

Attitudes towards Mathematics as a Predictor of Students' Motivation to Learn among High School Students in Laikipia County Kenya

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Abstract: This study examined the influence of students' attitudes toward mathematics on motivation to learn mathematics among high school students in Laikipia County, Kenya. The study was guided by Keller's ARCS model of motivation. Descriptive survey research design was used in the study. The target population consisted of all 8357 Form Four students in Laikipia County. Simple random sampling was employed to select the sample schools, sample classes, and respondents. A sample of 392 students (i.e., 216 males and 176 females) was selected for the study using Krejcie and Morgan's table of sample sizes. A self-administered questionnaire was used for data collection. Cronbach's alpha was used to determine the reliability of research instruments. Motivation to learn (MTL) had a reliability coefficient of 0.95, while attitude toward mathematics (ATM) had a coefficient of 0.97. Data was analyzed using t-test and simple regression analysis. The results revealed that: (i) there is a significant gender difference in attitudes towards mathematics favoring male students, and (ii) students' attitudes had a significant influence on students' motivation to learn mathematics. The study concludes that: (i) mathematics teachers should put more effort to ensure that all students regardless of gender have similar attitudes toward mathematics and (ii) mathematics teachers should avoid negative attitude influence practices and also apply appropriate motivational techniques to improve students' motivation toward mathematics.

Keywords: Attitudes toward mathematics, gender, motivation to learn

I. INTRODUCTION

Mathematics is an indispensable tool for the advancement of science and technology, and without developments in science and technology, no country can make meaningful progress in improving the quality of life of its people (Cockroft, 1982). Furthermore, mathematics as a discipline is applied in most other disciplines such as finance and commerce. Mathematics takes a significant position in human civilization as a medium of social function in our everyday life (KICD, 2019). The social functions of mathematics includes buying, selling, banking, counting among others.

In Kenya, there is a great reliance on its human resource power to meet the challenges of the technological developments and a substantial core of mathematics is needed to prepare students for their involvement in those challenges (KICD, 2019). Furthermore, those students who understand and can do mathematics will have significantly enhanced

opportunities and options for shaping their future (Bandura et al., 2001). KICD (2019) has put it clearly that mathematics is a vehicle of development and improvement of a country's economic development. Moreover, KICD argues that by learning mathematics, learners develop understanding of numbers, logical thinking skills and problem solving skills. Therefore, it has been made compulsory subject in primary and secondary levels of schooling in Kenya.

Despite the prominence laid in mathematics, poor performance in the subject has been consistent as reflected in the Kenya Certificate of Secondary Examinations (KCSE). Statistics of the Kenya National Examinations Council (KNEC, 2020) indicate a national grand mean score of 2.630, 3.161, 3.205, and 3.385 from the year 2016 to 2019 respectively (where maximum mean score is 12 points). The recurring poor performance in mathematics experienced nationally is also registered in the KCSE results for Laikipia County as depicted in Table 1.

Table 1: KCSE mathematics mean performance by Gender from 2016 to 2019 in Laikipia County

Year	Boys	Girls	Overall
2016	2.859	2.699	2.779
2017	3.350	3.123	3.236
2018	3.560	3.322	3.441
2019	3.739	3.459	3.599

Note: mean ranges from 0 to 12

Source: KNEC (2020).

The KCSE mathematics performance seen in Table 2 indicates poor performance in Laikipia County. This is evidence of poor mathematics performance in the County and the performance can be attributed to students' level of motivation to learn among other factors. Infact, psychologists believe that motivation is a necessary prerequisite in learning (Biehler & Snowman, 1997; Brophy, 2004; Ormrod, 2006; Stipek, 1998). It is believed that satisfactory school learning is unlikely to take place in the absence of sufficient motivation to learn (Brophy, 2004; Stipek 1998)

Motivation to learn can either be intrinsic or extrinsic (Biehler & Snowman, 1997; D'amico Snowman & Schimd, 1997; Huit, 2001; Lefrancois, 1997, Ormrod, 2006; Stipek, 1998). An

individual with an intrinsic motivation undertakes an activity for its own sake, for the enjoyment it provides, the learning it permits or the feelings of accomplishment it evokes (Stipek, 1998). In Stipek's view, those with an extrinsic motivation perform an activity in order to obtain some reward such as grades, approval or privileges or to avoid some punishment external to the activity.

In Laikipia County, despite the poor performance in mathematics, there is lack of information on the influence of students' attitudes in the learning of mathematics. Specifically, the influence of students' attitudes toward mathematics on motivation to learn has received no attention. This is a great omission.

Attitudes can be seen as positive or negative. A positive attitude toward mathematics reflects a positive emotional disposition towards the subject, and in a similar way, a negative attitude towards mathematics relates to a negative disposition (Mata, Monteiro, & Peixoto, 2012). These emotional dispositions have an impact on an individual's behavior, as one is likely to achieve better in a subject that one enjoys, the one that they have confidence in or finds useful (Eshun, 2004). For this reason positive attitude towards mathematics are desirable since they may influence one's willingness to learn and also derive the benefits one can desire from mathematics instruction (Eshun, 2004). Indeed, Ajisukmo and Saputri (2017) found a significant correlation between attitude towards mathematics and students' mathematics achievement as well as between attitude toward mathematics and metacognitive skills.

In regard to gender, mathematics is usually considered as a male domain in which boys are higher achievers both in terms of attitudes (Eshun, 2004; Mata, Monteiro & Peixoto, 2012) and self-efficacy (Bandura et al. 2001). Contrary to this, findings show that mathematics school achievement do not differ significantly between boys and girls (Scafidi & Bui, 2010). Some studies have shown girls outperforming boys (e.g., Stevens, Wang, Olivarez & Hamman, 2007), while others find boys outperforming girls (e.g., Preckel, Goetz, Pekrun, & Kleine, 2008).

In the current study it is hypothesized that students' attitudes towards mathematics has no influence on students' motivation to learn the subject. The four dimensions of motivation to learn that is the focus of this study are: (i) attention (A), (ii) relevance (R), (iii) confidence (C) or expectancy for success, and (iv) satisfaction (S) in the learning process (Brophy, 2004; Driscoll, 2005; Keller, 1999, 2006). In Laikipia County, empirical evidence on the relationship between students' attitudes and motivation to learn mathematics is lacking, hence the need for this study.

II. OBJECTIVES OF THE STUDY

The objective of this study is to determine the influence of gender and students' attitudes toward mathematics on motivation to learn mathematics in Laikipia County, Kenya.

III. NULL HYPOTHESES.

(All hypotheses are to be tested at .05 level of significance).

H_{O1} : There are no statistically significant gender difference in attitudes toward mathematics among secondary school students.

H_{O2} : There is no statistically significant influence of students' attitudes toward mathematics on students' motivation toward mathematics among secondary school students.

IV. METHODOLOGY

Descriptive survey research design was employed in this study. The target population was 8357 Form Four students from 113 secondary/high schools in Laikipia County. This category of students was selected because they have covered most of the content in secondary school mathematics syllabus and also they are mature enough to form independent opinion in mathematics.

The respondents were drawn from twenty (20) randomly selected public high schools in Laikipia County. Simple random sampling was employed in selection of schools, sample classes and respondents. The sample comprised of 392 students (i.e., 276 males and 176 females) randomly selected from the sample classes. The sample size was determined by the Krejcie and Morgan's (1970) table of sample sizes.

V. INSTRUMENTATION

In the study, the Students' Motivation to Learn (MTL) scale (Keller, 2006) and students' Attitude Toward Mathematics (ATM) scale (Tapia, 2004) were used. The MTL consisted of 34 items. Twenty five items were positively worded and nine items were negatively worded. The items were scored on a five-point scale from strongly disagree (1) to strongly agree (5). The scoring for negative items were reversed. Keller (2006) reported on alpha coefficient of 0.95 for the scale. The ATM scale had 40 items presented in form of positive and negative statements (Tapia & Marsh, 2004), and the responses were scored on a five point scale from strongly disagree (1) to strongly agree (5). The scoring for negative items were reversed. The alpha reliability for ATM scale was 0.97 (Tapia & Marsh, 2004).

VI. DATA ANALYSIS

The t-test, Pearson's correlation coefficient (r), and simple regression analysis were used in data analysis.

VII. RESULTS

The results of data analysis are presented in the following tables (i.e., Tables 1, 2 and 3):

Table 1: t-test for the mean scores of male and female students in attitude toward mathematics

S.No.	Gender	N	mean	df	t-value	P-value
1	Male	276	164.653	391	-136.191	.000
2	Female	176	161.949			

The results of the t-test in Table 1 shows that there is a statistically significant difference in students' attitude toward mathematics favoring male students ($t(391)=-136.191, p=.000$). Therefore, H_0 is rejected.

Simple regression analysis of students' attitudes (ATM) on motivation to learn mathematics (MTL) was done and results are presented in Tables 2 and 3.

Table 2: Pearson's correlation coefficient between MTL and ATM

Variables	r	r ²	Adjusted r-square	Std. error of estimate	r-square change	F-change	df	Df ₂	p-value
MTL and ATM	.725	.526	.525	9.595	.526	433.379	1	390	.000

The results in Table 2 shows a statistically significant correlation ($r=.725, p=.000$) between motivation to learn and students' attitudes toward mathematics. Therefore, MTL and ATM are not independent. Student's attitudes explain 52.6% of the variability in motivation to learn mathematics.

The results of simple regression of students' attitudes on motivation to learn mathematics is given in Table 3.

Table 3: Simple regression of students' attitudes on motivation to learn mathematics

Source	Sum of square	Df	Mean square	F	Sig.
Regression	399904.794	1	399904.794	433.379	.000
Residual	35910.489	390	92.078		
Total	75815.283				

- Dependent variable: motivational to learn
- Predictor :attitude toward mathematics

The results in Table 3 indicate that the F-value is significant ($F[1,390]=433.379, p=.000$). The interpretation is that students' attitudes towards mathematics makes a significant contribution in the prediction of motivation to learn mathematics among secondary/high school students in Laikipia County. Therefore, H_0 is rejected.

VIII. DISCUSSION.

The finding in this study that there is a significant gender difference favoring male students in attitude toward mathematics tend to agree with studies by Eshun (2004) and Mata, Monteiro and Peixoto(2012) who argued that girls do express less success and confidence in doing mathematics. Therefore, as a mathematics teachers attempt to improve students' attitudes toward mathematics, special attention should be given to female secondary school students to reduce the gender gap in attitude towards mathematics. It is clear that classroom behaviors and techniques employed by the teacher have an important influence on students' attitudes toward mathematics.

According to Marzita (2002), the most significant factors in the formation of negative attitudes and mathematics anxiety appear to be; (i) students' fear of asking for help, (ii) teachers blaming students for not understanding (iii) teachers ridiculing students, (iv) teachers' strictness and fierceness, (v) use of threats, and force by teachers, (vi) teachers not showing interest in their students (vii) teaching style which emphasis transfer of information and routines with little attention to the learning of the individual. Consequently, teachers should avoid using the mentioned negative influence practices if the existing students' attitudes scenario is not to be perpetuated, especially for female students.

This study also found a significant influence of students' attitudes on motivation to learn mathematics. Driscoll (2005) and Keller (1999) has provided the techniques for improving students' level of motivation. Among the techniques is to begin the lesson by telling students what you want to achieve, have students set short term goals, use of spoken or written praise, use of tests and grades carefully, capitalize on the arousal of suspense, discovery, curiosity, exploration, control and fantasy, use of familiar materials as examples, use prerequisites, use of simulation and games and minimizing unpleasant consequences of students' involvement. These motivational techniques combined with strategies of avoiding negative attitudes toward mathematics should be applied in the classroom to enhance students' level of motivation.

IX. CONCLUSION

First, the findings in the study indicated that male students had significantly better attitudes toward mathematics than female students. Therefore, mathematics teachers should put more effort to ensure similar attitudes for both boys and girls in mathematics. Second, students' attitudes toward mathematics contributed significantly to the prediction of motivation to learn mathematics. Therefore, positive students' attitudes toward mathematics play an important role in the development of students' motivation to learn mathematics among secondary /high school students in Laikipia County.

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