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## RESEARCH ARTICLE

## Peer Instruction and Secondary School Students Attitudes Towards Vectors in Bungoma County; Kenya

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### Abstract

The purpose of this study was to document the influence of peer instruction on students attitude towards vectors. It was guided by the social learning theory propounded by Bandura (1977). The study used an after only with control experimental design. The design was chosen because it is objective, logical and a systematic method that can be used to demonstrate the influence of peer instruction on attitude. The form three class in public secondary schools was the target population. Multi stage sampling was used to select 479 students from 16 schools who participated in the study. Streams were randomly assigned to either the control or the experimental treatment groups. The treatment took place over a duration of three weeks following which a questionnaire was used to collect data from the sampled students. The study found that more students in the experimental treatment groups indicated positive attitude than in the control treatment groups. This means that more students exhibit a positive attitude towards learning vectors when they are instructed via peer instruction than when conventional methods are used. It is recommended that teachers adopt the use of peer instruction so that learners can develop a positive attitude towards vectors and by extension towards mathematics.

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## INTRODUCTION

### 1 Background to the Study

Attitude of students towards mathematics has been shown to be closely related to and to influence performance in mathematics (Frost et al, 1994; Iben, 1991; Nyala, 2008). Negative attitude towards mathematics is a contributing factor towards poor performance. (Nyala, 2008). A base line survey by Strengthening Mathematics and Science Education (SMASSE), revealed that students had a negative attitude towards vectors (SMASSE, 2008). The Kenya institute of Education (KIE) outlines one of the objectives of teaching mathematics is to enable the learners acquire a positive attitude in it (KIE, 2004). Studies that relate an instructional approach to acquisition of positive attitude in a specific topic are few (Tokgoz, 2007, Unpublished Dissertation). Similarly, studies on how the method of instruction influences attitude in mathematics are limited (Armstrong, 2012).

### 2. Purpose of the Study

The purpose of this study was to document the influence of peer instruction and conventional methods of instruction on students attitude towards vectors. The study investigated the attitude towards vectors of learners taught vectors using peer instruction and those taught by conventional methods. From the objective it was hypothesized that there was no difference in attitude towards vectors by learners taught using peer instruction and those taught by conventional methods.

### **3. Theoretical Framework**

The study was guided by the social learning theory (SLT) advanced by Bandura (1977). This was because peer instruction leans heavily on the social element in learning. SLT stipulates that the interaction of personal and cognitive factors as well as the environment influence learning. The peer instruction learning environment exposes tutees to mathematics learning activities through tutors modeling positive attitude. Peers are the preferred models because according to Armstrong, 2012 people learn more from a model similar to them. Peer instruction presents the tutees with ample opportunity to practice solution strategies to mathematics problems in a conducive environment facilitating not just mastery of content but formation of positive attitude towards mathematics learning activities.

### **4. Research Methods**

The study adopted an after only with control experimental design. The design was chosen because it is objective, logical and a systematic method used to demonstrate the influence of peer instruction on achievement. It was also capable of being verified. The study used two groups of which the experimental group was instructed by peer instruction and the control group by conventional methods.

The study was conducted in Bungoma County in western part of Kenya along the Kenya-Uganda Boarder. It is a densely populated region with many schools within a walking distance of one another. It has two rainy seasons receiving rain almost every afternoon during the long rain season. It has been noted that afternoon lessons are usually disturbed by noise from the rain as some of the classrooms have tin roofs and lack ceiling boards. Within the county we have different school categories such as Boy's, Girl's and Co-educational schools. Despite posting impressive results in National examinations, performance in mathematics has remained poor.

### **5. The Target Population**

The form three class is comprised of students in the third year of the secondary cycle of the 8-4-4 system of education. There are about 4200 form three students in the county which was selected because of their relevance to the topic of investigation. They have covered vectors I in form 2 which is prerequisite knowledge to vectors II on which the peer instruction model was designed.

Multi stage sampling technique was used to select the participants. Sampling with probability proportional to size was used to select 16 schools from three strata. Where more than one stream existed in a school, simple random sampling was used to select one stream to participate in the study. Random assignment was used to determine which stream went to which treatment group hence, of the 479 students sampled, 240 were in the control treatment group and 239 in the experimental treatment group.

### **6. Data Collection Instrument.**

The researcher developed a questionnaire which had 10 items on a five point Likert type scale to collect data from students. The respondents were required to rate statements reflecting their attitude towards vectors. It comprised both negative and positive worded items. Depending on the nature of the items in the questionnaire, different scoring formats were used. Strongly agree = 5, Agree = 4, Undecided = 3, Disagree = 2, Strongly disagree = 1. For negatively framed questions the reverse scoring order was applied. For each questionnaire an overall attitude score was obtained. The minimum attitude score that a student could attain was 10 and the maximum was 30. A score in the range 24-30 was indicative of positive attitude, 17-23 indicative of moderate attitude and 10-16 was indicative of negative attitude. From these scores tallies were made and frequencies used to calculate percentages. The statistical package for social sciences (SPSS version 12.0) was used to compute frequencies, percentages and chi-square.

One school in Bungoma county (left out in the actual study) with an enrollment of 40 students was conveniently sampled for piloting of the instrument. Piloting was done to determine whether the time allocated for the questionnaire was adequate and to observe whether the learners understood the instructions on the questionnaire. The test-retest technique was used to determine reliability and a reliability coefficient of 0.85 confirmed that the questionnaire was reliable.

### **7. The Treatment**

The treatment groups covered vectors via peer instruction while the control groups covered it by conventional methods. The treatment was spread over a duration of three weeks, equivalent to about 14 peer instruction hours for each class. This allowed the learners adequate time for practice to internalize each concept before moving on to the next section. During the experiment, the researcher occasionally participated in the classroom activities in the experimental schools to ascertain that the peer instruction model of learning was being used as prescribed. The researcher also visited the classrooms in the control schools and ascertained that the peer instruction model was not used. The peer instruction model was a sequence of student classroom activities to be carried out by peer groups during the study period. Different students were given opportunities to be tutors during the study period. The peer group members were encouraged to critique the work and contribute towards accomplishing the task.

## 8.Data Analysis and Presentation

Of the 479 participants in the study, 239 were in the experimental treatment group and 240 in the control group. 158 were from boys schools, 167 from co educational schools and 154 from girls schools. The instrument yielded quantitative data which was analyzed using descriptive and inferential statistics. From the learners attitude scores, percentages were calculated and presented in Table 1.

Table 1: Percentages of Students' Attitude by Group

Attitude / Treatment group	Negative	Moderate	Positive
Experimental	1.7%	2.5%	45.7%
Control	5.6%	19.4%	25.1%

Table 1 shows that the number of students that indicated negative attitude in the control study units is greater than the number of students in the same range in the experimental study units. The number of students in the experimental study units that indicated a positive attitude is greater than the number of students in the same range in the control study units. This indicates that, of the learners with negative attitude, majority of them were instructed via conventional methods. Of the learners with positive attitude majority of them were instructed via peer instruction. To establish the validity of the null hypothesis the chi square test was done and the results presented in Table 2.

Table 2: Contingency Table for Attitude by Group

Attitude /Treatment Group	Negative	Moderate	Positive	Total
Experimental	8 (17)	12(52)	219 (169)	239
Control	27(18)	93(53)	120 (170)	240
Total	35	105	339	479

note: The figures in parenthesis are expected frequencies

$$\chi^2 = 99.17 \text{ df} = 4$$

The Chi square value indicated that there was a relationship between the method of instruction and the students attitude towards vectors. On the strength of these findings the hypothesis ' there was no difference in attitude towards vectors by learners taught using peer instruction and those taught by conventional methods' was rejected.

## 9. Discussion of Findings

This study reported that more students exhibit a positive attitude towards learning vectors when they are instructed via peer instruction. Similarly, Longaretti et al. (2002) posits that, after participating in the small peer led collaborative groups, students who previously had negative attitude towards mathematics changed completely. Mynard and Almarzouqi, (2006) reports, after the students engagement in peer group activities the attitude of the students improved. Van de Wale, (2014) holds that peer instruction, inspires positive feeling, desire to learn, improved reasoning and cognitive perception. Armstrong, (2012) also reports improved students attitude in terms of self confidence, interest, enjoyment, self concept for learners under PI. In their study they found a gender difference that favors males. This study recorded improved attitude for learners but no comparison was made by gender. Hedin, (2007) documented reasons for the introduction of peer instruction. It was most useful for, problematic students because it helped them acquire a positive attitude towards school. Similarly in this study it is documented that peer instruction enables students acquire a positive attitude towards vectors and by extension to school.

## 10. Conclusion

The study found that peer instruction had a marked positive influence on students attitude towards vectors than when conventional methods were used.

## 11. Recommendations

From the findings, it is recommended peer instruction be used in the teaching of vectors and by extension mathematics to enable learners acquire a positive attitude hence improve their achievement.

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