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EFFECTIVENESS OF COOPERATIVE LEARNING STRATEGY ON STUDENTS' ATTITUDE TOWARDS MATHEMATICS IN SECONDARY SCHOOLS IN MERU SOUTH SUB-COUNTY, KENYA

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ABSTRACT

Achievement in Mathematics at Kenya Certificate of Secondary Education (KCSE) examinations has been poor over the years. The low achievement has partly been blamed on teaching methods which do not actively involve learners in the learning process depriving them of taking charge of their learning. The aim of this study was to investigate the effectiveness of cooperative learning strategy in enhancing students' attitude in Mathematics in secondary schools in Meru South Sub-County. The study employed the Solomon Four-Group, Non-equivalent Control Group Design. The target population for the study was 2430 form three students in 44 co-educational secondary schools in Meru South Sub-County. The sample comprised of 164 form three students from four co-educational schools within the Sub-County. Random sampling was used to select the four schools from a list of prequalified schools. Prequalification was done based on number of students, students' entry behaviour, availability of teaching/learning resources and teachers' qualification. Simple random sampling technique was used to assign participating schools to experimental and control groups. A Mathematics Achievement Test (MAT) and Students' Attitude Questionnaire (SAQ) was administered to assess the students' achievement and attitude towards Mathematics. The instruments were piloted in Maara Sub-County in a co-educational secondary school with similar characteristics as the sampled schools. The reliability of the research instruments was estimated using Cronbach's Alpha. A reliability coefficient of 0.82 for SAQ and 0.79 for MAT was obtained. Validity of the instruments was ensured through expert judgment. Data was analyzed using both descriptive and inferential statistics. The difference between group means was checked for statistical significance using t-test, ANOVA and ANCOVA. The hypotheses were tested at α=0.05 significance level. Means were separated using Least Significant Difference (LSD) pair wise post-hoc comparisons. The study found that cooperative learning strategy was more effective than conventional teaching in enhancing students' attitude towards Mathematics in secondary schools.

Key words: Cooperative learning, Conventional teaching, Mathematics

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INTRODUCTION

Mathematics is a very important subject in an individual's daily life (Polya, 2011). Jebson (2012) notes that knowledge of Mathematics is required for science and technological advancement and attainment of the Millennium Development Goals (MDGs) on eradication of extreme poverty and hunger, reduction of child mortality, improvement of maternal health and combating of HIV/AIDS, malaria and other diseases. According to Umameh (2011), Mathematics education is bedrock and an indispensable tool for scientific, technological and economic advancement of any nation. Mathematics permeates the whole society and its use seems to assume ever increasing importance as the society advances technologically. Mathematics skills and thinking are therefore not prerogative of scientists, engineers and technologist only, but they are used in everyday decision making by people (Azuka, 2000).

In order to bring desirable change in students learning, teaching methods used by educators should be best for the subject matter (Adunola, 2011). According to Zakaria, Chin and Daud (2010), teaching should not merely focus on dispensing content for students to memorize, but should also actively involve students as primary participants. Oloo, Mutsotso and Masibo (2016) indicated that for effective acquisition of mathematical skills, teachers should use heuristic methods as much as possible so as to involve the learners and keep them interested in the subject. Other factors contributing to poor achievement in Mathematics include inadequate teaching and learning facilities, acute shortage of trained personnel and lack of text books (SMASSE, 2007).

In Mathematics, teaching techniques have been identified as one of the contributory factor that determines performance and attitude towards the subject (Fasasi, 2009). This low achievement may therefore be linked to the wide use of teacher centered methods of teaching.

Attitudes are general evaluations people hold in regard for themselves, other people, object, and issues (Petty & Cacioppo,1986). Hart (1989), defines an individual's attitude towards Mathematics as a more complex way by the emotions that he/she associates with Mathematics, his/her beliefs towards Mathematics, which could be either positive or negative and how he/she behaves towards Mathematics. Attitudes are acquired through learning and can be changed through persuasion using variety of techniques. Once established, attitudes help to shape the experiences the individual has with object, subject or person. Although attitude changes gradually, people constantly form new attitudes and modify old ones when they are exposed to new information and new experiences (Adesina & Akinbobola, 2005). To change attitudes, the new attitudes must serve the same function as the old one. Instructional design can create instructional environments to effect attitude change (Greenwald, 1989).

Borich (2004) argues that our attitudes and values are among the most important outcomes of schooling. They provide the framework for guiding our actions outside the classroom. Attitudes

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and values of learners are formed through social interaction. Furthermore, most of our attitudes and values are formed by discussing what we know or think with others and this exchange shapes our views and perspectives. Chacko (2000) observes that the kind of attitude the student has will affect learning, thereby determine their success in that subject. In assessing Mathematics performance and potential of students, attitude towards Mathematics and Mathematics learning are frequently cited as factors contributing to success (Sabita & Mofidul, 2001). Studies have shown that positive attitudes are conducive to good performance.

According to Akinsola and Olowojaiye (2008), a student's constant failure in a subject and Mathematics in particular can make him to believe that he can never pass in the subject thus accepting defeat. On the other hand, his successful experience can make him to develop a positive attitude towards learning the subject. This suggests that student's attitude towards Mathematics could be enhanced through effective teaching strategies. Research by Bekee (1987), Balogun and Olarewaju (1992), Akinsola (1994), Akale (1997) and Olowojaiye (2000) has confirmed that effective teaching strategies can create positive attitude on students towards school subjects. Further, according to Butty (2001), studies investigating the relationship between instructional practices and students' attitude toward Mathematics report that classroom organization and instructional variables correlates more strongly with students' achievement, while measures of teachers' personal qualities correlate higher with students' attitudes towards Mathematics.

Several studies in Mathematics have shown that instruction, especially at the secondary school level remains overwhelmingly teacher-centered, with greater emphasis being placed on lecturing and textbook than on helping students to think critically across subject area and applying their knowledge to real world situation (Butty, 2001). In view of this, practices such as individual exploration, peer interaction and small group work each of which emphasizes the use of multiple approaches to problem solving, active student inquiry, and the importance of linking Mathematics to students' daily life should be adopted (Butty, 2001). This shift from traditional to reform-based instructional practices in Mathematics requires examination of the effects and relationship among types of instructional practices that students receive and their resulting achievement and attitudes towards Mathematics.

According to Cornel (1999), Studies related to instructional practices and academic achievement have suggested that the quality of teachers' instructional messages affects learners' task involvement and subsequent learning in Mathematics. It is therefore necessary for teachers to appreciate and inculcate in students positive attitude towards Mathematics through use of improved and appropriate instructional strategies. This is likely to improve the poor performance in science and Mathematics, which has over the years been partly blamed on negative attitude.

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Research has shown that the use of cooperative learning improves students'attitude and achievement in science through development of higher-level thinking skills, increase in content retention and fostering of teambuilding (Akinbobola, 2004; Elvis, 2013). Cooperative learning is a teaching strategy in which small teams, each with students of different levels of ability, use a variety of learning activities to improve their understanding of a subject (Ronsini, 2000). However, there is little understanding on how cooperative learning can improve students' achievement and attitude towards Mathematics and thus there is need to determine its effectiveness on students' achievement and attitude in Mathematics. It is against this background that this study sought to establish the effectiveness of cooperative learning strategy in enhancing students' achievement and attitude in Mathematics among secondary school students in Meru South Sub-County.

METHODOLOGY

The study employed Solomon Four-Group, Non-equivalent Control Group Design. Borg and Gall (1989) hold that this design is rigorous enough for experimental and quasi-experimental studies. It combats many internal validity issues that can affect research so that the observed effect on the dependent variable can be attributed solely to the treatment and allows the researcher to exert complete control over the variables and to check that the pretest does not influence the results (Shuttleworth, 2009). Through this design, intact classes were randomly assigned to four groups. Intact classes were used because school authorities do not allow classes to be reconstituted for research purposes. The design is illustrated below.

Group 1	O1	X	O2
Group 2	O3	–	O4
Group 3	–	X	O5
Group 4	–	–	O6

In this design, group 1 was the experimental group that received the pre-test (O1), the treatment (X), and the post-test (O2). Group 2 was the control group that received the pre-test (O3), post-test (O4), but no treatment. Group 3 on the other hand was the experimental group that received the treatment (X), post-test (O5), but no pre-test. Group four was the control group that received the post-test (O6) only. The post-test O5 and O6 are meant to rule out any interaction between testing and treatment. The groups' equivalence were assessed before the start of the experiment through the use of pre-test. The experimental and control groups were from different schools to avoid experimental contamination as a result of interaction by respondents.

The design may however not control for those threats associated with interaction of selection and history, selection and maturation, as well as selection and instrumentation (Cook & Campbell

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1979). According to Barchok (2011), the researcher can endeavor to control these threats by randomly assigning participating schools to the control and treatment groups and keeping as similar as much as possible across the schools, the conditions under which the instruments will be administered. A common manual on cooperative learning was used to train teachers in experimental groups on the use of cooperative learning strategy to ensure uniformity in exposure of students to the strategy. Teachers involved in the study also adopted a common scheme of work for the topic of Trigonometry (2) to ensure the content is uniformly covered for all the groups in the study. To control maturation as a threat to internal validity, students in form three, assumed to be of approximately of the same age were used in this study.

The study was conducted in Meru South Sub-County, Tharaka Nithi County, Kenya. Singleton (1993) notes that an ideal reason for the setting for any study should be the existence of a problem that the study hopes to generate solutions for. The study location was chosen because it had been established that students' achievement in Mathematics in national examinations in the Sub-County had been poor.

The target population for the study was 2430 form three students in 44 co-educational secondary schools in Meru South Sub-County (Meru South Sub-County Education Office, 2015). Since the study considered the aspect of gender in performance, co-educational schools were the most suitable for the study. Co-educational schools accounted for 83% of all the secondary schools in the Sub-County enrolling majority of the students in the Sub-County.

Co-educational secondary schools formed the sampling frame for this study. The researcher first prequalified the schools to ensure similarity in their characteristics. Prequalification was done based on number of students, students' entry behaviour, availability of teaching/learning resources and teachers' qualification. Four co-educational schools were then selected randomly from the list of prequalified schools. The assignment of selected schools to either experimental or control group was done by simple random sampling. In cases where the selected school had more than one stream, all the streams were involved in the study, but random sampling was used to select one stream for analysis. Mugenda and Mugenda (2003) hold that for experimental studies, at least 30 cases are required per group. The sample size for this study was 164 students as shown in Table 1.

Table 1

Number of Students per Group in the Study Sample

Groups	Number of Students
Experimental (1)	39
Control (2)	49

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Experimental (3)	32
Control (4)	44
Total	164

INSTRUMENTATION

The study used Mathematics Achievement Test (MAT) for data collection. The researcher developed the MAT comprising of 6 questions on the topic of Trigonometry (2). MAT was used as a pre-test to measure students' achievement in Mathematics. It was then adjusted for use as a post-test. Students Attitude Questionnaire (SAQ) was adopted from Tapia and Marsh (2004) and modified to suit the study. It contained forty items of five point-likert scale designed to measure the level of attitude and interest towards learning of Mathematics.

RESULTS

The study sought to examine whether there was any statistically significant difference in attitude towards Mathematics between students exposed to cooperative learning and those exposed to conventional teaching methodsin secondary schools in Meru South Sub-County. Table 14 shows the post-test mean scores of the four groups involved in the study.

Table 2

SAQ Post-test Mean Scores Obtained by the Four Groups

Group	N	Mean	Maximum Score	Std. dev
Experimental 1	39	120.0	200	2.33
Control 2	49	100.0	200	5.11
Experimental 3	32	125.0	200	3.12
Control 4	44	95.0	200	6.41

The results in Table 2 show that experimental groups 1 (120) and 3 (125) had higher mean scores compared to control groups 2 (100) and 4 (95). This implies that the achievement of the experimental groups was higher than that of the control groups in the SAQ post-test. In order to establish whether the difference in the mean scores of the four groups was statistically significant, a one way ANOVA was run. The results are presented in Table 3.

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Table 3

ANOVA of Post-test Scores on SAQ

	Sum of Squares	df	Mean Square	F	Sig
Between groups	335.210	3	25.222	5.621	.000
Within groups	423.011	161	5.642		
Total	758.221	164			

The results in Table 3 show that the differences in the post-test mean scores of the four groups were statistically significant at α=0.05 significance level ($F(3,161) = 5.621$, $p<0.05$). To determine where the groups differed, the LSD post hoc comparison was conducted. The results are presented in Table 4

Table 4

LSD Post Hoc Comparisons of Post-test on SAQ Group Means based on ANOVA

(I) Group	(J) Group	Mean Difference (I-J)	P-Value
1	2	-2.33702*	.000
	3	-3.11329	.074
	4	-8.25151*	.000
2	1	2.33702*	.000
	3	-2.85211*	.010
	4	-4.21357	.065
3	1	3.11329	.074
	2	2.85211*	.010
	4	-2.45441*	.000
4	1	8.25151*	.000
	2	4.213857	.065
	3	2.45441*	.000

* The mean difference is significant at α=0.05 significance level.

The LSD test revealed that there was significant difference between groups 1 and 2, 1 and 4, 2 and 3, and 3 and 4. It was also found that the differences between groups 1 and 3, and 2 and 4 were not statistically significant at α=0.05 significance level. From Table 4, it is evident that SAQ post-test mean scores of experimental groups 1 and 3 were significantly higher than those of control groups 2 and 4. Therefore, $H_0 2$ was rejected.

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DISCUSSION

The researcher sought to establish whether there was any statistically significant difference in attitude towards Mathematics between students exposed to cooperative learning and those exposed to conventional teaching methods. The study established that the students exposed to cooperative learning exhibited more positive attitude towards Mathematics than those taught through conventional teaching methods. This is because students in the Experimental group 1 and 3 achieved significantly higher in the SAQ in comparison to those in Control groups 2 and 4.

The findings of this study are in agreement with Akinsola and Olowojaiye (2008) study that found out that students' attitude towards Mathematics could be enhanced through effective teaching strategies. Another study by Olowojaiye (2000) confirmed that effective teaching strategies can create positive attitude on students towards school subjects. Studies investigating the relationship between instructional practices and students' attitude towards Mathematics report that classroom organization and instructional variables correlate more strongly with students' achievement, while measures of teacher's personal qualities correlate higher with students' attitude towards Mathematics (Butty, 2001).

Studies by Effandi, Chung and Yusoff (2010) found out that cooperative learning strategy enhances students' attitude towards Mathematics. Similarly, Brush (1997) established that when cooperative learning strategy was used, students in the Experimental group showed more positive attitude towards Mathematics than those in the Control group. However, the results of this study disagree with Tarim and Akdeniz (2008) study that found no significant difference regarding students' attitude towards Mathematics when cooperative learning strategy was used.

Despite that some studies found no significant difference in students' attitude when cooperative learning strategy was used, evidence from this study suggests that the strategy was more effective than conventional teaching in enhancing students' attitude towards Mathematics in secondary schools.

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