

EFFECTS OF CO-OPERATIVE AND COMPETITIVE TEACHING STRATEGY ON STATISTICS ACHIEVEMENT OF STUDENTS IN SECONDARY SCHOOLS IN GWAGWALADA, ABUJA, NIGERIA

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Abstract

This study was set out to examine the effects of cooperative and competitive learning strategies on Statistics achievement of secondary school students in Gwagwalada, Abuja. The research adopted quasi-experimental control group design. Data was collected from a sample of students comprising 193 boys and 159 girls from two randomly selected senior secondary schools in Gwagwalada Area Council of the Federal Capital Territory. The schools were grouped into two experimental and one control groups. Cooperative and competitive learning strategies were used for the experimental groups while the control group was taught using the conventional method. A 50 item instrument called Statistics Achievement Test (SAT) developed by the researcher with a reliability coefficient of 0.88 using Kuder-Richardson formula 21 was used for data collection. Data collected were analyzed using descriptive statistics of mean and standard error for answering the research questions and One-way ANCOVA at coefficient alpha level of 0.05 for testing the hypotheses. The results showed that there was significant difference between the achievement of students taught with Cooperative and competitive learning strategies and their counterpart in

the control group. Cooperative and competitive learning strategies were found to be gender friendly as both male and female students performed equally. Based on these findings, it was recommended that mathematics teachers of statistics should be encouraged to use Cooperative learning strategies to teach statistics. For students to achieve maximally, conventional method should not be used to teach statistics students at senior level in secondary school education. Seminars, workshops and conferences should be organized to train teachers on the use of the cooperative and competitive learning strategies.

Keywords: Cooperative learning strategies, Competitive learning strategies, Statistics, Achievement, Conventional method.

Introduction

Mathematics is the cradle of all creations, without which the world cannot move an inch. Be it a cook or a farmer, a carpenter, or a mechanic, a shopkeeper or a scientist, everyone needs mathematics in their day-to-day. Mathematics is used as a basic entry requirement into any of the prestigious courses in tertiary institution such as medicine, architecture and engineering among other degree programmes. Students with an interest in a subject like mathematics are likely to be more motivated to manage their own learning and develop the requisite skills to become effective learners of that subject. Hence, interest in mathematics is relevant when considering the development of effective learning strategies for mathematics. Eguavon (2012) define mathematics as the gateway to achieving scientific and technological advancement and economic survival. Therefore a country like Nigeria cannot achieve technological advancement without a functional mathematical knowledge. Functional mathematics is an activities based subject and the way it is being taught is important in aiding the students to acquire basic mathematical knowledge, skills and attitude to solving different problem in life. Though mathematics is an important and compulsory subject for all students at the primary and secondary schools in Nigeria and many other countries in the world, researchers found that it is the subject mostly failed by students in both their internal and external examinations in Nigeria due to approaches the mathematics teachers are using (Adetula and Salam, 2017)

Statistics comprises the collection, tabulation, presentation and analysis of an aggregate of facts, collected in a methodical manner without bias and related to predetermine purpose. Statistics are sets of mathematical equations that we used to analyze things. It keeps us informed about what is happening in the world around us. Statistics are important because today we live in the world of information and much information's are determine mathematically by statistics help (Ginga, Usman and Mohammed, 2019). Statistics is relevance in to life of individual and society in the sense that it makes us critical thinkers and good decision makers. Statistics and mathematics are inseparable as average mathematicians are statistically inclines likes statistician are mathematically inclines.

Mathematics teaching demands the teachers using appropriate teaching methods that will give the students opportunity to be actively involved in teaching learning process. Teaching methods can broadly be categorized into two; expository and heuristic.

The expository methods also referred to, as conventional methods are largely teacher centered. The learners passively acquire knowledge as the teacher teaches and the students take notes (Wachanga & Mwangi, 2004). A number of problems have been identified concerning these methods of teaching such as passivity of students, lack of collaborative learning and emphasis on theory. According to Ndukwe (2018) when the teaching method is inappropriate for the level of students, the result is likely to be poor performance and dislike of a subject. The heuristic methods of teaching are learner-centered. These methods are such that the learners are actively involved in the learning process. Learning is through inquiry and it is where flexibility and creativity are encouraged. Co-operative Learning is one such approach that is learner-centered. This approach has an interactive nature of learning which enables the learners to take a more active role in the learning process, take responsibility for their work, be highly effective and develop cognitive skills, and provide enjoyment to the learner.

In co-operative learning approach, students are organized in small teams of three to five members. Each team member, from the fastest to the slowest learner has a contribution to make (Slavin, 2010). Rather than pitting the students against one another in competition for attention and grades, educators can select an appropriate Co-operative learning that effectively complements more conventional teaching styles and addresses their students' needs in terms of good performance (Kajuru, 2010). Using co-operative learning as a teaching approach, the students tutor one another and are likely to acquire greater mastery of the material than in the common individual learning. The current interest in co-operative learning stems from two broad forces; first, the recognition that some learning environments encourage students to compete with one another rather than learning a co-operative fashion. Second, evidence that suggests that cooperative learning, when properly implemented, has the potential for contributing positively to academic achievement.

According to Johnson and Johnson (2017), the way students perceive one another and interact with one another is a neglected aspect of instruction. In co-operative learning, the learner is an active participant in knowledge construction. Research studies done in different subjects and at different levels of learning using co-operative learning have shown that the learning process is activity based and enhances performance (Wachanga & Mwangi, 2004). Co-operative learning approach has the potential for providing a learning environment where learners are engaged in appropriate learning experiences and consequently as aroused the interest of educators. In a cooperative setting, students work together to attain group goals that cannot be obtained by working individually or by working competitively. In such classroom structure, students discuss subject matter, help each other learn, and provide encouragement for members of the group (Johnson et al., 2017). There are many cooperative learning strategies that are designed to achieve different objectives.

Out of the several cooperative learning strategies, the following six strategies had received attention and have been well researched and found to be effective: Learning Together (LT); Group Investigation (GI); Jigsaw Procedure (JP); Student Teams Achievement Divisions (STAD)

); Team Assisted Instruction/Individualization (TAI); and Cooperative Integrated Reading and Composition (CIRC) (Gambari, 2010).

The key elements of cooperative learning include: positive interdependence where each student must believe that they have a key role to play in the group; individual accountability where each student within a group must be accountable for mastery of the instructional content presented; group rewards that entails sufficient incentives for the group to work together; and group training where students cannot be placed together in a group situation and expected to cooperate without their being taught the social skills needed for collaboration (Slavin, 2010).

Competitive learning exists when one student goal is achieved but all other students fail to reach that goal. Competitive learning can be interpersonal (between individuals), or intergroup (between groups), where a group setting is appropriate. This strategy has been described as the most appropriate when students need to review learned material (Griffiths and Podirsky, 2012). However, there have been many criticisms of this type of learning, including promoting high anxiety levels, selfdoubt, selfishness, and aggression. It may also promote cheating and interfere with learners' capacity to problem solve.

Competitive interaction strategy as used in this study is where students work in subgroups. Members of each subgroup work strictly on his/her own, strive to be the best in the subgroup for price or reward.

Gender is the sum total of cultural values, attitudes, roles practices and characteristics based on sex. Sex is the innate biological differences between a man and a woman (Okeke, 2008). Gender influence on students' academic achievement has been of concern to researchers, but no consistent result has been established. In a study conducted by Oludipe (2012) agreed that gender bias is very prevalent in Africa and particularly Nigeria. He argued that in Nigeria, harder tasks are assigned to males while females are given the relatively easy and less demanding tasks. Stefanelli (2006) confirmed that teachers ask boys higher level questions and engage them in conversation in the classroom than girls. This makes girls develop negative attitude and also reduces their motivation to learn science. Gbaje (2007) suggested that teachers should give both boys and girls the opportunity to participate in the learning activities by giving all of them challenging questions while girls should be assigned leadership roles to increase their confidence. This is because girls tend to learn best when they work together while boys learning best when challenged by peers. Therefore this study is designed to examine the effects of Co-operative and Competitive learning strategies on statistics achievement of secondary school students in Gwagwalada Area Council of Federal Capital Territory.

Statement of the Problem

The performance of students in mathematics at secondary school level in Nigeria has been quite unsatisfactory over the years. The poor performance of students in mathematics as a subject has implications on tertiary institution admission because schools no longer produce adequate number of students that passed mathematics at credit level for tertiary admission.

on. This problem was attributed to poor instructional methods and lack of integrating technology into teaching pedagogy. To improve students' performance in mathematics, students must be more active in the classroom and must creatively acquire knowledge, especially in understanding and solving mathematical problems. Students need opportunities to develop, interact, and share with friends through cooperative learning activity.

Research evidence abound that highlight a number of factors responsible for low interest and poor achievement in mathematics. Among the several factors enumerated to account for this poor achievement in mathematics, poor teaching method seem to be a major contributory factor. The neglect of activity-oriented method of teaching has led to abstractness which makes the students less active (passive learners) and more prone to rote memorization. All these factors that affect students' achievement in mathematics have been an area of interest for researchers over the years. Many attempts have been made to improve the learning of the subject such as the provision of a better teaching approach. Many researchers, based on this, advocate the use of self-learning strategies such as co-operative and competitive as a way of enhancing students' achievement and promoting their interest in mathematics. The problem of this study is to investigate the effect of Co-operative and Competitive learning strategies on statistics achievement of secondary school students in Gwagwalada.

Research Objectives

The purpose of this study is to find out the effect of Co-operative and Competitive learning strategies on statistics achievement of secondary school students in Gwagwalada. Specifically, the objectives of the study were to find out the:

- i. Statistics achievement of secondary school students taught with Co-operative learning strategy and those taught with conventional teaching method.
- ii. Statistics achievement of secondary school students taught with Competitive learning strategy and those taught with conventional teaching method.
- iii. Statistics achievement of secondary school students taught with Co-operative and Competitive learning strategies.
- iv. Statistics achievement of male and female secondary school students taught with Co-operative learning strategy.
- v. Statistics achievement of male and female secondary school students taught with Competitive learning strategy.

Research Questions

The following research questions were posed to guide the study:

1. What is the difference between the statistics achievement of secondary school students taught with Co-operative learning strategy and those taught with conventional teaching method?
2. How does the statistics achievement of secondary school students taught with Competitive learning strategy and those taught with conventional teaching method differ?
3. What is the difference between the statistics achievement of secondary school students taught with Co-operative and Competitive learning strategies?

4. How does the statistics achievement of male and female secondary school students taught with Co-operative learning strategy differ?
5. What is the difference between the statistics achievement of male and female secondary students taught with Competitive learning strategy?

Hypotheses

The following hypotheses were formulated and tested at 0.05 level of significance.

- Ho₁:** There is no significant difference between the statistics achievement of secondary school students taught with Co-operative learning strategy and those taught with conventional teaching method
- Ho₂:** There is no significant difference between statistics achievement of secondary school students taught with Competitive learning strategy and those taught with conventional teaching method
- Ho₃:** There is no significant difference between the statistics achievement of secondary school students taught with Co-operative and Competitive learning strategies
- Ho₄:** There is no significant difference between the statistics achievement of male and female secondary school students taught with Co-operative learning strategy
- Ho₅:** There is no significant difference between statistics achievement of male and female secondary students taught with Competitive learning strategy

Significance of the Study

The study is of tremendous benefit to teachers, students, and educational bodies. The study would help mathematics teachers to be more effective in the teaching-learning processes in order to improve in the way they teach by changing their teaching methods (which are usually teacher-centred) to students activities base method, thereby making learning more participatory and interesting in order to produce critically minded students. Students would also gain in simultaneous interaction and constructive competition, when class time is designed to allow students' interactions. The outcome of the study would enable curriculum planners to consider the incorporation of co-operative and competitive methods into mathematics curriculum at the Secondary School (SS) level. Incorporation of the methods into the Mathematics curriculum would allow them to break the syllabus/topics into smaller units that would be easier for students at these levels to comprehend.

Delimitation of the Study

This study aimed at investigating the Effect of Co-operative and Competition learning strategies on achievement in Statistics of secondary school students. The study was carried out in the Federal Capital Territory, Abuja. Specifically, the research was restricted to only public schools in Gwagwalada Area Council of FCT. The choice of public schools was due to their students' population so that competitive will be more effective and they have many arms of the same class, and many students in each class that may not affect the normal class activity. The study was limited to co-educational schools that have SSII class as at the time of this study. The reason for choosing this level of students was that it is a more stable class, in addition to being reasonably exposed to mathematics concept in the senior secondary school syllabus; moreover they are not yet at the stage of writing their external examination.

Methodology

The target population of the study consisted of all SSII students in Public Secondary Schools in Gwagwalada Area Council of FCT Abuja. The total population is 5,783 (Department of Quality Assurance Gwagwalada, Zonal Educational Office, 2021). Adopted for this study was quasi-experimental non-equivalent control group design, which makes use of pre-test, treatment and post-test. The reason for the adoption of this design is based on the fact that students in the class was taught with Cooperative, Competitive, conventional teaching method, in other words, there was no randomization of the students for the treatment. The study used one experimental group and a control group. Students in the experimental group were exposed to either Co-operative or Competitive while the control group was taught with conventional method. Simple random sampling technique was used to select two senior secondary schools for this study.

The two schools have six arms of SSII each and simple random sampling technique was used to select three arms from each school (two for experimental and one for control) for the purpose of this research. Each arm selected was randomly assigned to either experimental (Cooperative or Competitive) and control group. The Cooperative experimental group comprised 64 male and 50 female students; the Competitive experimental group comprised 70 male and 56 female students and the control group comprised 59 male and 53 female students, making a total of 352 students. A Statistics Achievement Test (SAT) was used to collect data for the study. Twenty (20) items of the instrument test the students' knowledge, comprehension, application and analysis level. Each of the 50 items is a multiple-choice objective question with four options (A, B, C, and D). Time allowed was one 30 minutes. The Statistics Achievement Test (SAT) was content validated with the use of a Table of Specification (Test Blueprint) in constructing the test items. Having completed the construction of the SAT, it was face-validated by three experts from Mathematics Education Department of University of Abuja as well as National Mathematical Centre, Abuja. The experts' pieces of advice were adhered to in terms of content relevance of the test items. Corrections and suggestions made by the experts were used to review the SAT. Kuder-Richardson (KR- 21) formula was used to ascertain the internal consistency of the instrument which gave 0.88. The decision to use KR-21 for testing the reliability of SAT was borne out of the fact that the items were not of equal difficulty but of the same level and that one single test scores was used for the reliability. This confirmed a high reliability of the instrument as the correlation coefficient was close to 1.

Both the experimental and control groups were subjected to pre-testing sessions before experiment. After experimental groups were taught with either Co-operative or Competitive learning strategies while the control group was taught with the conventional method. The lesson plan was designed for both groups in line with Co-operative, Competitive learning strategies and conventional method for teachers to use during lesson. Teaching lasted for three weeks covering the whole content of statistics after which a posttest was administered. Data collected were analyzed with respect to the research questions and hypotheses formulated for the study. Descriptive statistics of mean and standard deviation

was used to answer the research questions while ANCOVA statistical tool SPSS version was used to test the hypotheses at 0.05 level of significance.

Answers to Research Questions

Table 1 and Table 2 below give the answers to the set out research questions that guided the study.

Table 1: Mean and Standard deviation of the Group by Method

GROUP (METHOD)	Mean	Std. Error
CONVENTIONAL METHOD	45.038	0.422
COMPETITIVE METHOD	65.370	0.400
COOPERATIVE METHOD	68.757	0.421

Table 2: Mean and Standard deviation of the Group by Gender

GROUP	GENDER	Mean	Std. Error
CONVENTIONAL	MALE	44.998	0.581
	FEMALE	45.078	0.613
COMPETITIVE	MALE	65.115	0.533
	FEMALE	65.625	0.596
COOPERATIVE	MALE	67.874	0.558
	FEMALE	69.639	0.631

Research Question One

It states that what is the difference between the statistics achievement of secondary school students taught with Co-operative learning strategy and those taught with conventional teaching method? Table 1 shows that the mean score of the group taught statistics using cooperative method is 68.757 and that of those taught statistics using conventional method is 45.038. The mean difference is 23.719 in favour of cooperative group.

Research Question Two

It states that how does the statistics achievement of secondary school students taught with Competitive learning strategy and those taught with conventional teaching method differ? Table 1 shows that the mean score of the group taught statistics using competitive method is 65.370 and that of those taught statistics using conventional method is 45.038. The mean difference is 20.332 in favour of competitive group.

Research Question Three

It states that what is the difference between the statistics achievement of secondary school students taught with Co-operative and Competitive learning strategies? Table 1 shows that the mean score of the group taught statistics using cooperative method is 68.757 and that of those taught statistics using competitive method is 65.370. The mean difference is 3.387 in favour of cooperative group.

Research Question Four

It states that how does the statistics achievement of male and female secondary school students taught with Co-operative learning strategy differ? Table 2 shows that the mean score of male students in the group taught statistics using cooperative method is 67.874 and that of female students in the group taught statistics using cooperative method is 69.639. The mean difference is 1.765 in favour of female students in the group.

Research Question Five

It states that what is the difference between the statistics achievement of male and female secondary students taught with Competitive learning strategy? Table 2 shows that the mean score of male students in the group taught statistics using competitive learning strategies is 65.115 and that of female students in the group taught statistics using competitive learning strategies is 65.625. The mean difference is 0.510 in favour of female students in the group.

Testing of Hypotheses

Table 3: Analysis of Covariance (ANCOVA) of Students taught Statistics with Cooperative Strategies, Competitive Strategies and Conventional Method

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	37298.369 ^a	6	6216.395	312.368	.000
Intercept	9607.390	1	9607.390	482.762	.000
pretest	.619	1	.619	.031	.860
group	37195.515	2	18597.757	934.518	.000
gender	53.561	1	53.561	2.691	.102
group * gender	43.168	2	21.584	1.085	.339
Error	6865.810	345	19.901		
Total	1309325.000	352			
Corrected Total	44164.179	351			

a. R Squared = .845 (Adjusted R Squared = .842)

b. Dependent Variable: POSTTEST

Table 3 shows that there is no significant difference in the achievement of the three groups of students in the pretest scores, P-value = 0.860, which is greater than 0.05 level of significance. This shows the homogeneity of the three groups before intervention.

Test of Hypotheses: Ho₁, Ho₂ and Ho₃

Also, from Table 3, method as a main factor shows that there is significant difference in the mean scores of the students taught statistics using cooperative, competitive and conventional method. P-value = 0.000, which is less than 0.05 level of significance indicate. Therefore, Ho₁, Ho₂ and Ho₃ are rejected respectively.

Test of Hypotheses: Ho₄ and Ho₅

Table 3, gender as a main factor shows that there is no significant difference in the mean scores of male and female students taught statistics using cooperative, competitive and conventional

method. P-value = 0.102, which is greater than 0.05 level of significance indicate. Also, interaction effect of group achievement by gender indicated that gender does not influence achievement in statistics but only the method. P-value = 0.339 which is greater than 0.05 level of significance, therefore, **Ho₄** and **Ho₅** are accepted respectively.

Summary of Major Findings

The major findings of this study were as follows:

1. Students exposed to cooperative teaching strategy significant achieve in statistics than their counterpart in the conventional method.
2. Students exposed to competitive teaching strategy significant achieve in statistics than their counterpart in the conventional method.
3. Students exposed to cooperative teaching strategy significant achieve in statistics than their counterpart exposed to competitive teaching strategy.
4. There was no significant effect of the interaction of teaching method and gender on the statistics achievement of students exposed to cooperative teaching strategy
5. There was no significant effect of the interaction of teaching method and gender on the statistics achievement of students exposed to competitive teaching strategy.

Discussion of Findings

The data presented in Table 1 and Table 2 provided answer to research questions; and the findings revealed that the cooperative group had a mean score of 68.757 with a standard error of 0.421; competitive group had a mean score of 58.370 with a standard error of 0.400 while those in the conventional group had a mean score of 45.038 with a standard error of 0.422. This indicates that students in the experimental group 2 had a higher mean score than their counterparts in the control group. The result of ANCOVA as reported in Table 3 showed that there was a statistically significant difference between achievement of students exposed to cooperative pedagogy and those exposed to the conventional method. The finding confirms that of Slavin, (2012) whose findings indicated that, the use of cooperative strategies fostered their social capital and assisted in building their knowledge via the collaboration than students in the conventional group. Also, there was a statistically significant difference between achievement of students exposed to competitive pedagogy and those exposed to the conventional method. The finding confirms that of Sunday and Tanko (2018) whose findings indicated that, the use of competitive strategies fostered their independence and self-development in building their knowledge via the pace development than students in the conventional group.

The result of ANCOVA as reported in Table3 revealed that there was no statistically significant difference in the mean achievement scores of male and female students exposed to the cooperative strategies. The reasons for the non-significant difference in the male and female students exposed to cooperative strategies could be due to the fact that both sexes collaborated very well in the process of learning and no gender dominated during class activities classroom are gender-friendly. This finding is in line with the conclusion of (Okeke, 2008) that suggested that teachers should see gender as only the biological difference,

and not the ability difference. Also, there was no statistically significant difference in the mean achievement scores of male and female students exposed to the competitive strategies. This finding is in line with the conclusion of Gbaje (2007) that suggested that teachers should give both boys and girls the opportunity to participate in the learning activities by giving all of them challenging questions while girls should be assigned leadership roles to increase their confidence.

Conclusion

From the findings of the study, the following conclusions could be drawn: Students learn statistics better when taught with cooperative and competitive learning strategies than conventional method this may be because collaboration builds borrowed ideas, and competition breeds the enthusiasm and development of discovered innate ability in students learning. Both methods are good for teaching students statistics and are not gender biased. Only that, cooperative learning strategies should be more encouraged among learners of various abilities.

Recommendations

Based on the results and findings of this study, the following recommendations were made:

1. Mathematics teachers should be encouraged to use either cooperative or competitive approach to teach statistics.
2. For students to achieve maximally, conventional method should not be used to teach statistics to students in secondary school level.
3. School authorities should make arrangement with resource persons who are knowledgeable on how to apply competitive or cooperative approach so that such valuable knowledge can be passed on to their statistics teacher.
4. Cooperative strategies should be encouraged as it increases the overall achievement of the students in statistics than other method compared.

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