies.

Source of Variation	N	Mean	Standard Deviation	Df	Z_c	Z_t	Result
Competitive	200	50.2	10.87	398	11.97	1.96	Significant
Cooperative	200	62.6	9.65				

$P < 0.05$

Mathematics Achievement Test (PTAT) and Post-test Mathematics Achievement Test. The researcher constructed the instruments. Pre-test Mathematics Test was designed to test the homogeneity of the two groups (cooperative and competitive learning strategies groups) and it was administered to all the students before treatment. Post-test Mathematics Test was administered to the two groups after treatment, (teaching them the mathematical package). Any difference between the Pre-Test and the Post – Test might have been due to treatment given to the cooperative and competitive groups. The Pre-Test Mathematics Achievement Test (PTAT) and Post-Test Mathematics Achievement Test were two equivalent tests, in other words they were equal in content, difficulty level, and psychometric properties.

Validity and reliability of the instruments

The two instruments were validated by content and face validity methods. They were given to two mathematics teachers teaching Senior Secondary Schools Three (SS 3) who are also team leaders in West Africa Examination Council (WAEC) marking exercise. Falon formula was used to establish the reliability coefficient of 0.85 and 0.89 for PTAT and PAT respectively.

Administration of the instrument

A purposive sampling technique was used to divide the sample into two groups (comparative and competitive groups).

The Pre-test Mathematics Achievement Test (PTAT) was administered to all treatment groups as Pre-test in order to ascertain the homogeneity of the treatment groups. The Post-test Mathematics Achievement Test was administered to the two treatment groups after teaching the groups for a term (13 weeks) using the same scheme of work.

Graduate Mathematics teachers in each school were employed as assistant researchers. 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. After treatment, the scores in Post-test in both groups were collated and subjected to appropriate statistical analysis. The four hypotheses were analyzed by Analysis of Z-test at $\alpha = 0.05$ level of significance.

RESULTS

Hypothesis 1: There is no significant difference the academic performance of mathematics students taught with competitive learning strategy and those taught with cooperative learning strategy.

Table 1 shows that Z-calculated is greater than Z-table, hence the null hypothesis is rejected at $\alpha = 0.05$ level of significance. This means there is a significant difference between the academic performance of students taught with cooperative and competition learning strategies in favour of cooperative learning strategies.

Hypothesis 2: There is no significant difference between the mean academic performance of boys and girls taught mathematics with competitive learning strategy.

Table 2 shows that Z-calculated is greater than Z-table, thus the null hypothesis is rejected. This implies there is a significant difference between boys and girls taught with competitive learning strategy in favour of boys.

Hypothesis 3: There is no significant difference between the mean academic performance of boys and girls Mathematics students taught mathematics with comparative learning strategy.

Table 3 shows that Boys performed better than girls in cooperative learning strategy.

Hypothesis 4: There is no significant difference between the mean academic performance of boys and girls taught with cooperative and competitive learning strategies

Tables 4(a) and (b) show that boys who were taught with cooperative learning strategy performed better than their girls counterpart in Mathematics.

DISCUSSION

The analysis in Table 1 showed that Mathematics students taught with cooperative learning strategy performed better than those taught with competitive learning strategy. This result is in line with Humphery et al. (1982) and Akinbobola (2006). Table 2 showed that boys performed significantly better than girls in cooperative learning strategy. Table 3 showed that boys performed significantly better than girls in competitive learning strategy. These findings are not in agreement with Usousuro (1999) who opined that gender of students did not have

Table 2. Z-test analysis of boys and girls performance in Mathematics under competitive learning strategy.

Source of variation	N	Mean	Standard deviation	Df	Z_c	Z_t	Result
Boys	120	56.8	16.8	198	5.63	1.96	Significant
Girls	80	42.4	18.3				

P < 0.05

Table 3. Z-test analysis on cooperative learning strategy for boys and girls.

Source of variation	N	Mean	Standard deviation	Df	Z_c	Z_t	Result
Boys	120	56.8	16.8	198	6.51	1.96	Significant
Girls	80	42.4	18.6				

P < 0.05

Table 4(a). Z-test analysis on competitive and cooperative learning strategies for boys and girls.

Source of variation	Cooperative			Competitive		
	N	Mean	Standard deviation	N	Mean	Standard deviation
Boys	120	64.8	12.3	120	56.8	16.8
Girls	80	52.5	13.6	80	42.4	18.6

P < 0.05

Table 4(b). Z-test analysis on competitive and cooperative learning strategies for boys and girls.

Source of Variation	Competitive		
		Boys	Girls
Cooperative	Boys		*
	Girls	*	

*:Significant at α = 0.05

cooperative learning strategy performed significantly better than girls taught with competitive learning strategy in Mathematics.

Conclusion

The following conclusions could be derived from this research: a). Cooperative learning strategy is more effective than competitive learning strategy in teaching of Mathematics at Secondary School level. b). The male students performed significantly better than their female counterparts in learning Mathematics with cooperative and competitive learning strategies. c). There is a gender influence with respect to performance of Mathematics through cooperative and competitive learning strategies. d). Boys that were taught with cooperative learning strategy performed significantly better than girls taught with competitive learning strategy in Mathematics. e). Cooperative learning strategy is more effective than the competitive learning strategy in the teaching of Mathematics in Nigeria.

Recommendations

Based on the following findings, it is hereby recommended that: Mathematics teachers should adopt coop-erative learning strategy as an effective learning strategy in order to improve student's performance, social inter-action skills and foster meta-cognition in students.

Cooperative learning strategy should be introduced in teaching our Secondary Schools Mathematics.

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