Self-efficacy Beliefs as a Predictor of Attitudes towards Mathematics among Secondary School Students in Laikipia County, Kenya

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Abstract
This study examined the influence of students’ self-efficacy beliefs on attitude towards mathematics of secondary school students in Laikipia County, Kenya. Descriptive research survey design was employed in the study. The target population consisted of all 8357 Form Four students in the County. A sample of 392 respondents (276 males and 176 females) was selected for the study. A self-administered questionnaire was used for data collection. Cronbach’s alpha was used to determine the reliability of research instruments. Data was analyzed using Pearson’s correlation coefficient and simple regression analysis. The study findings revealed that students’ self-efficacy beliefs makes a significant contribution to students’ attitudes towards mathematics. The study concluded that mathematics teachers should apply appropriate mathematics self-efficacy enhancement strategies in improving students’ attitudes towards mathematics for better performance in mathematics.

Keywords: Attitudes towards Mathematics among students; Self-efficacy Beliefs as a Predictor of Attitudes, Predictor of Attitudes towards Mathematics

1. Introduction
Mathematics plays a key role in shaping how individuals deal with the aspects of social, private, scientific and technological life in society. Its usefulness in the sciences as well as commerce, economics, education and even humanities is almost at per with the importance of education as a whole (Tella, 2008). But today as in the past, many students struggles with mathematics and become discontented with the subject as they progress in their schooling particularly at the secondary school level as can be seen in the case of Kenya (KNEC, 2020). Indeed, Tossavainen and Juvonen (2015) when comparing Finnish primary and secondary students’ interest relating to enjoyment of music and mathematics, and perception of their importance and usefulness argued that many children tend to enjoy mathematics in the primary grades but this enjoyment tends to fall drastically when children progress into and through secondary schools.

Despite the wide applicability and importance of mathematics, Kenyan students consistency perform poorly in the subject (KNEC, 2020), and hence achievement in mathematics has been a great concern for educators, teachers, parents and students themselves (KICD, 2020). However, the desired level of mathematics achievement seems greatly to require a dynamic interplay between students, teachers, and curriculum school factors.
In Kenya, great emphasis has been put on industrial and technological development (KICD, 2020), but in the move towards scientific and technological advancement the country needs nothing short of good performance in mathematics at all levels of schooling. However, according to the Kenya National Examinations statistics (KNEC 2020), the performance in mathematics has been consistently poor as seen in the report of Kenya Certificate of Secondary Examinations (KNEC, 2020). KNEC statistics gives the national grand means score of 2.630, 3.161, 3.205 and 3.385 from the year 2016 to 2019 respectively, where the maximum mean score is 12 points. The recurring poor performance in mathematics experienced nationally is also registered in the KCSE results for Laikipia County, Kenya where the current study is focused as seen in Table 1.

Table 1
 KCSE mathematics means performance from 2016 to 2019 in Laikipia County

<table>
<thead>
<tr>
<th>Year</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>2.779</td>
<td>3.236</td>
<td>3.441</td>
<td>3.599</td>
</tr>
</tbody>
</table>

Note: Maximum means score is 12 points; Source: KNEC (2020)

The dismal performance in secondary school mathematics can be attributed to many factors. These includes; lack of motivation for students and teachers, lack of teaching and learning resources, inadequate coverage of the spelt curriculum, attitude towards mathematics among other factors (TIMSS, 2004), and self-efficacy beliefs in mathematics (Bandura, 1997; Skaalvik & Skaalvik, 2010).

The complexity of factors influencing students’ performance in mathematics is further demonstrated by Singh, Granville and Dika (2002) who indicated that high achievement in the subject is a function of many interrelated variables involving students, schools and families. Among student variables attitudes towards mathematics (ATM) is one of the leading factors when attempting to understand and explain the variability in students’ performance in mathematics (Mohamed & Waheed; 2011, Nicolaidou & Philipou, 2003).

Educators as well as parents believe that students’ attitudes towards a school subject will affect achievement in the subject (Fraser & Kahle, 2000; Mohamed & Waheed, 2011). Moreover, Moenikia and Zahed-Babelan (2010) argued that students’ attitudes towards mathematics may affect how well or how often they do it, and how much enjoyment they derive from it.

Attitudes can be seen as either positive or negative. A positive attitude towards mathematics reflects a positive emotional disposition in relation to the subject, and similarly a negative attitude relates to a negative emotional disposition (Mata, Monteiro, & Peixoto, 2012). Furthermore, a positive attitudes towards mathematics encourages a positive self-confidence, value and enjoyment, while a negative attitude relates to low-confidence, value and enjoyment (Atanasova-Pacemska et al., 2015). These attitudinal dispositions have an impact on a students’ behavior, as one is likely to achieve better in a subject that he/she enjoys, has confidence in or finds useful (Eshun, 2004). According to Eshun, positive attitudes towards
mathematics are desirable for they may influence student’s willingness to learn, and also the benefits that are derived from mathematics instruction.

The relationship between students’ attitudes and achievement in mathematics has been of interest to researchers. Students’ attitudes towards mathematics has been correlated with mathematics achievement and found to be an important predictive factor of achievement (Ajisukmo & Saputri, 2017; Chagwiza et al., 2013; Sirmaci, 2010). In Laikipia County, Kenya despite the poor performance there is lack of information on the influence of students’ attitudes in the learning of mathematics. Specifically, the influence of students’ self-efficacy beliefs on the formation of attitudes towards mathematics has not received any attention.

Self-efficacy beliefs refers to one’s beliefs about his/her capability to successfully perform specific tasks in specific situations (Bandura, 1986, 1994,1997). These efficacy beliefs have been hypothesized to influence human functioning like choice of activities effort expenditure, and persistence in the face of obstacles, which in-turn influence learning (Bandura, 1986). According to Bandura (1997), perceived self-efficacy is concerned not with the number of skills you have, but what you believe you can do with what you have under a variety of circumstances. In Bandura’s view, how people behave can be better predicted by the beliefs they hold about their capabilities than by what they are actually capable of accomplishing, for the self-efficacy beliefs helps determine what individuals do with the knowledge and skills they possess. For example, two different people with similar skills or the same person under different situations, may perform differently depending on the fluctuations in the beliefs of personal efficacy. Bandura (1997) posited that self-efficacy beliefs are acquired and modified through four sources. These are: mastery experiences, vicarious experiences, social persuasions and emotional/physiological states.

Mastery experiences are an important source of efficacy beliefs because it provides direct information about past success through knowledge of performance attainments (Bandura 1997; Driscoll, 2005; Pajares, 2002; Usher, 2009). According to Pajares (2002), outcomes that are perceived as successful raises self-efficacy but failure lowers self-efficacy.

Self-efficacy beliefs are also created through vicarious experiences provided by social models (Bandura, 1997; Driscoll, 2005; Pajares, 2002; Usher, 2009). According to Bandura (1997), if individuals see similar others succeed they will have an increased perceived efficacy in their own ability to succeed. But, observing the failure of models instills doubt about one’s ability to succeed.

Self-efficacy beliefs are further created by respected/ competent others by providing positive feedback and words of encouragement through social persuasions (Bandura 1997; Driscoll, 2005; Pajares, 2002; Usher, 2009). According to Pajares (2002), just as positive persuasions may work to encourage and empower, negative persuasions can work to defeat and weaken self-efficacy.
Lastly, self-efficacy beliefs are created through judgments of one’s physiological and emotional states such as stress and anxiety (Bandura, 1997; Driscoll, 2005; Pajares 2002; Usher, 2009). According to Bandura (1997) people can gauge their degree of confidence by the emotional state they experience as they contemplate an action. In Bandura’s view, emotional reactions to a task will provide a cue about the anticipated success or failure of an outcome. For example, if a person feels physically tired when contemplating to performing a task the efficacy is likely to go down.

In all, self-efficacy of students can be created and strengthened by exposure to and interaction with the four sources of self-efficacy. Therefore, teachers of mathematics need to understand the four sources of personal efficacy for the benefits of their students. Furthermore, self-efficacy beliefs of students have been found to be significantly related to positive students’ academic outcomes such as achievement in mathematics (Ayotola & Adedeji, 2009; Liu & Koirala, 2009; Skaavik & Skaalvik, 2006). In the current study it is hypothesized that self-efficacy beliefs of students has no significant influence on students’ attitudes towards mathematics. The effect of efficacy beliefs on students’ attitudes can be clearer if the relationship between the two variables is established. In Laikipia County, such empirical evidence is lacking hence the need for this study.

Despite mathematics playing a critical role and being an important subject for the preparation of students to appropriately contribute and function well in society, the performance of students in most secondary schools in Kenya and in particular, Laikipia County has been poor. Studies show that many factors can be attributed to the poor performance including attitudes towards mathematics. Literature on the relationship between self-efficacy beliefs and attitude towards mathematics is scanty. Therefore, there is need to establish whether self-efficacy beliefs has any effect on students’ attitude towards mathematics in secondary schools in Laikipia County, Kenya.

2. Methodology
Descriptive research design was employed in this study. The target population was all 8357 Form Four secondary school students in Laikipia County, Kenya. This set of students was selected because they are mature enough to form an independent opinion in mathematics, and also have covered most of the content in secondary mathematics curriculum. The respondents were drawn from twenty (20) randomly selected public secondary schools in Laikipia County. Simple random sampling was used to select schools, sample classes and respondents. The sample consisted of 392 respondents (216 males and 176 females) randomly selected from the sample classes. The sample size was determined using Krejcie and Morgan’s (1970) table of sample sizes.

In this study, the attitudes towards mathematics (ATM) scale and students’ self-efficacy beliefs (SSE) scale were used. The ATM scale had 40 item presented in the form of positive and negative statements (Tapia & Marsh, 2004). The responses were scored on a five-point scale from strongly disagree (1) to strongly agree (5). The scoring for negative items was reversed. The alpha reliability for the scale was 0.97. The SSE scale had 84 items. The scale has eight
subscales. All the items were presented in form of positive statements on an 11 point scale (Bandura, 2006), from 0 (the lowest) to 10 (the highest). The total alpha reliability for the eight subscales was 0.98.

The Pearson’s correlation coefficient (r ) to measure the degree of relationship between students’ self- efficacy beliefs and attitudes, and simple regression analysis that applies the F-test were used in data analysis.

3. Results
3.1 Demographic Characteristics of the Respondents
The respondents were 392 Form four secondary school students. Out of this, 276 were males while 176 were females. Their age ranged from 16 to 20 years selected randomly from participating boys only, girls only and mixed secondary schools.

3.2 Correlation Coefficient between Attitude towards Mathematics and Students’ Self-efficacy beliefs

The results of data analysis are presented in Tables 1 and 2. Table 1 presents the correlation coefficient between attitude towards mathematics (ATM) and students’ self-efficacy beliefs (SSE). This was done to establish the degree of relationship between the two variables.

<table>
<thead>
<tr>
<th>Variables</th>
<th>r</th>
<th>r²</th>
<th>Adjusted r-square</th>
<th>Std. Error of estimate</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATM and SSE</td>
<td>.621</td>
<td>.386</td>
<td>.384</td>
<td>18.452</td>
<td>.000</td>
</tr>
</tbody>
</table>

The results in Table 2 indicate a statistically significant correlation (r=.621, p=000) between attitude towards mathematics (ATM) and students’ self-efficacy (SSE). This means that ATM and SSE are not independent. Students’ self - efficacy beliefs in mathematics explains 38.6% of the variability in attitude towards mathematics among secondary school students. To establish whether students’ self- efficacy beliefs contribute significantly to attitudes toward mathematics simple regression analysis was done. The results of the regression analysis are shown in Table 3.

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of squares</th>
<th>df</th>
<th>Mean square</th>
<th>F</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>83423.402</td>
<td>1</td>
<td>83423.402</td>
<td>245.002</td>
<td>.000</td>
</tr>
<tr>
<td>Residual</td>
<td>132795.129</td>
<td>390</td>
<td>340.500</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>216218.531</td>
<td>391</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. Dependent variable: Attitudes towards mathematics
b. Predictor: Students’ self-efficacy

The results in Table 3indicate that the F-value is significant (F (1,390)= 245.002, p= .000). This means that students’ self- efficacy beliefs make a significant contribution in the prediction of
attitudes towards mathematics among secondary school students in Laikipia county. Therefore, $\text{Ho}_1$ is rejected.

4. Discussion
From the analysis of data it was found that the correlation coefficient between attitude towards mathematics and students’ self-efficacy beliefs was 0.621 which is moderately high. This means that any increase in mathematics efficacy beliefs of students will lead to a corresponding increase in positive attitude towards mathematics. Furthermore, students’ self-efficacy beliefs were found to make a significant contribution to the prediction of attitudes towards mathematics.

The finding in this study is in agreement with studies by Ayotola and Adedeji (2009), Liu and Koirala (2009) and Skaavlik and Skaavlik (2006) which found that students’ self-efficacy beliefs is one of the important variables influencing students’ outcomes like achievement in mathematics. This study has found that students’ efficacy beliefs significantly contribute to attitudes towards mathematics among secondary school students. The implication that arises is that as mathematics teachers attempt to improve students’ attitudes in mathematics, the self-efficacy beliefs of students need to be strengthened for better performance in the subject.

As part of their normal teaching, mathematics teachers should enhance students’ mathematics self-efficacy beliefs over and above the development of knowledge and skills in the subject. According to Pajares (2006), the instructional strategies for enhancing students’ self–efficacy beliefs includes: Emphasizing skill development than self-enhancement, praising what is praiseworthy, fostering optimism and a positive look at life, promoting authentic mastery experiences, exercising care in grouping practices, selecting appropriate peer models, tailoring instruction to students’ capabilities, challenging under-confidence, helping students set proximal than distal goals, providing instrumental than executive help in solving problems. These self-efficacy enhancement strategies can help students strengthen their mathematics self-efficacy beliefs which in-turn will help to improve students’ attitudes towards mathematics.

5. Conclusion
The finding in this study revealed those students’ self-efficacy beliefs makes a significant contribution to the prediction of students’ attitudes towards mathematics. Consequently, it emerges that enhanced students efficacy beliefs plays an important part in improving students’ attitude towards mathematics among secondary school students. Therefore, to improve students’ attitudes and hence better achievement in mathematics, teachers should enhance students’ mathematics self-efficacy beliefs over and above the development of knowledge and skills in the subject especially in Laikipia County, Kenya.
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