

Effects of Attitudes of Female Students on the Performance in Mathematics in Various Types of Secondary Schools in Teso District, Kenya.

Anne Wasike

Kibabii Diploma Teachers Training College, P.O. Box 931-50200, Bungoma -Kenya.

* E-mail of the corresponding author: annenabalayo@yahoo.com

Abstract

Studies from diverse fields continue to search for clues underlying the disparity between interest and achievement of male and female students in Mathematics. In Western countries, psychologists have focused on factors such as attitudes and motives when studying females' Mathematics achievements. Relatively little attention has been placed on women in sub-Saharan countries. This study seeks to determine the influence of attitudes of female students on the performance in Mathematics in various types of secondary schools in Teso District, Kenya.

Keywords: Attitude, Performance, Effect, School.

1.0. Introduction

Globally, education is fundamental in the development of human persons and has been viewed principally in light of a fundamental human right (Kyalo *et al.*, 2006) as well as being the cradle of mankind. Education in Kenya has continued to play a significant role in imparting knowledge to many people, which portends a good future life for many people (Shiundu and Omulando, 1992). Many high performing schools in Kenya often attribute their "excellent students' performance" on students hard work and discipline in the schools (Sifuna, 1990). Transition of the students from secondary schools to the university education Kenya is tied to academic performance (Njuguna, 1999).

Academic performance could be defined as the display of knowledge attained or skills developed in school subjects designated by test and examination scores or marks assigned by the subjects' teachers (Smith, 1997). It could also be said to be any expression used to represent students' scholastic standing. Many researchers, psychologist and educators alike, have identified some of the variables that have effects on students' academic performances. Academic performance is an individual's inherent potentials in terms of intelligence combined with other sociological factors. Ojerinde (2009) in his study identified personality factors such as anxiety, achievement, motivation and level of interest as factors that affect academic performance. The consistence of these claims was asserted by Ford (2010), which claimed that student with high self-efficacy received higher grades than those with low self-efficacy and that students with negative self-concept have poor academic performance. Moreover, academic performance is a facet of many interrelated variables key among them is the inherent students' efforts, teachers' inputs, school environment and students attitudes. Despite various efforts to improve academic performance, some schools continue to perform dismally in national examinations and therefore most students from such schools fail to secure admission to higher learning institutions. There are a number of suggestions that apart from school- related factors, the students' achievements are a facet of attitudes that students have (Saha, 2007).

Attitude could be defined as a consistent tendency to react in a particular way-often positively or negatively – toward any matter. Attitude possesses both cognitive and emotional components. Fazio and Roskes (2004), say, "attitudes are important to educational psychology because they strongly influence social thought, the way an individual thinks about and how he/she processes social information". According to Eggen and Kauchak (2002), positive students' attitudes are fundamental to effective learning. Johnstone (1992) supports this view by stressing the importance of students holding favorable attitudes if learning experiences are to be successful. Extending this further, Thomas (2006) states that "negative attitudes ... can powerfully inhibit intellect and curiosity and can keep us from learning what is well within our power to understand". In secondary school, several researchers (Fennema and Sherman, 1978; Forgasz and Leder, 1996; Eshiwani, 1983; Fisher and Rickards, 1998; Frankel, 2010) have found that it is common knowledge that the majority of the students in secondary schools dislike mathematics. When comparing the two sexes, internationally females have been noted to have more negative attitudes (Fennema and Sherman, 1977; Oyedonkun, 1983; Otiende *et al.*, 1992; Erickson, 2007; Onobowale, 2007; Osibodu, 2007; Ojerinde, 2009; Hart, 2010).

The reality of the gross under-representation of Kenyan females in science, mathematics, and technology (STM) fields is unsettling (Otiende *et al.*, 1992; Ndonye, 2003; Mordi, 2005). The problem for Kenyan females mirrors the situation found in other sub-Saharan African countries. According to the educational statistics from MOEST

(2006) in 2006 women represented less than 25% of Kenyan students at the third level enrolled in the fields of natural or computer sciences, medical sciences, mathematics, and engineering. For the year 2007, overall, the enrollment figures were somewhat better: 29% of students in Mathematics and computer science and 6% of students in engineering were women (Kibui et al., 2008). Nonetheless, the fact remains – women still have not attained educational equity in many African countries, and they are systematically under-represented in scientific and technical disciplines at universities (Adams and Kruppenbach, 2006).

At the workshop on “Science, Technology and Mathematics Education,” organized by the Women Education Unit of the Ministry of Education in Kenya (November 20 December 2, 1987), a good number of papers focused on the problem of under-representation of females’ in the above- named fields. Common to most papers at the workshop was a dearth of discussion about methodological and statistical tools that authors used. Instead, audience members were presented with general or global descriptions of the possible factors affecting science, technology, and Mathematics education of African female students and women. This deficit of empirical data makes it difficult to arrive at confident conclusions concerning factors affecting women’s education.

In addition, there is insubstantial documentation regarding the impact that psychological and familial variables have on access and achievement for African female students and women in STM education. Adams and Kruppenbach (2006) state:

Unfortunately, in the UNESCO reports and the sector studies of the World Bank and US-AID there are insufficient information about the factors that might be thought to influence the in-school attainment of students. At the same time, the inadequate treatment of in-school factors that influence equity is a conceptual weak spot reflecting the fact that sector assessment methodology is still in an early stage of development.

With the exception of the Ghana Commonwealth Africa Regional Workshop held in Accra (January 1987), and the National Workshop on Promoting Science, Technology, and Mathematics among Female students and women held in Lagos, Nigeria (November 1987), there have been no recent systematic attempts to explore these issues in sub-Saharan Africa. In the non-compulsory school system of sub-Saharan Africa, a variety of factors are believed to deter female access and achievement, specifically in STM fields (Johnston 1992).

On the basis of such, this study will seek to explore psychological analysis on attitudes and ability of secondary school female students in Teso District.

2.0. Literature Review.

2.1 Attitude

The definitions of attitude that have been proposed are remarkably numerous and diverse. Attitudes are likes and dislikes. Scholl (2007) defined attitudes as mental predisposition to act that is expressed by evaluating a particular entity with some degree of favour or disfavour. That is the way individuals evaluate people with whom they are familiar in everyday life. Eggen and Kauchak (2010) gave the cognitive dimension of attitude; they see attitude as the process by which people attach meaning to experiences. They explain that after people attend to certain stimuli in their sensory memories, processing continues with perception.

It is easy to use attitudes, beliefs and values interchangeably. According to Freeman W. and Franc, J.(1962) an attitude is a dispositional readiness to respond to certain situations, persons, or objects in a consistent manner, which has been learned and has become one’s typical mode of response. An attitude has a well-defined object of reference. Flopert (1999) defines attitude as a mental and neural state of readiness, organized through experience, existing directive or dynamic influence upon the individual’s response to all objects and situations with which it is related. However, Mordi, C. (2005) defines attitude as a predisposition to act in a certain way towards some aspect of one’s environment including other people”. Bem (1976) notes that “attitudes are likes and dislikes.

Attitude could be defined as a consistent tendency to react in a particular way-often positively or negatively – toward any matter. Attitude possesses both cognitive and emotional components. Fazio and Roskes (1994), says, “Attitudes are important to educational psychology because they strongly influence social thought, the way an individual thinks about and process “social information”. According to Eggen and Kauchak (2001), positive teachers’ attitudes are fundamental to effective teaching. A teacher must be interesting. That is the teacher must work his students into such a state of interest in what the teacher is going to teach him that every other object of attention is banished from his mind. The teacher should also fill the students with devouring curiosity to know what the next steps in connection with the subject are. Eggen and Kauchak (2001) identified a number of teachers’ attitudes that will facilitate a caring and supportive classroom environment. They are: enthusiasm, caring, firm, democratic practices to promote students responsibility, use time for lesson effectively, have established efficient routines, and interact freely with students and providing motivation for them.

Research findings on teachers’ attitudes (Brunnering *et al.*, 1999), established the following facts: Teachers characteristics such as personal teaching efficacy, modelling and enthusiasm, caring and high expectation promote learners’ motivation. These same characteristics are also associated with increase in students’

achievement (academic performance). High levels of learning may occur as well as learners feeling good about themselves and the material they are learning when teachers use instructional time efficiently. Learning takes place with ease and faster under teachers that are well organized. The way teachers interact with students influences their motivation and attitudes toward school. How students perceive their teachers' attitudes in Kenya secondary school will be measured based on some of the stated points. To promote order and learning in the classroom every teacher should possess essential teaching skills. No one can teach something to someone without doing it in some particular way, and that way of teaching has significant effects on the entire teaching and learning situation. Ehindero and Ajibade (2000) posit that: teaching is a process of continuous personal development and professional self-discovery alongside an emerging understanding of the teaching and learning process.

If there is an art essential to good teaching, it is that of communication. It is very important because teaching cannot occur without the use of oral or sign language communication. It implies that teachers should monitor their own speech to ensure that their presentation is as clear and logical as possible. Eggen and Kauchack (2001) highlighted four aspects of effective communication that are highly essential for learning and motivation. They are; precise terminology, connected discourse, transition signals and emphasis.

Skillful teachers summarize and link ideas together at the end of his/her lesson. Review summaries of previous work and help students link what has been learnt to what is coming. Closure is a form of review occurring at the end of a lesson; in it topics are summarized and interpreted. Essential teaching skills and teaching methods are like two sides of the same coin. Skills are the required characteristics or ingredients for effective teaching while methods can be compared to pattern to be followed in teaching. There are many teaching methods as there are teachers in the world. In teaching seven steps and the required skills may be suggested for effective teaching as follows: Preparation for instruction (Organizational skills); Motivation (Communication skills); Presentation of the learning task (Focus skill); Inducement of the trial response (Feedback skill); Correction of the trial response (Questioning skill); Fixation of response (Closure skill); and Test response (Evaluation skill) Even though the enumerated skills are interdependent; one is as effective alone as it is when combined with others. Eggen and Kauchak (2002) claimed that the interaction and integration of those skills are crucial to teaching and learning.

Academic performance could be defined as the display of knowledge attained or skills developed in school subjects designated by test and examination scores or marks assigned by the subjects' teachers. It could also be said to be any expression used to represent students' scholastic standing. For this study, students' academic performances were based on the average scores of students in five subjects in the mock examination conducted in the students' various schools. Many researchers, psychologist and educators alike, have identified some of the variables that have effects on students' academic performances. Academic performance is individual inherent potentials in terms of intelligence combined with other sociological factors. Ojerinde (1981) in his study identified personality factors such as anxiety, achievement, motivation and level of interest as factors that affect academic performance. The consistence of these claims was asserted by Ford (1996), which claimed that students with high self-efficacy received higher grades than those with low self-efficacy and that student with negative self-concept have poor academic performance. Teachers variable are also noted to have effect on students' academic performances. These includes, teachers' knowledge of subject matter, teaching skills, attitude in the classroom, teachers, qualification and teaching experience.

2.2 Attitude, gender and Mathematics learning

One of the most common explanations for gender disparities in mathematics achievement has focused on attitude that students have towards mathematics. Several studies have reported that there are gender differences in attitude towards mathematics with female students showing more negative attitudes than boys. In general, most of the studies reported that, compared with boys, female students lacked confidence, had debilitating causal attribution patterns, perceived mathematics as a male domain, and were anxious about mathematics (Casey *et al*, 2001; Hyde *et al*, 1990; Ma, and Kishor, N.(1997); Sayers, 1994; Vermeer *et al*, 2000). The causes of the gender differences in Mathematics attitude were found to be multifaceted. Researchers have identified parental and societal attitudes (Papanastasiou, 2000; Wong, 1992), and students' classroom experiences (Fisher and Rickards, 1998; Forgasz and Leder, 1996), as being influential in making female students internalize the feeling that they are inferior to boys in mathematics.

Studies that have considered classroom environments infer that teachers' classroom behaviours is a factor associated with students' attitudes. Fisher and Rickards (1998) found that students' attitudes towards mathematics tended to be more positive in classrooms where students perceived greater leadership and helping/friendly behaviours in their teachers, and more negative in classrooms where students perceived their teachers as admonishing and enforcing strict behaviours. Other researchers have compared the effect of single-sex and co-educational classrooms upon students' attitudes (Forgasz and Leder, 1996; Norton and Rennie, 1998). Students in single sex schools were found to have more positive attitudes than students in the co-educational schools. For example, Norton and Rennie's (1998) study of grades 8 to 12 in four secondary schools (one private

single-sex female students' school, one private single-sex boys' school, one coeducational state high school, and one coeducational private school) in Queensland, Australia, found that boys in the single sex schools had the most positive attitudes.

The attitudes of boys in coeducational schools were similar to the female students in the single-sex school, and the female students in the coeducational schools reported less positive attitude on most scales. All these results suggest that strategies that target teachers' instructional practices may have an effect on students' attitudes towards mathematics. The reported gender differences in attitude towards mathematics influenced some researchers to study some affective variables as mediators of gender differences in mathematics achievement (Casey *et al*, 2001). However, little consensus existed among researchers regarding the influence of affective variables on gender and mathematics achievement. For example, some studies reported statistically significant effects of affective variables on the learning of mathematics (Casey *et al*, 2001); Ho, *et al*, 2000, Ma and Kishor, 2010), while others indicated no relationship between attitude variables and mathematics achievement (Papanastasiou, 2000).

Even among those studies that found a significant relationship, there was still controversy regarding the educational implications of the results. For example, some researchers concluded that although statistically significant, the mean effect size for the relationship between attitudes towards mathematics and achievement in mathematics was not strong enough to have useful implications for educational practice (Ma and Kishor, 2010). On the other hand, some researchers (Hyde *et al*, 1990; Norton and Rennie, 1998) have cautioned against dismissing the effects of affective variables on longer term learning outcomes, despite the finding that most of the gender differences in mathematics were small. One of the explanations for the inconsistent findings regarding the relationship between attitude and mathematics achievement, was that such a relationship existed only with respect to particular mathematics content areas (Casey *et al*, 2010; Ma, 1999) and for specific affective variables (Ho *et al*, 2000).

Saha (2007) conducted a study Gender, Attitude to Mathematics, Cognitive Style and Achievement in Mathematics. It was found that all the three contribute to statistically significant difference in achievement in mathematics. Thomas (2006) conducted a study to determine the Attitude towards Mathematics and Achievement by combining co-operative learning strategies with instruction delivered using an Integrated Learning System (ILS). Sixty five fifth grade students were randomly divided in two groups, co-operative and individual. Result revealed that students using on ILS for mathematics instruction performed better on standardized tests and were more positive towards math and they worked in co-operative groups than when they worked on the same individually. Xin Ma and Jianymin (2004) conducted a study to determine the casual ordering between Attitude towards Mathematics and achievement in mathematics of secondary school students. Results showed the achievement demonstrated casual predominance over attitude across the entire secondary school. Gender difference in this casual relationship was not found but elite status in mathematics moderated this casual relationship.

However, Confidence in learning mathematics, or the degree to which a person feels certain of his/her ability to do well in mathematics, has consistently emerged as an important component of gender-related differences (Casey *et al*, 2001, Vermeer *et al*, 2000). Generally confidence in mathematics has been associated with mathematics achievement (Ryan and Pintrich, 2010), with correlation coefficients ranging from 0.3 to 0.4 (Hart, 2010; Newman, 1990; Ryan and Pintrich, 2010). For example, Ryan and Pintrich (2010) showed that students who perceived themselves as cognitively competent were less likely to avoid seeking help, whereas, students who were unsure of themselves were more likely to feel threatened when asking their peers for help and more likely to avoid seeking help. Hart (2010) found that the mean for public teacher-student interaction was higher for high confidence students than the mean for low confidence students. Ryan and Pintrich explained that students with high confidence in mathematics do not attribute their need for help to lack of ability and thus are more likely to seek help when they need it (Ryan and Pintrich, 2010). Hart further found that high confidence students were engaged in mathematics a greater percentage of the time than were low confidence students.

Studies that have compared gender differences in mathematics self-confidence have mostly reported that female students had lower self-confidence in mathematics than boys (Case *et al*, 2010); Norton and Rennie, 1998). In some cases, boys were more confident than female students even when their mathematics achievement was similar to that of female students (Casey *et al*, 2010). Vermeer *et al* (2000) have further shown that the gender differences in self-confidence were more marked for application problems than computation problems, with female students showing significantly lower confidence for application problems.

Despite such consistent findings of female students' low confidence in mathematics, studies of classroom environment have shown that the female students' confidence in mathematics improved greatly in classes which actively involved female students in the learning of mathematics (Boaler, 2000).

3.0. Research Methodology

3.1 Research Design

This study used Descriptive survey design. This is normally used to systematically gather factual quantifiable information necessary for decision-making. According to Kothari (2004), such designs are efficient methods of collecting descriptive data regarding the characteristics of populations, current practices and conditions or needs.

3.2 Population

The target population for this study comprised of female students from secondary school in Teso District. Currently there are 16 schools within the district's four divisions. There are a total of 1143 female students and 1709 male students (District Education Office, Teso District, 2008).

3.3 Sample Design and Sample Size

The research sample consisted of 240 students. The schools within Teso District were selected using proportional stratified random sampling from each of the four divisions as presented in Table 3.1; ensuring that at least 50% of the schools are sampled from every location. Three additional schools, which represent schools with special needs, were added to the initial 10 schools using purposive sampling. From the sampling frame, a total of 240 students were used in the sample. The study comprised of Female boarding schools, co-educational boarding schools and co-educational day schools.

Students were selected through stratified sampling technique. The lower strata were represented by students who are poor in Mathematics. This was based on the class lists of the students' performance kept by the head teachers in school administrative units. The researcher ensured that equal representation is used for all the school sampled. Form 4 and Form 3 students were selected for the study. The choices of the above were based on the fact that the students have been in the school much longer and are more knowledgeable about the school environment than the **Form one and Form two**.

Table 3.1: Population of schools and samples selected for this study

Division	Schools	Sampled schools	% of sampled schools	Students sampled per school	Total number of students
Amagoro,	3	2	67.0	20	40
Angurai,	5	3	60.0	20	60
Chakol,	3	2	67.0	20	40
Amukura	5	3	60.0	20	40
Additional*		3		20	60
	16	13			240

*Add – Additionally sampled schools based on special needs

Source: District Education Office, Teso, 2005

3.3 Research Instrument

The Fennema-Sherman Mathematics Attitude Scale (1976) is a new instrument developed to measure students' attitude towards mathematics (Fennema and Sherman, 1976). Conventional wisdom and some research suggest that students with negative attitudes towards Mathematics have performance problems simply because of anxiety. Attitudinal research in the field of Mathematics has dealt almost exclusively with anxiety or enjoyment of subject matter excluding other factors. The Fennema-Sherman Mathematics Attitude Scales (1976) was developed in 1976, and it has become one of the most popular instruments used in research over the last three decades. The Fennema-Sherman Mathematics Scale consist of a group of nine instruments: Attitude towards success in Mathematics scale, Mathematics as a male domain Scale, Mother/father scale, Teacher scale, Confidence in learning Mathematics scale, Effectance motivations scales in Mathematics, Mathematics anxiety scale, and Mathematics usefulness scale.

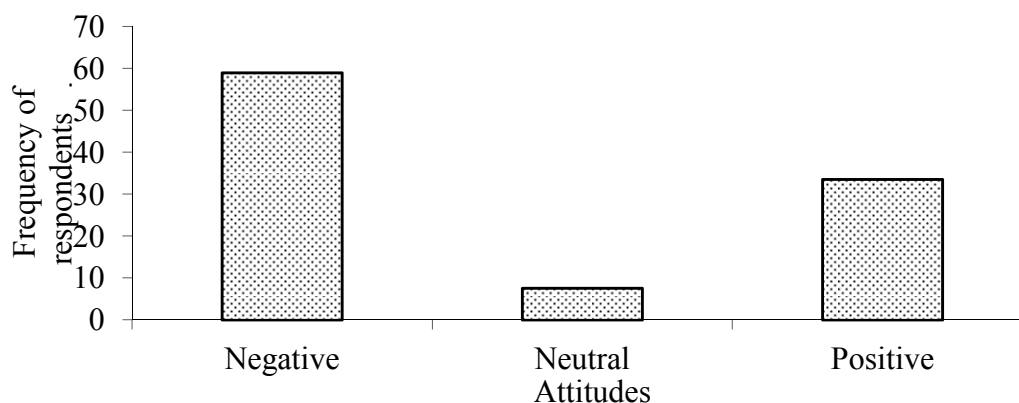
Since the research design was descriptive survey design, the researcher used questionnaires presented in the Likert's scale method for students. Orodho (2004) noted that in education and social sciences research, the most commonly used instruments are questionnaires, interviews schedules and observation forms. Thus questionnaires are used to collect important information about the population.

Attitudes of the student's scores were obtained from Fennema-Sherman Attitude Scale (1976). However performances were obtained directly from the performance documents analysis reports within the school administrative units domain(MD); mother(M); teacher[T]; anxiety(A); effectance motivation(E); confidence (C); and usefulness(U).

4.0. Results and Discussion

4.1 Effect of Attitudes of female students on performance in Mathematics in secondary schools in Teso District

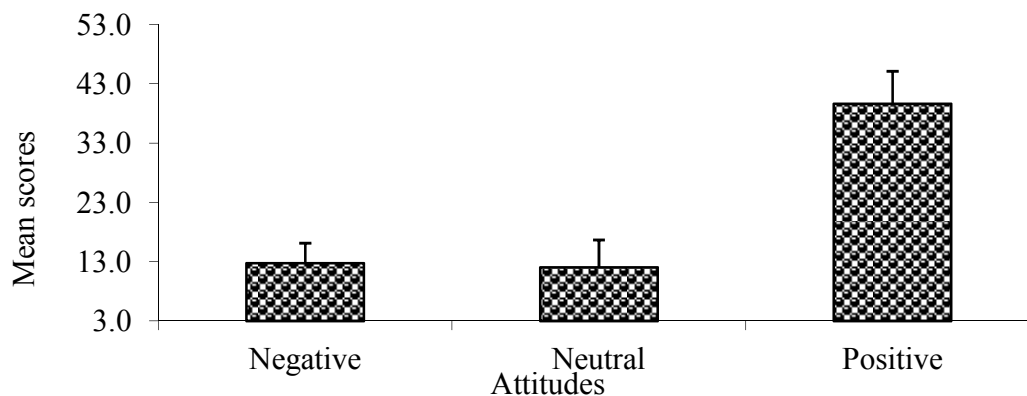
Figure 4.1: Overall Attitudes of the Female Students towards Mathematics



There was a significant difference in the attitudes of the female students towards mathematics. The majority of the female students had negative attitudes (58.9%) towards Mathematics. Female students with positive attitudes towards mathematics were moderate in proportion (33.5%). However, the proportions of students with neutral attitudes were the lowest compared to the other two attitudinal categories. This implies that most of the students interviewed in this study were having generally negative attitudes towards mathematics.

In order to establish the relationships between the attitudes of female students towards Mathematics and how this influence the performance in mathematics, mean performance of female students in Mathematics were computed as shown in Figure 4.2. Parametric ANOVA test was performed on the attitudes of female students as independent variable and performance in Mathematics as the dependent variable (Table 4.2).

Figure 4.2: Performance in Mathematics (mean score) of Female Students with Negative, Neutral and Positive Attitudes.



Performance of female students with positive attitudes toward Mathematics was the best at a mean score of 37.9% than the performance of female students with negative and neutral attitudes which registered a mean score of 12.7% and 12.0% respectively.

The performance of the female students with negative, neutral and positive attitudes was analyzed using Analysis of Variance (ANOVA). The ANOVA table is shown in Table 4.2.

Table 4.2: ANOVA table showing level of significant differences in Mathematical performance among female students with negative, neutral and positive attitudes towards Mathematics in Teso District.

ANOVA					
SCORES					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	48.025	2	24.013	86.570	.000
Within Groups	82.381	297	.277		
Total	130.406	299			

The ANOVA table 4.2 above indicates highly significant ($P < 0.005$) differences in the Mathematical performance of female students with negative, neutral and positive attitudes towards Mathematics. Therefore the null hypothesis indicating that attitudes of female students towards mathematics have effect on mathematics performance was rejected.

4.2 Attitudes of females students toward mathematics from various types of schools

Table 4.3: Attitudes of female students towards Mathematics from various types of schools

	Co-educational day	Co-educational boarding	Single sex boarding
Negative	36.6	39.2	25.2
Neutral	12.5	7.9	9.1
Positive	50.9	52.9	65.7
Total	100	100	100

The differences in attitudes of female students toward Mathematics were significantly different ($\chi^2 = 14.859$, $df = 6$, $P = 0.021$) among the various types of schools. Negative attitudes were recorded in 36.5%, 39.2% and 25.2% of the female students in co-educational day schools, co-educational boarding and female students boarding respectively. Neutral attitudes were recorded in 12.5%, 7.9%, and 9.1% in female students from co-educational day schools, co-educational boarding schools and female students boarding respectively. Positive attitudes in female students towards Mathematics were recorded more in female students boarding (65.7%) followed by co-educational boarding (52.9%) then co-educational day schools (50.9%). The performance of female students in Mathematics was also compared among the various types of schools by computing the mean scores of female students with negative, neutral and positive attitudes toward Mathematics (Figure 4.3).

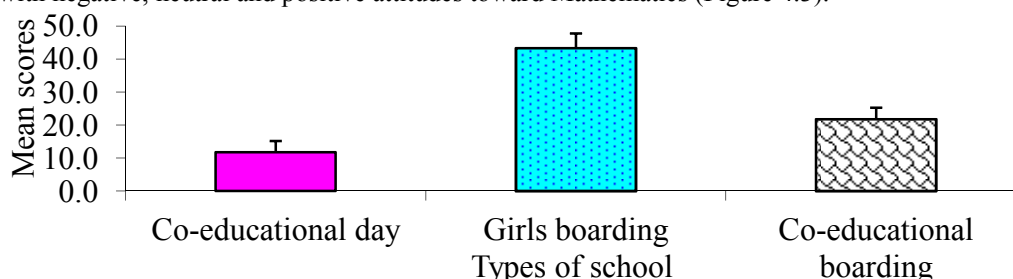


Figure 4.3: Performance of female students in Mathematics among various types of schools in Teso District. Students from Girls' boarding schools had the best performance at a mean score of 43.3% followed by co-educational boarding (21.8%) and the least performing female students were from co-educational day schools (11.7%). The differences in performance of female students were significant (One-Way ANOVA; Table 4.4) among the various types of schools. Multiple comparisons using Post-Hoc Duncan's Multiple range Test (DMRT) indicated that single sex (female students only) boarding schools were performing better than female students from mixed sex school types. The null hypothesis stating that the attitudes of female students from various types of schools toward Mathematics have no effect on the performance in mathematics was rejected.

Table 4.4: ANOVA table for differences in Mathematics performance in female students from various types of school

ANOVA					
SCORES					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	58.552	3	19.517	80.400	.000
Within Groups	71.855	296	.243		
Total	130.406	299			

The research also sought to investigate the Mathematics performance of females students with negative, neutral and positive attitudes from co-educational day, co-educational boarding and female students schools (Table 4.5)

Table 4.5: Performance of students with negative, neutral and positive attitudes towards Mathematics among the various types of schools

	Co-educational day	Co-educational boarding	Female boarding
Negative	21.5	16.2	26.2
Neutral	11.5	19.9	28.1
Positive	20.9	32.9	52.7

Generally, there were significant interactions between the type of school and the attitudes of female students in determining the Mathematical performance in the schools sampled. Student with positive attitudes performed better regardless of the school than female students with neutral or negative attitudes. However, in co-educational boarding and girl schools, performance in Mathematics among the female students with neutral attitudes was better than students with negative attitudes.

5.0. Discussion

5.1 Attitudes of female students towards Mathematics

Several African authors suggest that overall attitudes are partially responsible for female students' low or poor performance in Mathematics and Science (Onobowale 1982; Oyedonkun 1983; Aghenta 2010; Bajah and Bozimo 2010; Osibodu 2010). Yet, these authors fail to identify the specific attitudinal components presumed to have an inhibitory or enhancing effect on actual behavior. From the results of this study, apparently certain components of students' attitudes relate positively to achievement. The null hypothesis that the female students' attitude does not affect their performance in the subject was rejected. Particularly in the area of mathematics, the relationship between attitude and ability is believed to be both dynamic and interactive. Within this context, attitudes and their respective components deserve closer examination. The study attempted to critically examine specific components of attitudes towards mathematics and their relationship to achievement. The results of the t-tests revealed significant differences between students in the high achieving group and those in the low-achieving group. The high-achieving students reported less anxious attitudes, more positive attitudes towards persistence and problem-solving and more positive attitudes towards the usefulness of mathematics than their low-achieving peers.

In this study, a feeling of lessened anxiety towards mathematics refers to decreased feelings of dread, nervousness, and concomitant bodily symptoms associated with doing mathematics. The present findings reveal that high-achieving students reported less anxious attitudes. Thus, the students who performed better academically were those who felt more at ease and less nervous toward the subject. It is difficult to determine the exact cause of the lessened anxiety for this group. However, one can speculate that the high-achieving group may have had more positively reinforcing experiences in the past with mathematics classes, examination, or teachers, which then acts to reduce the anxiety and fear associated with a stereotypically difficult or masculine subject.

In this study, high-achieving students reported more positive attitudes towards this sort of behavior. This finding suggests that students who feel more positive about their problem-solving abilities, who actively seek out challenges, and who are not easily discouraged by difficult problems are higher achievers in mathematics. Students who score high on effectance motivation may be more intrinsically motivated, or have a history of positive reinforcement from parents or teachers for persistence in the face of difficulty. Perceived usefulness of mathematics was another attitudinal component that differentiated the high-achieving group from the low-achieving group of students. Previous research has found that students who perceive the utility of studying mathematics will tend to perform better in the subject (McLeod 2010). Conversely, students who fail to see the practical or future utility in studying mathematics tend to enroll less often in higher-level math courses, perform less well in math courses, or find math less than interesting than other courses. Stereotyping mathematics as a predominantly male domain is an important variable in understanding the complexities of gender and mathematics achievement. In both Western and African samples, stereotyping mathematics may account for poor performance of female students (Fennema and Sherman, 1977; Osibodu, 2010).

Within the West African socio-cultural context, occupational decisions frequently separate along rigid stereotypical lines with specific jobs being perceived as more masculine or feminine. These stereotypical attitudes likewise may affect students' perceptions of their ability to study certain subjects or pursue a certain career path. It is interesting that the subscale measuring attitudes towards mathematics as a male domain evidenced significant differences only for the group divided by age. Students age 17 years or older indicated less stereotypical attitudes towards mathematics as a field of study than the younger students did. The older group perceived mathematics to be a subject open for both males and females to pursue and achieve. The implication of

this finding suggests that the more female students persist in the educational pipeline, the less stereotypic their attitudes become. Additionally, one might hypothesize that the longer female students stay in the educational pipeline, the more likely they are to challenge existing traditional ideas or beliefs based on the rigidity of gender. Likewise, the longer they stay in school, the more chances they have to be exposed to successful female role models in Mathematics and other related subjects; these role models may positively affect the formation of students' attitudes.

An additional interpretation of this finding suggests that students with less stereotypic views of mathematics might possess a history of successes in mathematics that in turn influences their idea of appropriateness of the subject for them as a female. It is worth noting that the majority of the sample (44.9%) indicated they would pursue traditionally female-typed occupations, such as "teachers, librarians, and counselors" (26.3%), or "registered nurses, pharmacists, dieticians, therapists, and physical therapists" (18.6%); this reflects the persistence of sex-typed stereotypes for African female students' occupational choices. In contrast, only 6.2% of the sample indicated traditionally male-typed occupations, such as "engineers, surveyors and architects" (3.9%) or "natural scientists and mathematicians" (2.3%) as their future aspiration. However, given the contrasting socio-economic environments, one can imagine there would arise differences in the constraints on the education of female students and women. One of the challenges of administering this particular scale to a sample of Kenyan female students was interpreting the unusually low scores found on both the mother and father subscales. Quite a few students voluntarily responded that they had difficulty responding to these two subscales due to the illiteracy of their parents. Additionally, an assumption underlying the two subscales (referring respectively to the subject's mother and father) is that the biological parents are the central family figures in the daughter's life. In this and other African samples, however, the extended family system is equally if not more important in terms of its impact on the socialization and shaping of African student ren. In this case, the F-S MAS may pose a problem for this sample in that there is not a subscale that addresses the perceptions of the extended family.

While it is well known that female students score significantly higher than boys on for example reading tests, there is now increasing evidence that the gender gap in school performance is closing in math and science, subjects thought of as being dominated by boys. For example, U.S. educational statistics report that between 1973 and 1999, the male advantage in mathematics and science scores at age 17 was significantly reduced (Campbell, Hombo and Mazzeo 1999). Like previous years, female's performance in KCSE was better than males in the arts and humanities - English, Kiswahili, Hindu Religious Education, Home Science, Art and Design, Woodwork, German, Music and Economics. Boys excelled in the Mathematics, Biology, Chemistry and Physics, the subjects that are critical to science and technology (KNEC, 2006). It has been argued all along that gender parity is the foundation for education equity.

Though the disparities of gender have been pointed out, it has been demonstrated that a relatively high and stable survival rate is maintained in secondary education which means that a closed gender gap is imminent and that that progress is being made towards other aspects of education equity. In this connection, it is relevant to explore what patterns there are with regard to education output because quality education output tends to follow where school access and survival is secured. The items that were to provide the score were ranked in typical Likert Scale scores of 1 to 5. Where 5 would indicate pupils in strong agreement (SA) to the statement while 1 would be pupils in strong disagreement (SD) to the statements. The responses to the questions were supposed to be either in strong agreement to strong disagreement to the negative statements or strong agreement to strong disagreement to the positive questions. If the respondents strongly agreed with a negative statement then higher scores for this means that the respondent has generally a negative attitude towards the statement. Similar scoring for strong agreement with positive statement meant that the respondent has positive attitudes towards the subject. The majority of female students involved in the study were found to have a negative attitude towards Mathematics. Students with positive attitudes towards Mathematics were moderate in proportion (33.5%) however the proportion of students with neutral attitude were significantly lower than the rest.

Earlier studies reported that students with positive attitude towards Mathematics achieved better performance in science subjects that required critical thinking and also the students performance is not only influenced by his /her attitudes towards his/her teacher but other factors such as school environment, family background, health of student come into the play, there is every reason to suspect the existence of a link between students attitude towards his/her teacher and his/her academic performance . Since the teacher is in most cases, the student's role model as well as surrogate parent. Attitude is positively correlated with behaviour and both are reciprocal (Gordon, 2000).

At this juncture, it is important to point out that the pattern seen here is replicated from much earlier. It is a pattern that goes beyond school enrolment numbers and is less an attribute of poor female competition and more the result of colonial history and education development in Kenya (Jones, 1999:14); in particular the development of female education. Unlike Central Province, whose history of secondary education dates to the 1938, Coast, Nyanza and North Eastern provinces suffered late start in education because of the lack of colonial

interest in these regions (Prewitt, 1974:205). Because of poor education investment in general, secondary education for females in these provinces has a weak foundation especially in terms of the number of schools and also quality of schools. North Eastern is the hardest hit by this history.

In addition, historically, boys have always had a head start in secondary education (Otiende, Wamahiu and Karugu, 1992). The majority of secondary schools established in Kenya during the colonial period enrolled boys (Sifuna, 1990: 131). This skewedness continued after independence even though with varying degrees of severity. To date disparities in education are demarcated along the region and gender. While post independent policies on education make every attempt to closing of the gender gap the history of secondary education in Kenya makes sealing the gaps beyond mere numbers a difficult task. Attributes of this history can be traced in the low female representation among the top 100 KCSE candidates.

It is also overwhelming that a higher number of female students with neutral attitude still performed lower than others with positive attitudes especially in the female students boarding despite the fact that they understood very well about working hard to achieve good results. The study concurred with Lindgren (1980) who reported that some teachers become preoccupied with structure, control, rules and regulations leading them to use strategies that are autocratic or authoritarian. The female students as explained earlier differ from the “norm” Since they usually are ahead of the rest of students in the way they grasp the content that is taught. If information is repeated or slowed down, it results in boredom hence frustration. This was expressed through disruptive behaviour: Some lose interest in their daily work and seek refuge in excessive day dreaming.

Grenshaft *et al.* (1995) reported that often female students will perform well even if they do not put in much effort toward learning unlike other students without much academic talents. Though, this study did not sample students, who have less academic talents, it can be seen that many students with high academic talent and possess negative attitude toward mathematics did not perform dismally. Therefore, attitudes of the students toward mathematics seem to be a major shaping factor rather than determinants of performance. Possible reasons are that the learning level may be too simple for them, teaching methods may be opposed to the student’s learning style, content may appear to have no reason or purpose, or learning may be occurring without opportunity to apply the knowledge. The student could be bored with classes or with school or he/she may have personality conflict with the teacher. These and many factors other than academic or intellectual ability can affect student’s classroom performance.

5.2. Influence of type of school on Female students’ Attitudes toward Mathematics.

In this study, three types of schools in Teso District; co-educational day, co-educational boarding and female students’ boarding were analyzed. The differences in attitudes of female students toward Mathematics were significantly different among the various types of schools. Negative attitudes were recorded in 36.5%, 39.2% and 25.2% of the female students in co-educational day schools, co-educational boarding and female students boarding respectively. Neutral attitudes were recorded in 11.5%, 7.9%, and 9.1% in female students from co-educational day schools, co-educational boarding schools and female students boarding respectively. Positive attitudes in female students towards Mathematics were recorded more in female students boarding (65.7%) followed by co-educational boarding (52.9%) then co-educational day schools (50.9%).

Quality performance in KCSE is often attributed to the type of school. In most Kenyan studies, single-sex schools are the solution to poor female performance in secondary school (Murimi, 2001). The study concludes by examining the kinds of schools that produce top KCSE performance. Schools are explored so as to establish whether a single-sex or mixed education has any connection to the quality of achievement or education output. A useful question to ask is whether a single sex girl’s education leads to top performance in KCSE. Data obtained from the KNEC website (KNEC, 2006) shows that the top 100 schools in the 2005 KCSE were single sex. Leading were boys schools (47%), closely followed by female students schools (40%) and far behind mixed sex schools (13%).

Given that the minority (22 out of 101) of top performers nationally are female, (KNEC,2006), one could argue the 22 are the products of a few schools even though the statistics may indicate that more than a third of top performing schools are single sex female students’ schools. Now, if the greater percentage of top performing students is from single-sex schools, then it means that female students will continue to be disadvantaged in their secondary education because of the schools they attend. If Central Province can serve as an illustration, the evidence is that even in cases where there is higher female enrolment, the output in terms of female achievements in KCSE is not reflected (Kibui *et al.*, 2008). There are two reasons that could be advanced to explain why improved female performance in secondary education fails to be translated into equally improved education output. First, a high output for females is an indication that those secondary schools are a conducive learning environments. Conducive learning environments may hint at the possibility of improved education output but being in school does not guarantee it either. This appears to be a plausible explanation for the low number of female students among top achievers.

Second, though this is not within the scope of this thesis, the other possible explanation - which is drawn from

the fact that female students are accessing and surviving secondary education – is that, if schooling and education continues to isolate female students. Through school and classroom experiences that perpetuate a gendered discourse. How else does one explain the low representation of females among the top 100 when there are over 40 female students' schools among the top 100 schools? This simply means that a few female students' schools are responsible for high quality education output while the others in the group do much less to challenge the discourses that prevent female access to secondary education from becoming a more tangible and far reaching outcome.

The performance of female students in Mathematics was also compared among the various types of schools by computing the mean scores of female students with negative, neutral and positive attitudes toward Mathematics (Figure 4.4). The differences in performance of female students were significant (One-Way ANOVA; Table 4.5) among the various types of schools. Multiple comparisons using Post-Hoc Duncan's multiple range Test (DMRT) indicated that single sex (female students only) boarding schools were performing better than female students from mixed sex school types. Students from female students' boarding schools had the best performance at a mean score (Fig 4.3) of 43.3% followed by co-educational boarding (21.8%) and the least performing female students were from co-educational day schools (11.7%).

There were also attempts to determine the Mathematical performance of female students with negative, neutral and positive attitudes on the performance in Mathematics among the female students from co-educational day, co-educational boarding and female students schools (Table 4.6). Over all there were significant interactions between the type of school and the attitudes of female students in determining the Mathematical performance in the schools sampled. Student with positive attitudes performed better regardless of the school than female students with neutral or negative attitudes. However, in co-educational boarding and girl schools, performance in Mathematics among the female students with neutral attitudes was better than students with negative attitudes.

6.0. Conclusion

This study has shown that there was a significant difference in the attitudes of the female students towards Mathematics. 58.9% of respondents had negative attitudes; 33.5% had a positive attitude while less than 10% of the female students a neutral attitude. It was also established that attitude significantly affected students' performance with those having positive attitudes performing better than those with negative attitudes.

The students in the study had neutral to negative attitude towards mathematics, which supports the assertion that attitude influences performance in mathematics. Positive attitude may help a learner to persist in mathematics considering the fact that it is fundamental in careers related to science and technology. Also good performance in mathematics would be a lee way to scientific and technical disciplines in the university. The research findings also showed that most female students with positive attitude performed very well in Mathematics. It was still established that female students' boarding schools performed remarkably well followed by co-educational boarding and co-educational day schools. The poor performance may probably be because of lack of effort, persistence or stereotyped beliefs about mathematics by female students. From this, it was concluded that performance of female students is a function of attitude as well as school and learner related reasons.

7.0. Recommendation

Based on the foregoing discussion of the findings and conclusion, the following recommendations are offered to female students, educators and the government regarding the performance in Mathematics in secondary schools.

1. Special teaching methods for students with negative attitudes toward Mathematics which are in harmony with the basic principles of education, to be developed to ensure their capacities are developed.
2. Schools in Kenya should come up with group discussion under the guidance of female students with positive attitudes towards Mathematics and include other students who are less academically endowed. Such group will have a mandate of trying to encourage students to develop positive attitudes toward Mathematics.

References

- Aghenta, J.A. (2010). Access by Women to Scientific Studies and Technological Training. In: *Report of the National Workshop on Promoting Science, Technology, and Mathematics among Females and Women in Kenya*. Pp. 37-39. Ikoyi-Lagos, Kenya: Federal Ministry of Education (Women Education Branch).
- Bajah S.T. and Bozimo, H. (2010). Low Performance of Females in Science, Technology, and Mathematics Education. In: *Report of the National Workshop on Promoting Science, Technology, and Mathematics among Females and Women in Kenya*. Pp. 45-54. Ikoyi-Lagos, Kenya: Federal Ministry of Education (Women Education Branch).
- Ojerinde A (2009). Birth order and academic achievement. A Seminar Paper, Department of Educational

- Foundations and Counseling, University of Ife (Obafemi Awolowo University Ile-Ife). Ma, X. and Kishor, N. (1997). Assessing the relationship between attitude toward mathematics and achievement in mathematics: A meta-analysis. *Journal for Research in Mathematics Education*. 28(1): 27-47.
- Ma, X. (1999). A meta-analysis of the relationship between anxiety toward mathematics and achievement in mathematics. *Journal for Research in Mathematics Education*. 28(1): 26-47.
- Murimi, J. (2001). *Central female students outnumber boys in KCPE, KCSE*. Retrieved November 17, 2000, from <http://www.eastandard.net/education/edunews/edu17112001005.htm>.
- Papanastasiou, C. (2000). *The effect of attitudes on mathematics outcomes*. Paper presented at the 9th International Congress of Mathematics Education (ICME-9). Tokyo.
- Papanastasiou, C. (2010). Linkage of attitudes and performance of Mathematics among students in middle level schools. *International Journal of Education*. 102: 34-39.
- Saha, S. (2007) A study of Gender Attitude to Mathematics, Cognitive style and Achievement in mathematics". *Experiments in Education*. 35: 6-13.
- Thomas, L.T. (2007). The effects on student's achievements and attitudes using integrated learning systems with co-operative pairs. *Journal Educational Technology Research and Development*. 45: 51-64.

Author's Profile

Anne Wasike is a B.Ed. and M.Ed. (Guiding & Counseling) degrees holder from Kenyatta and Egerton University respectively. She has worked as a High school teacher and a student Counselor. Currently she is a lecturer in the Department of Geography at Kibabii Diploma Teachers Training College in Bungoma County in Kenya.

This academic article was published by The International Institute for Science, Technology and Education (IISTE). The IISTE is a pioneer in the Open Access Publishing service based in the U.S. and Europe. The aim of the institute is Accelerating Global Knowledge Sharing.

More information about the publisher can be found in the IISTE's homepage:

<http://www.iiste.org>

CALL FOR PAPERS

The IISTE is currently hosting more than 30 peer-reviewed academic journals and collaborating with academic institutions around the world. There's no deadline for submission. **Prospective authors of IISTE journals can find the submission instruction on the following page:** <http://www.iiste.org/Journals/>

The IISTE editorial team promises to review and publish all the qualified submissions in a **fast** manner. All the journals articles are available online to the readers all over the world without financial, legal, or technical barriers other than those inseparable from gaining access to the internet itself. Printed version of the journals is also available upon request of readers and authors.

IISTE Knowledge Sharing Partners

EBSCO, Index Copernicus, Ulrich's Periodicals Directory, JournalTOCS, PKP Open Archives Harvester, Bielefeld Academic Search Engine, Elektronische Zeitschriftenbibliothek EZB, Open J-Gate, OCLC WorldCat, Universe Digital Library, NewJour, Google Scholar

