

**GENDER DIFFERENCES IN MATHEMATICS PERFORMANCE AMONG  
SECONDARY SCHOOL STUDENTS IN BURETI SUB-COUNTY, KERICHO  
COUNTY KENYA**

**BY:**

**CHEBET CATHERINE MUTAI**

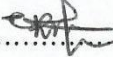
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## DECLARATION


I confirm that this research thesis is my original work and has not been presented in any other university/institution. The thesis has been complemented by referenced works duly acknowledged. Where text, data, graphics, pictures or tables have been borrowed from other works including the internet, the sources are specifically accredited through referencing in accordance with anti-plagiarism regulations.

Signature.......... Date. 11-04-2016

**CHEBET CATHERINE MUTAI**

DEPARTMENT OF EDUCATIONAL COMMUNICATION AND TECHNOLOGY

We confirm that the work reported in this thesis was carried out by the candidate under our supervision as University Supervisor(s)

Signature.......... Date. 11-04-2016

**DR. MIHESO M. K-O' CONNOR**

Department of Educational Communication and Technology

Kenyatta University.

Signature:

.......... Date: 11-04-2016

**PROF. TWOLI. N.W.**

Department of Educational Communication and Technology

Kenyatta University

## **DEDICATION**

To the creator, the Almighty God, who gave me the physical and mental strength to undertake and accomplish this thesis in the prescribed period of time.

## **AKNOWLEDGEMENT**

The preparation of a thesis is due to cooperative efforts from several key individuals and institutions. Though it might be impractical to mention all of them, some minimum credit is inevitable.

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**LIST OF ABBREVIATIONS AND ACRONYMS**

FAWE	Federation of African Women Education
KCSE	Kenya Certificate of Secondary Education
KICD	Kenya Institute of Curriculum Development
KNEC	Kenya National Examinations Council
NCTM	National Council of Teachers of Mathematics
NGO	Non-Governmental Organization
OECD	Organization for Economic Cooperation and Development
QMT	Questionnaire for Mathematics Teachers
TIMSS	Third International Mathematics and Science Survey
TMTQ	Trained Mathematics Teachers Questionnaire.
SMT	Students Mathematics Test
SMASSE	Strengthening Mathematics and Science in Secondary Education
SPSS	Statistical Package for Social Sciences
UNESCO	United Nations Educational, Scientific and Cultural Organizations

## ABSTRACT

In all developing countries, mathematics education is being called upon to play an even more important role for the future. For an all round contribution, there is need to involve both men and women. This study focused on the gender differences in performance in mathematics among form three secondary school students in Bureti Sub-County. It focused on the influence of students perception, parental expectations, teachers' characteristics and perceptions and school environment on their learning of mathematics. The objectives of this study were: (a) to determine the gender differences in achievement in mathematics in secondary schools (b) to establish gender-related factors that influence performance in mathematics (c) to establish the relationship between students career aspiration and their attitude towards mathematics in learning (d) to establish teachers' perceptions about boys' and girls' ability to grasp mathematics concepts (e) to establish best practices adopted by teachers to motivate and encourage boys and girls towards improvement of mathematics performance in secondary schools. The study was a cross-sectional descriptive survey employing correlation methods to investigate gender differences in Mathematics achievement levels of girls and boys. A total of 430 students responded to a five-item, mathematics Achievement Test (MAT) comprising statistics and probability questions. Descriptive Survey design was used. Data was collected using Mathematics Teachers Questionnaires (MTQ) for teachers, Mathematics Students Questionnaire (MSQ) for students and Mathematics Students Achievement Test. The target population was mathematics teachers and form three students from selected secondary schools in Bureti Sub-County, Kenya. Stratified sampling technique was used to select eight (8) secondary schools: 2 for boys, 2 for girls and 4 for mixed from 54 secondary schools in Bureti Sub-County, Kenya. The study used a sample of four hundred and thirty (430) form three students from the eight stratified and randomly selected secondary schools. Eighteen mathematics teachers teaching the study classes were purposively sampled. Simple random sampling was used to select one stream from each category where there were more than one stream, otherwise the stream was purposively selected. The instruments were piloted to enhance their validity and reliability. Students did a mathematics test. Data obtained from the study were analyzed using SPSS software. The students also responded to the Attitude Scale. The teachers filled the Mathematics Teachers Questionnaire (MTQ) on the reasons for poor performance of students in Mathematics and their possible solutions. The validity and reliability of the instruments were enhanced by a pilot study and the adoption of some already validated items. A reliability coefficient of at least 0.8 was acceptable for the study. The study revealed the following findings; gender was strongly associated with mathematics achievement ( $r= 0.9880$ ,  $p< 0.05$ ). As a result, boys' schools performed better than girls schools. Boys had a stronger affinity and interest towards mathematics. Teacher and school factors were of little effect on mathematics achievement with respect to gender. The key recommendation was that measures are needed to be taken as early as possible, probably already in primary education, which aim at the suppression of socialization factors known to lead to the establishment of gender differences in mathematics achievement. It would be desirable to implement strategies in the curriculum as well as in the pre and in-service training which would help moderate gender differences in students' achievement in mathematics.

## **CHAPTER ONE**

### **INTRODUCTION**

#### **1.1 Background of the Study**

Mathematics is perceived by society as the foundation for scientific and technological knowledge that is cherished by societies worldwide. It is an instrument for political, socio-economic, scientific and technological developments (Githua & Mwangi, 2003). This does explain why mathematics is a compulsory subject for all learners in primary and secondary schools in Kenya (KICD, 2002). It is also used by universities to select secondary school learners for entry into science-based degree programmes (Kenya Universities Joint Admissions Board, 2006).

Most decisions taken are based on such questions as ‘what and how’? These questions are answered by converting every statement to mathematical statement before solution is sought. The depth of mathematical knowledge an individual has dictates, the level of accuracy of his or her decision. This implies the fact that before an individual can function well in the society, one must possess relatively good knowledge of mathematics especially in this era of technological age. Okebukola (1992) referred to mathematics as the central intellectual discipline of the technological societies. Kerlinge (1985) describes mathematics as a language of science. Aminu (1990) argues that mathematics is not only the language of sciences, but essential nutrient for thought, logical reasoning and progress. Mathematics liberates the mind and also gives individuals an assessment of the intellectual abilities towards direction of improvement. The author concludes by saying that mathematics is the basis of all sciences and technology and of all human endeavours. Application of mathematics

cuts across all areas of human knowledge (Aminu, 1990). The Republic of Kenya (1999) acknowledges perceived role of mathematics in scientific and technological development and recommends it as a compulsory subject in the secondary school curriculum. The syllabus is designed in such a way that the knowledge and skills acquired in one level become a prerequisite for the next level, for example, the laws of statistics are arithmetic. For example, systematic learning of statistics should require the fundamental processes of arithmetic, namely; addition; subtraction; multiplication and division. Several studies (Cockcroft, 1982; Stanic, 1995) suggest that mathematics need not be learned by students in secondary for the sake of career choice or advancement but students should be able to learn mathematics with understanding and to apply mathematical ideas later in life.

The intention of curriculum developers at the Kenya Institute of Curriculum Development (KICD) is to develop secondary school mathematics syllabus that will help students become numerate, accurate and precise in thought (KICD, 2002). This is in line with National Goals of Education of Kenya, KICD (2002). As much as this could be a noble desire of curriculum developers, a student may complete his/her secondary school education without necessarily being numerate, accurate and precise in thought, in the strict sense of the words. But that does not mean such a student has not learnt mathematics at all in his/her secondary education. Macnab and Cummine (1986) state that learning of mathematics is a continuous process and is not limited to the classroom experience only.

With all the emphases given to mathematics including making it a core subject in secondary school curriculum, students performance in examination has registered various inequalities. The 2010 KCSE examination results show that of those sitting the examination, 55% were boys and 45% were girls. Thirty percent of boys sitting the KCSE obtained a mean grade of C+ or above whereas only 23% of girls sitting the exam obtained a mean grade of C+ or above (KNEC, 2011).

Table 1.1 shows the overall candidates mathematics performance by gender from 2011 to 2013 nationally.

**Table 1.1: Overall Candidates performance by gender from 2011 to 2013 National**

			121 Mathematics Alternative A	122 Mathematics Alternative B
2011	ALL	No.	409889	1,247
		Mean %	24.79	13.32
	Female	No.	181770	570
		Mean %	21	12.51
	Male	No.	228117	677
		Mean %	27.8	14
2012	ALL	No.	433014	1,281
		Mean %	28.66	9.49
	Female	No.	195093	635
		Mean %	25.3	8.96
	Male	No.	241233	727
		Mean %	31.38	9.95
2013	ALL	No.	444792	1,104
		Mean %	27.31	8.65
	Female	No.	202,129	561
		Mean %	24.51	7.56
	Male	No.	242663	543
		Mean %	30.13	9.84

**Source: KCSE Examination Essential Statistics (KNEC)**

Table 1.1 indicates that boys performed better than girls in the three consecutive years. But worth noting though is that both girls and boys improved by an average of 15% in KCSE 2012, however, it dropped by 4% in KCSE 2013. Hence the assertion of Stanic (1995) may not necessary mean that teacher reinforcement on students learning is the sole reason for better achievement in examination. Girls can perform as well as the boys, so long as they are given an enabling environment of learning mathematics. Stereotyped perception of the gender should be discouraged by all education stakeholders. Difference between sexes in achievement varies depending on topic. Girls do significantly better than boys on questions demanding computational skills. But on the other hand, boys do better in areas dealing with measurement and problem-solving (Costello, 1991). Results indicate that mathematics alternative a subject registered better performance than latter. According to (KNEC statistic, 2011) mathematics alternative A subject performance improved to (23.06 %) from the previous year's (21.13%). However, few gains were noticeable in the newly introduced mathematics alternative B subject which was examined for the first time in 2010. This is a clear indication that other factors other than the curriculum influenced the outcomes.

In Bureti Sub-County, secondary schools do pure sciences and therefore, mathematics alternative A only is offered. Table 1.2 shows the KCSE overall performance in mathematics alternative A, for the years 2010 to 2013, in Bureti-Subcounty.

**Table 1.2: Overall candidates' performance by gender from 2011 to 2013 in Bureti Sub-County**

			121 Mathematics Alternative A
2011	ALL	No.	2681
		Mean %	3.71
	Female	No.	1230
		Mean %	2.62
	Male	No.	1451
		Mean %	4.63
2012	ALL	No.	3251
		Mean %	4.02
	Female	No.	1594
		Mean %	3.44
	Male	No.	1654
		Mean %	4.59
2013	ALL	No.	3264
		Mean %	4.01
	Female	No.	1496
		Mean %	3.24
	Male	No.	1768
		Mean %	4.66

**Source: Bureti Sub-County Education Office.**

In Bureti Sub-County, student performance in KCSE mathematics has not been good. Boys performed better than girls. Table 1.2 indicates the sub-county mean scores from 2011 – 2013. Mondoh (2001) argues that people differ in learning according to how they perceive and process reality. In the line of gender, Eshiwani (1984) in his research with regard to overall performance in KCSE, research findings show that, generally girls are lower achievers than boys. A research by Meadows (2003) on gender effects in seven subjects: biology, psychology, English, computer, mathematics, history and general studies, found that females performed significantly better than males in all specifications except mathematics, which showed no significant gender difference.

Bryden (1979) notes that brain lateralization has been used to explain the cognitive differences that lead to differences which are in favour of boys' achievement in mathematics as opposed to girls. Similarly, learners have their unique learning styles referred to as four-mat system. Each type of learners is contributed by certain attributes that lead to compatibility or incompatibility between their preferred thinking which is likely to affect understanding and performance in mathematics. Type one learners perceive information concretely and process it reflectively. They learn best by personal involvement, listening and sharing ideas, their favourite question is 'why?' Teachers, therefore, need to provide them with particular concept. This implies that in situations where mathematics lessons are teacher-dominated and individualized, girls are likely to lag behind boys. Type two learners are observers and thinkers who are best taught using experimental methods, which are practical and require use of mathematical laboratories and teaching aids (FAWE, 1997; Mondoh,

2001). The majority of girls are inclined to learning through this approach. Type three learners perceive information abstractly and process it actively. They like trying out things for themselves; they prefer hands-on activities that relate to real life and especially those within the context of their own lives and environment. Boys are recognized to have these attributes, which are favourable for learning mathematics. Type four learners are risk takers and dynamic, their favourite question is “if”. Such type of learners are inclined to work on their own or left on their own to teach themselves and others. Self-discovery is the best method for teaching them.

Mensch and Lioyd (1998), in their study on gender differences in schooling experiences of adolescent in low income countries, noted that in low performing schools, teachers tend to think that mathematics is somewhat important for boys. In keeping with the conventional stereotypes, not one teacher in the school said that mathematics was easier for girls. According to Pamela (2000) and Githua (2002), learning mathematics by girls may be inhibited by the presence of boys. Mbuthia (2011) found that female students performed better than the male counterparts in mixed secondary schools, while male students recorded a better performance compared to their female counterparts in single sex secondary schools. Githua and Mwangi (2003) in their research on mathematics self-concepts (MSC) and students motivation to learn mathematics (SMOT) conclude that students’ mathematics self-concept is related to their motivation to learn mathematics. Gender differences, favouring boys, exist in students’ perception of likelihood of success, and satisfaction in learning mathematics. The researchers also conclude that students’ MSC is differentiated by gender, school social setup and grade level and that girls in co-

educational secondary schools have the least self-concept and motivation to learn mathematics. Kosgei and Bii (2007) in their research on gender differences and attitudes towards learning of mathematics among secondary school students, found that both boys and girls have positive attitudes towards learning of mathematics though boys were more inclined than girls. Guzel (2004) states that the female students' attitude towards mathematics is more positive than the male students. Students' perceptions of parental, teachers and peer expectations were found to significantly influence gender differences and attitudes towards learning of mathematics.

Despite spirited gender awareness efforts, gender disparity in students' performance in Mathematics persists. Hence, there is a need to explore more on gender differences in students' achievement in Mathematics in secondary schools with a view of suggesting possible intervention strategies. Hence the need for such a study.

## **1.2 Statement of the Problem**

Education stakeholders continue to invest heavily in the education of young Kenyans with the view to getting good, if not excellent output in terms of skills and knowledge. The institute of Policy and Research (2008) indicates that despite the emphasis given on education towards the realization of United Nation's Millennium Development Goals (MDGs) to achieve gender equity by 2015, challenges such as access, curriculum relevance still characterize Kenya's Education over the years.

Mathematics is generally viewed as a difficult subject to all and more so to girls. While gender choices are made more freely today, inequity remains in science and mathematics occupations, healthcare and technology. Mainstreaming the gender perspective at all levels of policy is one aspect of efficiently enhancing gender equality (OECD, 2012). Many attempts have been made to improve mathematics performance, including spirited gender awareness, efforts by governments as well as intervention by NGO; gender disparity in mathematics performance still persists. No such research has been done in Bureti Sub-County, Kericho County Kenya. It is in view of this gap that this study on gender difference in students' performance in mathematics was prompted the investigation of the problem.

### **1.3 Purpose of the Study**

The purpose of this study was to identify gender differences in students performance in mathematics, focusing on probability and statistics in Bureti Sub-County of Kericho County.

### **1.4 Objectives**

The study aimed at accomplishing the following objectives;

- i. To establish gender-related factors that influence performance in mathematics.
- ii. To establish the relationship between students career aspirations and their attitude towards mathematics in learning.
- iii. To establish teachers' perceptions about boys and girls ability to grasp mathematics concepts.

- iv. To establish best practices adopted by teachers to motivate and encourage boys and girls towards improvement of mathematics performance in secondary schools.
- v. To determine the gender differences in performance in mathematics in secondary schools.

### **1.5 Research Questions**

The research questions for facilitating this study were as follows:

- i. Do boys and girls secondary school students have gender related opinions about mathematics that influence on performance?
- ii. What differences are there in attitudinal and inspirational expressions by boys and girls towards learning school mathematics?
- iii. Do Students have gender related professional aspirations towards mathematics?
- iv. How do teachers help students cope with the demands of mathematics concepts?
- v. What is the relationship between boys and girls performance in secondary school mathematics?

### **1.6 Significance of the Study**

The findings of the study will add to the pool of academic knowledge in mathematical areas. It is hoped that the study will be helpful to researchers, classroom teachers and learners in an effort to improve teaching of mathematics and improving learners' involvement in mathematics curriculum. The results will enable teachers to evaluate their teaching approaches and adopt those which improve performance in mathematical instructions. In addition, they will realize the importance of being

sensitive on gender to avoid bias. It will shed light on the future needs and capabilities of the students of Bureti Sub-County and change the attitudes of the learners, teachers and the entire society. The study will also add to literature which can be adopted and used to compare to other studies done elsewhere.

## **1.7 Scope and Limitations**

### **1.7.1 Scope**

The study only included girls, boys secondary schools and mixed secondary schools. Form three students were involved, because by the time of study, they would have fully covered the more basic concepts of mathematics. Forms one and two were excluded because they might not have studied a lot of topics at the time of research. The form four students were also not studied, because they were likely to be doing their KCSE examinations at the time of research. The study covered only the students who were already enrolled and present in the sampled schools at the time of study.

### **1.7.2 Delimitations and Limitation of the Study**

#### **Delimitations**

The study was carried out in secondary schools in Bureti Sub-County and therefore, the findings mainly reflected the situation in this sub-county.

#### **Limitation**

The following were considered as the main study limitations:

- a) Since the sample respondents were drawn from some selected public secondary schools in Bureti Sub-County, the effects that were found will

reflect the situation in the sub-county. Hence, the findings may not be representative of all secondary schools in Kenya.

- b) Resources (time and funds) were other limitations of the study. Inadequate time and funds for the programme hindered the extension of the research to other parts of the country. But this study optimized these available resources.

### **1.8 Assumptions of the Study**

In the study, the following assumptions were made:

- i. The sample used in this study is representative of the wider population of secondary school students in Kenya.
- ii. There are relationships between variables identified in this study and achievement in mathematics unless otherwise stated.
- iii. All mathematics teachers are trained and effective in their instruction.
- iv. All secondary schools investigated adhere to a uniform mathematics syllabus.

### **1.9 Theoretical Framework: Social Learning Theory**

This study was guided by the social learning Theory by Bandura (1997). The theory states that in social situations, people often learn more rapidly by observing and modeling the behaviours of others. Education is always carried out in a social context. This theory is applicable to this study since the social factors underlie the gender difference in mathematics performance. This study is influenced to a great extent by observable teacher behaviours that affect students performance, either directly or indirectly. The nature and the strength of the influence of teachers on learners depended to a significant extent on a variety of contextual factors such as availability

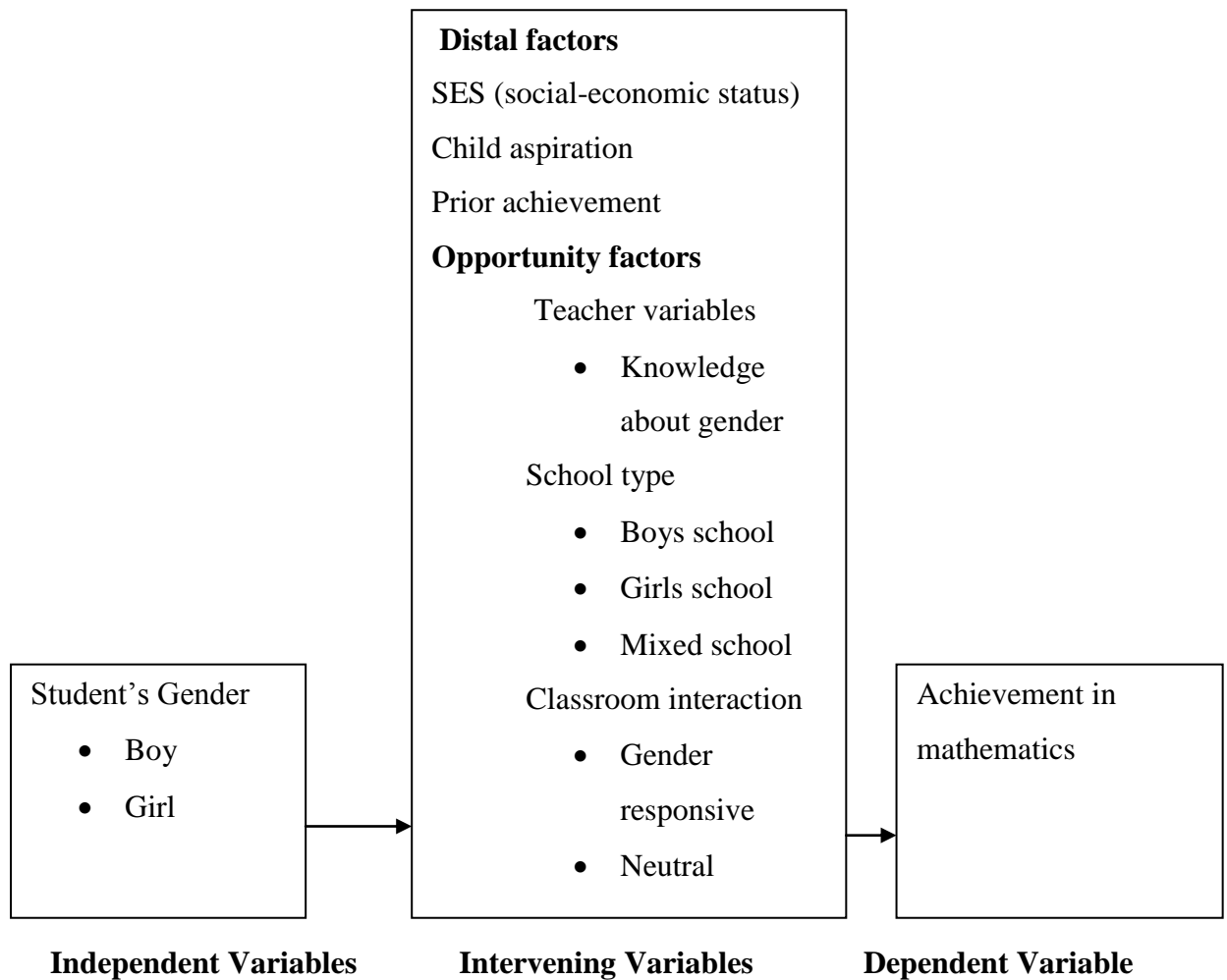
of equipment and materials, the number of students in a classroom and the teaching method used by the teacher.

In patriarchal cultures, male students link their achievement to future opportunities and outcomes. As a result of the decreased opportunities afforded to females, girls do not perceive such a link and thus do not achieve as boys do in domains that they perceive to be less useful. Baker and Jones (1993) argue that female students, who are faced with less opportunity, may see mathematics as less important for their future and are told so in a number of ways by teachers, parents and friends. Opportunity structures can shape numerous socialization processes that shape performance.

Over the last decades, diverse theories and frameworks have been developed and many have tried to identify factors that influence the mathematics performance in order to reduce gender inequality in mathematics achievement (O' Connor, Kanja, & Baba, 2004). The present research borrows heavily from the suggestions advanced by the Social Learning Theorists.

### **1.10 Conceptual Framework**

This study was guided by the opportunity-propensity model. The opportunity-propensity model is one of the distinct models being developed by Byrnes and Miller (2007) in recent years in the field of mathematics learning. The conceptual model underlying this study is concerned with how educational opportunities are provided to students and the factors that influence how students use these opportunities.



**Fig.1.1: Opportunity-propensity model.**

Source: Adapted from Byrnes and Miller, (2007).

Figure 1.1 shows the relationship of factors that directly contribute to effective learning which then contribute to the students achievement in mathematics. Performance in mathematics involves independent variable, that is, students gender. Intervening variables such as distal factors and opportunity factors which include teacher-variables, student-variable and school type. And the output is the student's mathematics achievement. Schools with high social economic status, students are

more likely to have greater support from parents, fewer disciplinary problems and more chance to attract talented and motivated teachers. Fullarton (2004) indicates that at the student level, home background index is a strong predictor of achievement in mathematics. Child's aspirations towards mathematics affect achievement in the subject. It is primarily the acquisition of proficiency in a subject that leads to positive attitudes in that subject (Maccoby & Jacklin, 1974). The ability of the learners in terms of how they handle different mathematics questions also affects performance.

The opportunity factors that mainly involves teachers' variables, classroom interaction and school type as intervening variables, have a great impact on mathematics performance. Mathematics teachers play an important role and therefore, have a strong influence on students learning of the subject. Rukangu (2000) indicates that teachers' inability to evaluate one-self in a classroom context led one to being unable to understand the students' problems especially for girls, hence ineffective communication in a mathematics classroom. The effects of these factors on mathematics formed dependent variable, that is, the achievement in mathematics.

### 1.11 Definition of Terms

In this study, the following terms were used:-

**Statistics-**A branch of applied mathematics concerned with the collection and interpretation of quantitative data and the use of probability theory to estimate population parameters.

**Stereotypes-** Are thoughts that may be adopted about specific individuals or certain ways of doing things.

**Attitudes:** Opinion or way of thinking. Generalized feelings towards a particular object, subject or situation. A perception that one forms towards an event object or subject. It can either be favourable, neutral or unfavourable towards the event, object or subject.

**Achievement:** Reach or attain a certain level, especially by effort. Specifically, it is the level of academic performance in a given examination.

**Equitable:** Refers to dealing fairly and equally with everyone.

**Performance:** Accomplishment in a particular area of a course, usually by reasons of skill, hardwork or interest and attitudes.

**Gender inequalities:** Attitudes that show a difference in expectations of boys and girls experience.

**Learning:** Gain skill. Relatively persistent change in an individual potential behaviour due to experience.

**Algorithms-**Refers to a set of steps used to do or perform a mathematical computation.

**Probability:** Refers to a numerical measure of the likelihood of an event happening or not happening.

## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.1 Introduction**

This chapter presents review of literature related to the study under the sub-headings; effects of students gender difference on mathematics, students cognitive development and mathematics ability, mathematics achievement, gender differences in mathematics achievement in Kenya secondary schools meaningful learning and gender differences in mathematics participation. A brief summary of the literature has also been given.

At the very beginning, the concept of gender occurred in the field of social science, gender difference and gender gap was being taken as an important issue in socio-economic development and social wellbeing. Depending on the context, the discriminating characteristics vary from sex to social role to gender identity (Ajai & Imoko, 2015). Gender differences in mathematics achievement and ability has remained a source of concern as scientists seek to address the under-representation of women at the highest levels of mathematics, physical sciences and engineering (Asante, 2010). From the beginning till today many researches have been done in gender difference and its impact in student's achievement in mathematics. Gender differences in secondary mathematics are a prominent issue that has been the focus of many studies, with reported differences in mathematics achievement between boys and girls as contentious. The literature has not come to a clear consensus; some studies have shown girls outperforming boys (Stevens, Wang, Olivarez, & Hamman, 2007), while others find boys outperforming girls (Preckel, Goetz, Pekrun, & Kleine,

2012). Recent research from large-scale studies such as the Trends in International Mathematics and Science Study (TIMSS) has found that “there were no gender differences in 22 of the 42 countries that tested at Year 8, including Australia” (Thomson, Hillman, & Wernet, 2012, p. 20). And no gender differences were found within any single state or territory.

## **2.2 Effects of Students Gender Differences on Mathematics Performance**

Literature indicates that the role played by gender in mathematics education is multifaceted. (Fennema, Carpenter, Jacobs, Franke & Levi, 1998; Maccoby & Jacklin, 1974; Shibley-Hyde, Fennema & Lamon, 1990) show that many reports of differences in mathematics performance related to gender have been presented over the past decades. Performance differences have been postulated to be due at least in part, to attitudinal differences regarding mathematics. Fennema & Sherman (1977), using the Fennema-Sherman mathematics attitudes scales, found several gender differences in high school students' attitude. For the students in those high schools in which the males performed significantly better on mathematics achievement tests, Fennema & Sherman (1977) found that males also had higher scores on attitude scales including confidence in learning mathematics, viewing mathematics as male domain, attitude towards success in mathematics, mother's support, father's support and usefulness of mathematics. Since that initial report, similar gender differences in attitude towards mathematics have been reported for different ages and using different measurement scales (Duffy, Gunther & Walters, 1997; Forgasz & Bleder, 1996; Kloosterman, 1998; Meyer & Koehler, 1990; Stipek & Gralinski, 1991; Tocci & Engelhard, 1991).

Hence the study aimed at establishing the effects of gender differences in mathematics achievement in Kenya secondary schools.

### **2.3 Students Cognitive Development and Mathematics Ability**

Cognitive psychologists emphasise on the role of thinking process. Psychologists assumed that there are developmental changes in the child's brain that allow it to process information in more sophisticated ways. Bryden (1979) notes that brain lateralization has been used to explain cognitive differences which are in favour of boys achievement in mathematics. The explanation given has been that the right hemisphere which controls spatial related activities develops earlier in boys than girls. Spatial skills or spatial visualization is the ability to move geometric figures in ones' mind. Hence, a person with greater competence in spatial related activities is likely to perform well in science and mathematics. This explains why boys are more likely to be good in science and mathematics compared to girls. These differences also have implication on instructional procedures to be adopted for the purpose of setting up an appropriate teaching learning environment for mathematics instruction that is suitable for both genders.

According to Barmao (2006), majority of the girls perceive information concretely and process it reflectively. They learn best by personal involvement, listening and sharing ideas. Boys on the other hand, perceive information abstractive and process it actively. They learn best through hands-on activities and self-discovery. How much gender role is influenced by biology and how much by environment is still a matter of conjecture, but it is evident that both influences are involved. With the new

information about cognitive differences, girls should know that there are many reasons why they can do well in mathematics and science.

If boys and girls are not processing information in the same way, this has implications for classroom. Teachers need to be cognizant of these differences and understand that not only do children learn differently but also good students may learn from the way the teacher teaches. If a child approaches a learning task in a way that is different from the way the teacher would, that does not necessarily make either approach better or worse than the other. Using this information will help all the students. However, there are two sides to the academic arguments about cognitive gender differences. One group works at research on adults and concludes that because men and women don't differ a great deal on cognitive measures that education of children should focus on similarities that exist between boys and girls. Generally, this group believes that if gendered educational principles are used the difference between boys and girls will widen. The other group concludes that the problems that girls have with mathematics and science that boys have with language arts begin early and only by using gendered educational approaches will men and women become more equal in their cognitive abilities (Norfleet, 2007). Hence, the research intended to find out the effects of students cognitive development and mathematics ability on mathematics performance.

### **2.3.1 Gender Difference by Genetic Predisposition**

Cockcroft (1982) refers briefly to theories indicating that different attitudes could be as a result of genetic factors or hormonal influences or even differences in brain lateralization. Despite the report being credible, this assertion may not exactly be

verified as to how a student, either a girl or a boy may be pre-disposed to like something or dislike it. Twoli (1986) agrees that there is no clear-cut evidence that a learner is pre-disposed genetically. But Twoli (1986) cites cases of documented differences in cognitive ability between girls and boys which in one way or another, the learner may form attitudes towards learning a particular subject. Orton (1987) agrees with the view that ability especially in mathematics is not innate, and he qualifies his assertion by stating that:

Mathematics abilities are not innate, but are properties acquired in life that are formed on the basis of certain inclination... some have inborn characteristics in structure and functional features to the development of mathematics abilities... anyone can become an ordinary mathematician, (but) one must be born an outstandingly talented one (p. 111).

While the author is not completely dismissing the genetic factor, Orton agrees that other pertinent factors come into play. This researcher's interaction with some of the high school students has shown that there are students who do well in other subjects but not in mathematics. Some openly resisted learning mathematics but in internal and external examinations, they posted above average results in other subjects while performing dismally in mathematics. Orton (1987) in the research indicates that males excelled in spatial ability whilst females excelled in verbal ability. These differences may predispose the students to view mathematics learning differently. But Ying and Ching (1991) disagreed that the difference in ability may not necessarily be genetic but could be due to other factors.

This study intends to find out the gender contributing factors to performance in mathematics among secondary school students. Students' experience of negative feelings towards learning of mathematics may lead to unfavourable attitudes to the

subject. Such negative feelings could be as a result of excess workload or poor teachers teaching method and the teachers' failure to attend to individual differences. Stanic (1995) while quoting Fennema (1976) states that some boys enjoy more learning mathematics than girls. This is so depending on their earlier experience. But author asserts that if the learning environment created by the teacher is conclusive, both sexes persist in doing mathematics. The various attitudes formed by students as they interact in school, have determined how they learn mathematics. Consequently, this determines their achievement in secondary school mathematics examinations. Whenever attitudes are formed, especially negative attitudes, girls are usually the ones who are on the receiving end. Research by Kaino (1998) in Botswana found that girls feel harassed by boys when they do not answer questions correctly in class. This was so in mixed classes. That they feel shy when with the opposite sex, learning mathematics together. Boys, on the other hand, indicated that they cannot concentrate when they learn while sitting next to girls. Worse still, they claim girls make noise (Kaino, 1998).

### **2.3.2 Societal Influence on Students Performance**

By the time a student joins form one, he/she will have interacted with his/her parents, who to a great extent, influence his/her perception of learning in school in general and specifically learning of mathematics. Orton (2007) attributes the noticeable difference in learning among boys and girls to "societal attitudes and expectations". The author asserted that influences of society and from the environment affect mathematical development of students at various levels amongst boys and girls. Boys and girls are socialized differently while playing children games. Boys are engaged in more

vigorous activities while girls take more passive roles. This scenario is replayed in school and class while learning. If no deliberate steps are undertaken to counter this mind-set, students may form unfavourable attitudes towards any learning activity and this may lead to variation in what is learned in a subject. Steele is quoted by Halpern (2000) to have found that when talented students took an advanced test of mathematics with a negative stereotype that male will outperform female, male students did score higher than female students. When these students took the same test with a positive stereotype that female and male will score equally, no overall gender difference was found in test scores. Such a phenomenon is referred to as “stereotype threat”. Steele (1999) also found that among the talented, the fear of being associated with a negative stereotype impaired intellectual functioning and disrupted test performance regardless of preparation, ability, self-confidence, or motivation.

Difference in parental expectations, desires and pressure they exert at home on their sons and daughters has been attributed for attainment variations among the sexes (Orton, 1994). Society views mathematics as a male subject as Costello (1991) found. This is especially when parents react and reinforce daughters and sons differently. When their children do something mathematical, daughters are told “you’ve really tried” meaning nothing much is expected from the female child. But to their sons, they are told “you can do far much better” (Costello, 1991). Meaning male children are expected to do a lot more in mathematics. Such comments said by parents consciously or without much thought are registered in the sub-conscience of a child and may influence how he/she perceives mathematics. Hence formation of attitudes among students may have been unconsciously registered from parents particularly and

from the society in general. Ying and Ching (1991) did a study comparing 894 students from 26 schools in Hong Kong. They undertook a study to identify correlations between mathematics achievement and expectations from parents and of students themselves. After conducting multiple regression analyses, they revealed that the parental expectations and students achievement in mathematics had a strong correlation. Whether societal and parental expectations influence performance amongst secondary school students became the contention of the study.

#### **2.4 Meaningful Learning and Mathematics Achievement**

Mathematics is, after all, a very hierarchical subject in which new knowledge generally must be linked to existing knowledge if pre-requisites have not been mastered, the knowledge just cannot be learned. Any theory of learning mathematics must take into account the structure of the subject. It is not possible to learn about integers and about rational numbers before natural numbers are understood meaningfully. Meaningful learning implies more than knowledge of the number system which allows counting and accounting. It implies an understanding of constraints, for example, the facts that subtraction and divisions cannot always be carried out within the set of natural numbers. When the existing knowledge structure is sufficiently rich and varied and better still when the child is asking questions which require new concepts, the time is right for injecting these new ideas. If an attempt is made to force children to assimilate new ideas that cannot be related to knowledge which is already in the knowledge structure, the ideas can only be learned by rote.

The algorithm for calculating arithmetic mean is one of the simplest of all algorithms in mathematics. Basically, the arithmetic mean is one of a number of measures associated with the idea of representative value. If a class were to write to a class in another country and regularly exchange information and news, they might wish to include some statistical information. There would be a number of ways of sending information about height and weight. The ideas of mean, median and mode must be seen as attempts to convey information about a population. If the teacher were to leave a tin of sweets for the children to help themselves, different children would take different number of sweets and that would not be considered fair. Instead, they should all really have the same number of sweets, which could be calculated by putting all the number of sweets and divide by the number of children. It is possible to link the idea of arithmetic mean to previously held knowledge, thus conveying mean to previously held knowledge, thus conveying ideas in a meaningful way (Orton, A, 1987). Students learning and performance in mathematics was the contention of the study.

## **2.5 Gender Differences in Mathematics Achievement in Kenya Secondary Schools**

Mathematics achievement is the attainment, accomplishment or successful performance in a mathematics examination, measured in scores that candidates obtain in an examination (Makau, 1997). Kenya's records show that girls continue to under-achieve in mathematics national examinations. In the 1999 KCSE examination results, for instance, girls obtained a lower mathematics performance mean score of 10% compared to 14% for boys (Muthini, 2006; Mwaniki, 2000; Mureithi, 2000). Gender

differences in mathematics achievement begin to appear at the upper primary school level and increase in secondary schools (Githua, Mwangi / *International Journal of Educational Development* 23 (2003) 487–499 491, Makau, 1994; Obura, 1991). These differences are caused by an interaction of factors within and outside the school as well as by the students' background (Makau, 1987; Makau & Coombe, 1994).

Students' efforts, ability and their teacher's effectiveness greatly influence their performance in mathematics (Scott, 1997) but, unlike in developed countries where teaching resources are in abundance, in developing countries mathematics performance is influenced more by current factors within a school (Farrel, 1993). Study done by Dénes Szűcs (2012) in Britain, has revealed that secondary school children experience Mathematics Anxiety (MA). Importantly, girls showed higher levels of MA than boys and high levels of MA were related to poorer levels of mathematics performance. Potentially having a detrimental effect on 'online' mathematics performance, past research has shown that high levels of MA can have negative consequences for later mathematics education. Therefore, MA warrants attention in the mathematics classroom, particularly because there is evidence that MA develops during the primary school years. Furthermore, study showed no gender difference in mathematics performance, despite girls reporting higher levels of MA. These results might suggest that girls may have had the potential to perform better than boys in mathematics, however, their performance may have been attenuated by their higher levels of MA. Therefore, the study intended to find out the gender differences in mathematics performance.

## **2.6 Gender Differences in Mathematics Participation**

Boys and girls participation in mathematics studies at all levels of education refers to their enrolment and extent of being retained and active in mathematics classrooms and in mathematics-related courses (Abagi & Wamahiu, 1995; Burton, 1996; Wanjiku & Masheti, 1997). Girls enrolment in Kenya's secondary schools and public universities is much lower than that of boys (Abagi & Wamahiu, 1995; Mwaniki, 2000). However, Abagi, Wassuna, and Wamahiu (1997) in their research on household based factors as determinants of school participation of girls in Kenya, found that national figures indicate that girls account for 50% of primary schools enrolment with slight variations in individual districts. Less than half (48%) of the girls complete their Kenya Certificate of Primary Education (KCPE) examination compared to more than half (52%) of the boys (Kering, 2001).

Girls are also under-represented in mathematics classrooms and in mathematics-related courses at Kenya's tertiary institutions (Eshiwani, 1984; Mureithi, 2000; Mwathi, 2000). An analysis of enrolment of 1999 second year Calculus, a core-mathematics course revealed that students in a Kenyan public universities showed 18.3% of the students were females compared to 81.7% males (Mureithi, 2000). Furthermore, out of 157 mathematics lecturers in Kenyan public universities, only nine (5.7%) were females compared to 148 (94.3%) males (Mwathi, 2000). Girls' attitudes towards mathematics reinforced by their socio-cultural beliefs; modes of teacher-students interaction; and boys' negative attitudes towards girls as mathematics learners.

Learners contribute to their low performance in the KCSE examination and under-representation in mathematics-related courses thereafter (Eshiwani, 1984; Makau, 1994; Mwangi, 1983; Obura, 1991). Mureithi (2000) and Mwathi (2000) mention five factors that are responsible for underachievement and under-representation of women in mathematics. These factors are peer influence against girls' serious study of mathematics particularly during adolescence; indoctrination by parents, book writers and society against girls' serious study of mathematics which is seen as a male domain; and lack of women role models as mathematicians. Others are lack of adequate study time for girls due to domestic chores and historical mistake that Kenya made by ensuring that prior to 1980 the school curriculum in girls 'high schools was art- based. Whether gender determined student's achievement in mathematics was the contention of this study.

## **2.7 Mathematics Teachers' Knowledge About Gender and Learners'**

### **Achievement**

Bayazit and Gray (2004) found that teaching practices that differ in qualitative way will produce qualitatively different learning outcomes. New curriculum implementation and syllabus re-arrangement become a challenge to teachers to acquaint themselves and this negatively impacts on how students learn mathematics while in class (Russell, 1983). The education ministry is working on changes that will ensure only those professionally qualified to teach mathematics and sciences are allowed to nurture students in the discipline (Godia, 2012). The minister further argues that to improve in these subjects, teachers would have to be assessed and allowed to teach only subjects that they can competitively handle. Students will also

be coached on the mastery of subjects and allowed to pursue careers that fall in their preferred cluster of sciences.

Geliert (1999) reported that “In mathematics education research, it seems to be undisputed that teacher’s philosophy of mathematics has a significant influence on the structure of mathematics classes” (p.24). Bransford, Brown, and Cocking (2000) added that teachers not only need knowledge of a particular subject matter but also need to have pedagogical knowledge and knowledge of their subject. The author added that competent mathematics teachers provide a roadmap to guide students to an organized understanding of mathematical concepts, to reflective learning, to critical thinking and ultimately to mathematical achievement.

The teacher’s attitudes reinforce the attitudes formed by the students towards learning of the new concept or the consequent similar concepts. Twoli (1986) in a study on sex-difference in science achievement found that teachers’ characteristics influence learning. A teacher’s way of looking at issues generally and in particular, mathematical concepts influence the learner. A student would like to learn a new concept depending on how the teacher presents it. Costello (1991) agrees that many teachers often unconsciously reinforce and validates students’ perceptions of appropriate gender-related behaviour. The author further asserts that boys are assigned assertive roles and when they do well, they are told they have a talent. But girls may be assigned less assertive roles and when they do well in mathematics, they are reminded that they have at least worked hard to achieve such grades. Because of this unconscious reinforcement from teachers, boys and girls form different attitudes

towards learning of mathematics. Costello (1991) also found that advice given to girls by teachers is too restricted in scope, usually too little and given too late when a female student is almost completing her secondary school education. Teacher's gender may determine how he/she portrays mathematics. Unconsciously, male and female teachers form attitudes towards the subject they are teaching. These attitudes formed by teachers depending on their own gender influence how their students will learn the subject being taught, mathematics included.

Fennema and Sherman (1976) assert that teachers are a major determinant in students learning of mathematics and to a large extent determine what the students might achieve (Eshiwani, 1984). This is because of the teacher's inherent attributes; his/her qualification and training, his/her general behaviour and attitudes towards mathematics, other subjects and towards the students themselves. Worth noting is that most female teachers prefer to teach language subjects and in arts subjects. But male teachers mostly prefer science and mathematics. This scenario is consciously registered in the minds of students and in the process, they unconsciously form attitudes towards learning in general and particularly learning mathematics (Oketch, 1982, Mwangi, 1983, Cockcroft, 1982 & Onyango, 2003).

Cockcroft (1982) noted aptly that there is no area in knowledge, where a teacher has more influence over the attitudes as well as the understanding of his/her pupils than he/she does in mathematics. During his/her professional life, a teacher of mathematics may influence for good or bad the attitudes towards mathematics of several students and decisively affect many of their career choices. Ortons (1987) works found that

teachers pay more attention to boys than girls while teaching mathematics because of their own prejudiced belief that boys achieve better than girls in mathematics. This could be so in a mixed class, but not in a single-sex class. Regardless of this misconception, girls achieve more in mathematics in single sex schools than in mixed schools while boys perform better in mixed schools than in single sex schools KNEC Report (2007). Hence, the type of class setup became this study's contention.

## **2.8 Summary of Literature Review**

The literature review has tried to bring out research on different variables that may affect performance of mathematics either positively or negatively. Other variables that explain discrepancies in performance of the students by gender have also been reviewed. This is upon realization that a lot of weight has been put in the subject as far as the secondary school curriculum is concerned. Studies from Kenya on gender difference in mathematics achievement in Kenya's secondary schools have been reviewed in order to identify with them and evaluate the impact of these researches on mathematics education. Other factors affecting mathematics achievement which include; students' interest, students' cognitive development and teacher characteristics have also been addressed. This has been done elsewhere but not in Bureti Sub-County.

## **CHAPTER THREE**

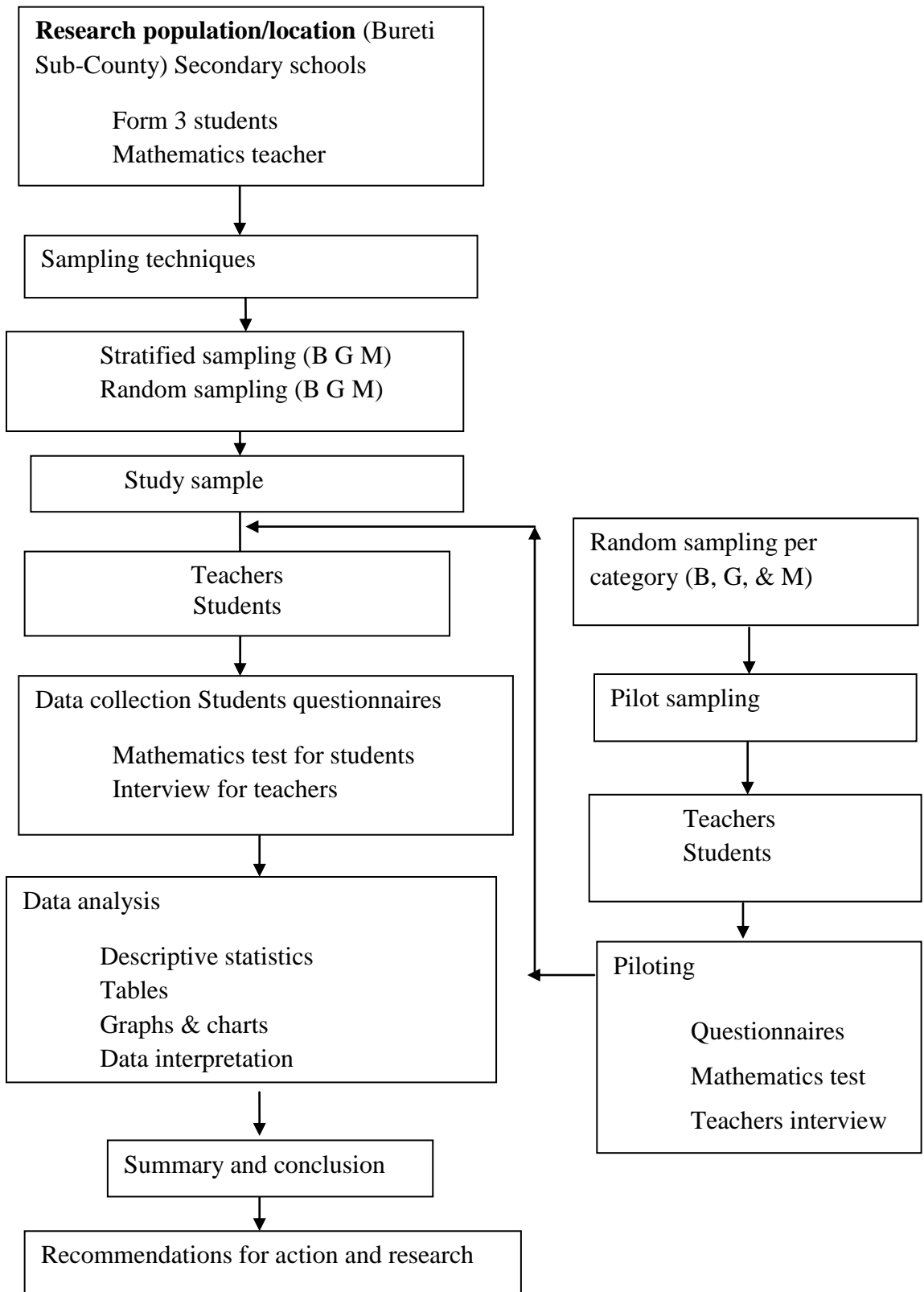
### **RESEARCH DESIGN AND METHODOLOGY**

#### **3.1 Introduction**

This chapter describes the methodology that was employed in the fulfillment of the research objectives. The following are discussed: research design, variables location of the study, description of the population, sampling design and sample size, research instruments, pilot study, data collection, data analysis techniques and finally ethical considerations.

#### **3.2 Design of the Study**

The research design used in this study is descriptive survey. It was preferred because it involves collecting data from schools in three different types of schools that are boys' girls', and mixed secondary schools. The study aimed at collecting information from respondents on their attitudes and opinions in relation to performance in mathematics. This process is summarized in figure 3.1.



**Figure 3.1: Design and process of the study**

Source: Adapted and modified from Cohen and Manion (1994:89)

### **3.2.1 Variables**

The following were considered the main variables that were used in the study.

#### **Dependent variables:**

Performance in Mathematics. Test items were used to determine the performance.

#### **Intervening variables:**

- Student-related variables include:  
Learner's expectations, attitude towards in mathematics.
- Teacher-related variables include:  
Qualification, teaching load, training background and experiences.
- School-related variables include:  
School type, provision of resources like textbooks and enough teaching staff.

#### **Independent variable:**

The gender of the student.

### **3.3 Location of the Study**

The study was carried out in Bureti sub-county, which is one of the sub-counties in Kericho county of Kenya. The choice of the sub-county is because it still performs dismally in KCSE and mathematics in particular, for the last four years, as reports from Sub-county Education Offices indicate. The county also has that gender problem in mathematics performance. Its proximity to the researcher's work station helped the researcher to maximize on administration and management of the research and reduce the cost of research.

### 3.4 Target Population

Borg and Gall (2007) have defined target population as all the members of the real or hypothetical set of people, events or objects for which the researcher wishes to generalize the results of the research study. The study targeted 54 secondary schools with a population estimate of 17,155 students. The enrolment shows that there are 8,561 boys and 8,594 girls. The distribution of the schools is shown in Table 3.1.

**Table 3.1: Distribution of Secondary schools by Type and Enrolment**

School Type	Number of Schools	Enrolment
Boys	10	5,527
Girls	14	5,530
Mixed	30	6098
Totals	54	17,155

**Source: District Education Office, Bureti Sub-County (2014).**

### 3.5 Sampling Techniques and Sample Size

This section elaborates techniques and explains how the sample was obtained. The sample comprised students and their teachers in selected secondary schools in Bureti Sub-County.

#### 3.5.1 Sampling Techniques.

Various sampling techniques were used to select different samples as explained below:

**School nature:** The selection of the sample was done through stratified sampling. This technique was chosen because it guarantees desired representation of relevant sub-groups to increase the efficiency of the population estimates (Gay, 1992).

**Individual schools:** The schools were first divided into three strata, which were boys, girls and mixed secondary schools. The group from each stratum was then selected using simple random sampling. Each school was assigned a number. The numbers were written down on small pieces of papers, which were folded and placed in three different cartons representing each stratum. The researcher picked at random 8 schools in equal ratios as follows; 2 boys, 2 girls and 4 mixed secondary schools, from each carton which represents 14.8%, the schools under study as shown in sampling grid (Table 3.2).

**Table 3.2: Sampling grid for schools**

School type	Number of schools	Sample of schools
Boys'	10	2
Girls'	14	2
Mixed	30	4
Total	54	8

**Mathematics teachers:** The selection of this was proportional random sampling. The study targeted trained mathematics teachers because they have been trained on how to teach mathematics. Sample teachers were in the ratio 2:2:4, for boys, girls, and mixed secondary schools respectively.

**Class:** In selected schools with more than one stream, random sampling was used in selecting a class.

**Students:** The study was carried out among form three mathematics students. This is because the form four students were expected to be preparing for their KCSE examinations while the test items that were done required a student to have completed form one and form two mathematics syllabuses. The sample of students was selected using simple random sampling. The student's admission numbers in form three were written on pieces of papers, put in a box and selected randomly as per number required.

### 3.5.2 Sample Size

A sample size of 430 from three students were sampled from a population of 4100 students in all form three classes in Bureti Sub-County.

**Table 3.3: Sampling grid for students**

School type	Enrolment	Sample of students
Boys'	1424	150
Girls'	1376	145
Mixed		
(a)Boys	720	75
(b)Girls	580	60
Total	4100	430

### 3.6 Research Instruments

Three tools were developed and used. These were Mathematics Test (MT) for students, a questionnaire for students (MSQ) and Mathematics Teachers Questionnaire.

### 3.6.1 Mathematics Achievement Test

A forty-minute item mathematics achievement test was constructed based on the experience and standard of KNEC (Kenya National Examinations Council) to cover the basic area of statistics and probability. The Mathematics test items were set by the researcher based on the following table of specifications;

**Table 3.4: Table of specification**

Content	Knowledge 3	Comprehension 2	Application 8	Thinking 7	Total 20
Mathematics Questions	1	1	2	2	6

**Source: Researcher**

This was used to determine how pupils in secondary schools in Bureti Sub-County tackle mathematical tasks. It aimed at determining the gender differences in students achievement in mathematics. It was constructed with some items adapted from KNEC (2012). It emphasized two abilities: Problem-solving ability and computation skills.

### 3.6.2 Mathematics Students Questionnaire (MSQ)

A questionnaire was developed and administered to all the schools in the sample. Kiess and Bloomquist (1985) observed that questionnaires have the ability to collect a large amount of information in a reasonably quick space of time and provides the investigation with an easy accumulation of data.

MSQ was used to obtain data from mathematics students in secondary schools. The data were consequently used to identify the gender-related professional aspirations

(towards mathematics). This questionnaire was administered to the randomly selected form three students in the selected secondary schools. MSQ contains two major sub-sections; general information about the student/school and students' feelings towards mathematics. A 5-point Likert Attitudes Scale ranging from "strongly agree" to "strongly disagree" was used to determine students' feelings. The Likert Scale contained three sub-categories of items, namely; items on mathematics as a subject, items on mathematics teachers and their influence on performance and learning of mathematics, items on the students, peers and family members (Appendix B).

### **3.6.3 Questionnaire for Mathematics Teachers (QMT)**

A questionnaire is widely used in research because it is possible to give similar or standardized questions to the respondents (Kerlinger, 1973). This makes it possible to compare responses from different respondents on the same questions. The questionnaire for the mathematics teachers was used to find the factors which the teachers perceive to influence student performance in mathematics. It was also used to provide more information about the teacher and his or her curriculum characteristics. The researcher got more information relating to gender disparity in mathematics performance in secondary schools of Bureti Sub-County. Structured questions were preferred; this is because the reliability of the information gathered is high. Each informant is subjected to similar questions with the others.

### **3.7 Pilot Study**

The drafted test items adopted from (KNEC) were piloted in the randomly selected secondary schools in Bureti Sub-County in order to refine and enhance the validity

and reliability. Forty-five form three randomly selected students were requested to do the test items of which fifteen students were from each school type. Similarly, a random sample of four trained mathematics teachers from pilot schools filled the questionnaire. That means from every sampled school above. Those sampled for pilot studies were not involved in actual survey. This process was necessary for verifying time allocated to the test items and any ambiguities in teachers questionnaire. The data were collected; analyzed and necessary amendments were made on the research instruments.

### **3.7.1 Validity of the Instruments**

The content validity of the mathematics test (MT) was established by use of table of specification after which three heads of Mathematics department were used to ascertain the face and content validity of mathematics test. Kothari (2004) notes that validity is the extent to which a measuring instrument provides adequate coverage of the topic under study, if the measurements contain a representative sample, then content validity is good. Also, a panel of persons can judge how well the measuring instrument meets the standard. The suggestions made by the experts were used to revise the instruments before collecting data.

### **3.7.2 Reliability of the Instruments**

Since the Mathematics test items had a dichotomous score with varied levels of difficulty, its reliability coefficient was determined using Kuder Richardson (K-R) formula 20 estimates. This was determined using the formula adapted from (Sattler, 1988).

Thus,

$$r_{tt} = \left( \frac{n}{n-1} \right) \left( \frac{S_t^2 - \sum pq}{S_t^2} \right)$$

Where ;

$r_{tt}$  - reliability estimates

$n$ -Number of items on the Test

$S_t^2$  – Variance of the total test

$p$ -Proportion of the respondents getting an item correct

$q$ -Proportion of the respondents getting an item wrong

$\sum pq$  – sum of the product of  $p$  &  $q$  for each item.

Using the above formula, the pilot findings showed a reliability coefficient of 0.846.

This coefficient led to the determination of the reliability index of 0.9259, the reliability of the non-dichotomous score tools, questionnaires for both teachers and students were determined using the Cronbach coefficient formula adapted from

Sattler (1988). Test and retest method was used.

$$\alpha = \left( \frac{n}{n-1} \right) \left( \frac{S_t^2 - \sum (s_i^2)}{S_t^2} \right)$$

$\sum s_i^2$  is the sum of variance of individual items. The researcher administered the instruments with the assistance of the Mathematics teachers in the three schools; fifteen students from each school were used. The researcher also administered mathematics instruments. Split-half method of assessing reliability was used to test for the reliability of the data. Split half technique, according to Kothari (2004), requires only one testing session hence eliminating the errors due to differing

conditions. The questionnaires were numbered and their contents entered into a SPSS computer code sheet and reliability determined using split half for the even numbered and odd numbered questionnaires. The Cronbach's Alpha was used to measure the internal consistency and a value of 0.7781 was obtained and since 0.667 indicates an acceptable reliability coefficient (Jackson, 2003), the coefficients of all sections were found to be reliable hence the safe conclusion that the questionnaire used in this study as main data collection tools was reliable.

### **3.8 Data Collection Procedure**

Before the actual administration of research instruments and data collection, the researcher visited sampled schools to verbally explain the purpose of the study. The researcher discussed with mathematics teachers and sought for their assistance towards administration and collection of students test items. A total of 430 students did the Students Mathematics Test (SMT) and 16 teachers filled the questionnaire. This was done at the time agreed upon by the school authority and the researcher, to avoid inconveniencing the school time table. The instruments were administered through personal visits on appointment with heads of mathematics departments in schools through the schools principals.

The study used primary data obtained by implementing the mathematics achievement test in the sampled students. Since it was impossible to conduct the test in all sample school at same time, the test was conducted in sampled schools in different time schedule. And marks obtained by the sample students were used as the primary data in the study.

The questionnaires were given to teachers concerned to fill. The teachers filled the questionnaires as requested by the researcher. The respondents were given instructions and assured them of confidentiality and anonymity after which they were given enough time to fill in the questionnaire. The researcher then collected the completed questionnaires from the teachers.

### **3.9 Data Analysis**

The data collected were analyzed using both descriptive and quantitative statistics. Frequency tables, graphs, percentages and means were used in the data analysis. The results from Mathematics Test and filled questionnaires by students provided data which were scrutinized and then coded for computer data analysis. The mathematics test performance was first worked out as a percentage. Mean percentage for girls and for boys was calculated. Analysis of data concerning students' views on secondary school mathematics curriculum was done by calculating mean scores on the scale. To achieve this, numerical scores were assigned to five response options given to each item on the scale. For positively stated items, the score values were assigned as follows: Strongly Agree (SA) -5; Agree (A) – 4; Undecided (U) – 3; Disagree (D) - 2; Strongly Disagree (SD) – 1. However for negatively stated items, the scoring was reversed as follows, Strongly Disagree (SD) – 5; Disagree (D) – 4; Undecided (U) – 3; Agree (A) – 2; and Strongly Agree (SA) – 1. The data were keyed into SPSS data editor for analyses. Conclusion was drawn using the data analyzed.

### **3.10 Logistical and Ethical Considerations**

The researcher sought for a research permit and a research authorization letter from the Ministry of Higher Education, National Council for Science and Technology in Nairobi before embarking on data collection process as dictated by ethics. Further permission was sought from Bureti Sub-County Education Office. The researcher also wrote an introductory letter to all the schools which were sampled for the study explaining the purpose of the research and requesting them to allow their students to do the SMT and teachers to fill the questionnaire on behalf of the researcher. The consent of the teachers was sought before they were engaged in this study. The respondents were assured of the confidentiality of the research results.

## CHAPTER FOUR

### DATA ANALYSIS, PRESENTATION AND INTERPRETATION

#### 4.1 Introduction

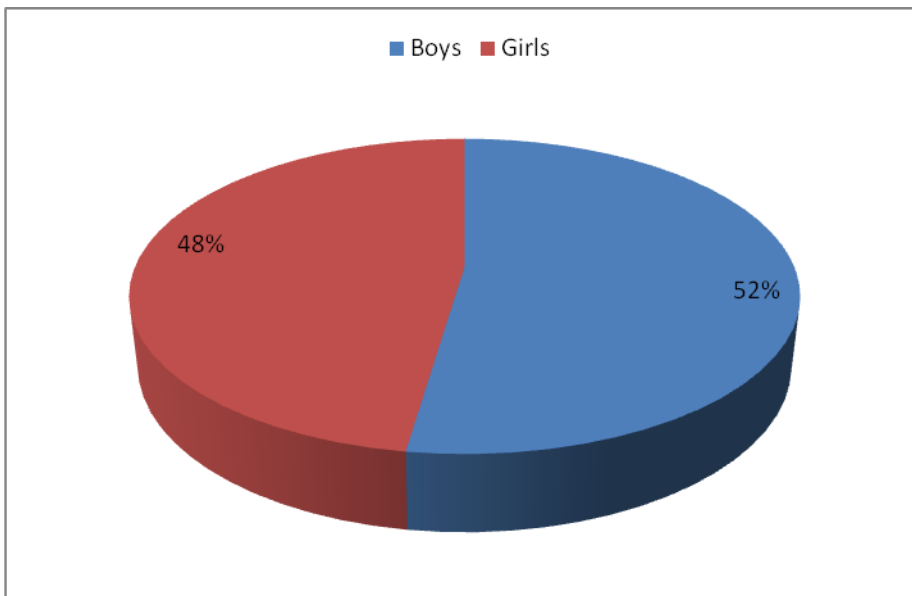
This chapter presents analysis and interprets the findings regarding the gender differences in performance in mathematics among form three secondary school students in Bureti Sub-County. It focused on the influence of students' perception, parental expectations, teachers characteristics and perceptions and school environment on their learning of mathematics. The descriptive and inferential statistics were used to analyze the data. This chapter is sub-divided into six sections focusing on the following:

- i. Demographic data of the respondents.
- ii. Main factors that affect learning of mathematics.
- iii. Gender-related factors that influence performance in mathematics.
- iv. Relationship between student's career aspiration and their attitude towards mathematics in learning.
- v. Mathematics teachers' attitude towards learners of mathematics in secondary schools.
- vi. Student performance in Mathematics.

## 4.2 Demographic Data of the Respondents

### 4.2.1 Students Gender Distribution

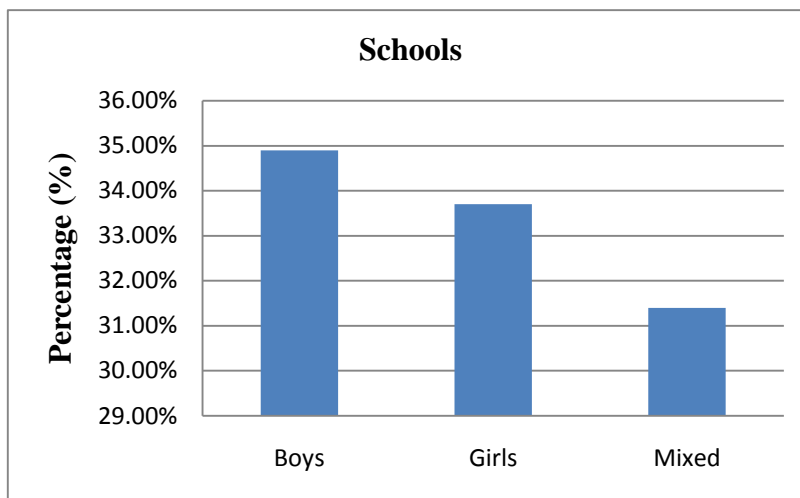
The gender of the respondent was considered to ensure conclusive information was obtained. The sample selected for the study constituted 52.32% boys and 47.67% girls as indicated in figure 4.1.



**Figure 4.1: The proportion of girls and boys**

**Source: Researcher**

The number of respondents from each school type (boys, girls and mixed school) is shown in figure 4.2.



**Figure 4.2: Percentage of respondents from each school type**

**Source: Researcher**

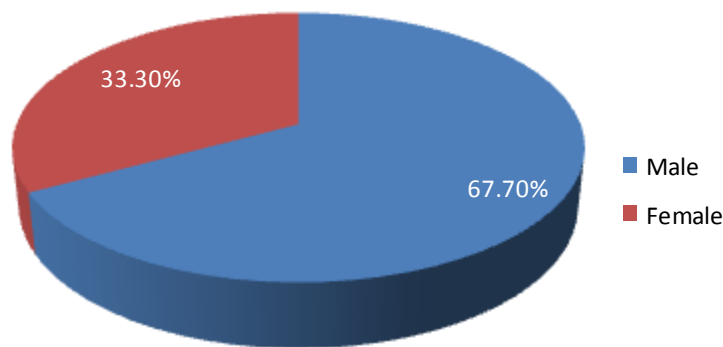
#### **4.2.2 Schools Category**

The study revealed that slightly above one third of the respondents came from boys school, one third from girls schools and slightly below one third from mixed school as shown in figure 4.1. Majority of the respondents were male and this was due to the fact that from mixed day schools, most of the form three students were male. This was attributed to the fact that there was a high rate of girls' dropouts due to unwanted pregnancies in form two and lack of school fees and demand for child labour. In socio- economic context, Eshiwani (1993) notes that in areas where there is demand for child labour or where there are employment detractors, school quality is adversely affected.

#### **4.2.3 Distribution of Mathematics Teachers by Gender**

The researcher also sought to establish the gender of the teachers included in the study. This information is presented in figure 4.3.

The gender of the sampled mathematics teachers was analyzed and figure 4.3 shows that majority were male teachers while one-third of them were females. This can be regarded as quite representative considering the regional or locale composition.



**Figure 4.3: Proportion of teachers by gender**

**Source: Researcher**

The results indicate that mathematics teaching in secondary schools in Bureti Sub-County is done mainly by male teachers. This could explain why some scholars have regarded mathematics as mainly a male domain and this impression is likely to spill over the performance of girls in particular.

### **4.3 Main Factors that Affect Learning of Mathematics**

To determine the factors that influence learning of mathematics in secondary schools, respondents were asked to choose among options given, what affects them most when learning mathematics. A questionnaire was used to get the responses. Learners were asked to indicate the factors that affect them most in the learning and understanding of mathematics. The results are as shown in Table 4.1.

**Table 4.1: Factors Affecting Performance of Students in Mathematics by Gender.**

<b>Factors</b>	<b>Students by Gender</b>			
	<b>Boys</b>	<b>% of Boys</b>	<b>Girls</b>	<b>% of Girls</b>
Lack of interest	53	23.9%	48	23.6%
<b>Inadequate mathematics Textbooks and Learning resources</b>	<b>90</b>	<b>40.5%</b>	<b>87</b>	<b>42.9%</b>
Language used by the teacher	52	23.4%	37	18.2%
Lack of confidence	27	12.2%	31	15.3%
<b>Total</b>	<b>222</b>	<b>100%</b>	<b>203</b>	<b>100%</b>

Table 4.1 indicates that lack of interest in mathematics scored a small percentage by both boys and girls. Language used by the teacher seems to affect boys more than it does to girls. This is evidenced by 52(23.4%) of boys who cited language used by the teacher affects their performance in mathematics which is higher among boys at 23.4% compared to girls at 18.2%. Lack of confidence accounts for the least factor in both genders. Majority of the students cited inadequate mathematics textbooks and learning resources as factors that affect mathematics performance.

Resources such as textbooks are useful to learners for revision and doing home work. Such activities have been known to improve performance in mathematics and other subjects in general. Textbooks at school library are motivators for students to engage in personal study and hence improved outcomes in subjects such mathematics (UNESCO, 2009). These findings are in consonance with the findings of Yadar

(2007) and the report by UNESCO (2008) which opined that teaching/ learning materials such as textbooks, classrooms, teaching aids (chalk, board, ruler and protractor), stationeries and laboratories affect academic performance of the learners. Also, the result, of the findings agreed with that of Mutai (2006) who asserts that learning is strengthened when there are enough reference materials such as textbooks, exercise books, teaching aids, classrooms and the academic achievement illustrates per excellence the correct use of these materials. The implication of this result is that provision of conducive classrooms, laboratories and other teaching/learning resources can positively change teachers' attitude to the teaching of mathematics and make the subject to be very interesting, meaningful and exciting to the students and hence will encourage mathematical exploration and manipulation by students which will keep them alive and thinking and will also help them realize the applications of mathematics.

#### **4.4 Gender-Related Factors that Influence Performance in Mathematics**

The study further sought to identify the opinions of students towards learning and performance in mathematics. Students were asked to indicate the extent to which their learning and mathematics performance is affected. This helped in detecting the gender-related factors that influence performance in mathematics. The responses were put under five categories of a five-point Likert-scale which included strongly agree, agree, undecided, disagree and strongly disagree. The study measure of positive response is Strongly agree and Agree, while the negative response is Strongly disagree and Agree. The results are indicated in table 4.2.

**Table 4.2: The effect of Gender in learning and mathematics performance in secondary schools**

<b>BOYS SCHOOL</b>	<b>Percentage (n=144)</b>				
	<b>SA</b>	<b>A</b>	<b>U</b>	<b>D</b>	<b>SD</b>
Being a girl or a boy interferes with my learning and my performance of mathematics	11.1	5.6	6.9	9.7	66.7
I learn mathematics well regardless of the gender of my teacher (boys)	48.6	35.4	5.6	2.8	6.3
	Percentage (n=139)				
<b>GIRLS' SCHOOL</b>					
Being a girl or a boy interferes with my learning and my performance in mathematics	12.2	5.8	1.6	10.3	70.1
I learn mathematics well regardless of the gender of my teacher (girls)	45.3	15.4	5.6	12.8	6.3
	Percentage (n=135)				
<b>MIXED SCHOOL</b>					
Being a girl or a boy interferes with my learning and my performance of mathematics	20.6	14.2	12	9.3	43.9
I learn mathematics well regardless of the gender of my teacher	51.1	27.8	10.3	2.5	8.3
	<b>N = 421</b>				

In the analysis, (SA and A) were considered positive while (D and SD) were considered negative. Using these indicators, findings indicated that a small proportion of boys agreed that their gender interferes with their learning of mathematics, while three quarters among boys gave a negative response to the statement. A small percentage among girls gave a positive response to the statement and more than three quarters disagreed that being a boy or a girl interferes with learning of mathematics. In mixed school, slightly above half of the students gave a negative response. Gender seems to be a non-issue when it comes to mathematics performance especially if the discipline is handled without discriminating on the basis of gender as the issues cited by the respondents cut across all the gender with no significant differences in any of the school studied in this research.

The teachers' gender only affects a very small number of respondents. This result is reflected in all the categories of school in this research. This is in contrary to report by UNESCO (2004) which indicates that teachers' gender has an impact on learning and achievement in mathematics. The fewer female mathematics teachers in the sample imply that girls have few role models and it also reinforces the stigma that mathematics is a men's domain. At any rate, all the students care about is an instructor who will deliver the lessons in an organized manner in such a way that it is easier to understand the complex concepts in mathematics.

## **4.5 Attitudinal and Inspirational Expressions by Boys and Girls Towards Learning School Mathematic**

### **4.5.1 Students' Attitude towards Learning and Performance in Mathematics.**

Eight items were used in the questionnaire to assess Bureti Sub- County students' attitude towards mathematics. To achieve this objective, the study sought to inquire whether students considered mathematics as an important subject or not, whether or not they enjoyed the subject, who influenced their choice of the subject among others. The study measure of positive response is Strongly Agree and Agree, while the negative response is Strongly disagree and Disagree. The summary of the analysis from boys school is represented in Table 4.3.

**Table 4.3: Students' attitude towards learning and performance in mathematics in boys' school.**

Students' Feelings /opinions	Percentage of boys who responded				
	SA	A	U	D	SD
I enjoy learning mathematics	38.8	16	18.8	13.9	12.5
Among the subjects taught, mathematics is my favourite	33.6	19.7	26.1	18.1	2.5
I feel extremely anxious and fearful, when mathematics examinations are mentioned or brought	7.6	8.3	15.3	26.4	42.4
Mathematics should not be a compulsory subject	6.9	7.6	9.0	28.5	47.9
Mathematics is impossible to learn	10.4	11.8	13.9	20.1	43.8
Learning mathematics is just remembering what the teacher says and does while in class	6.3	11.2	18.9	18.2	44.8
The best way to learn mathematics is to discover a concept by oneself	25.2	32.8	20	9.2	12.8
I do mathematics for the sake of it	13.2	16.0	9.7	18.8	42.4
<b>N=144</b>					

Findings indicated that slightly above half of the respondents enjoyed mathematics lessons. Half of the respondents cited that among the subjects taught, mathematics was their favourite. In addition, two-thirds of the respondents strongly disagreed that

mathematics was impossible to learn. Those who agreed that the subject was impossible to learn said that mathematics was for intelligent students since it was a tough subject and that few students managed to study the subject to higher levels. They added that the subject needed sharp and fast thinking students. Slightly below two-thirds, however, strongly disagreed that they did mathematics for the sake of it. A good percentage thought that the best way to learn mathematics was to discover a concept by oneself. When asked whether mathematics should be a compulsory subject, three quarters were positive towards mathematics being compulsory subject. Mathematics is a compulsory subject in Kenya for all students in both primary and secondary schools. Ndimbirwe (1995) as quoted by Githua (2002) indicated that the subject is both academically and vocational. Important for both males and females as seen from the research findings.

The study also revealed that a small percentage of the respondents agreed that they felt extremely anxious and fearful when mathematics exams were mentioned or brought while the majority disagreed. High level anxiety in students had negative influence on their learning and performance in the subject. Small percentage of the respondents either strongly agreed or agreed with the statement. This has been associated with increasing test stress, low self-confidence, fear of failure, and negative attitudes towards learning mathematics (Besant, 1995). The summary of the analysis from boys school is represented in Table 4.4.

**Table 4.4: Students' attitude towards learning and performance in mathematics in girls school.**

<b>Students' Feelings /opinion</b>	<b>Percentage of girls who Responded</b>				
	<b>SA</b>	<b>A</b>	<b>U</b>	<b>D</b>	<b>SD</b>
I enjoy learning mathematics	15.0	37.0	17.0	15.4	13.6
Among the subjects taught, mathematics is my favourite	22.6	10.7	19	20.1	27.6
I feel extremely anxious and fearful, when mathematics examinations are mentioned or brought	8.2	5.2	15.7	26.9	44
Mathematics should not be a compulsory subject	8.9	15.6	6.8	30.1	38.6
Mathematics is impossible to learn	12.0	8.4	13.2	15	47.3
Learning mathematics is just remembering what the teacher says and does while in class	9.4	12.2	13.7	19.4	54.7
The best way to learn mathematics is to discover a concept by oneself	25.2	31.7	21.6	10.1	11.5
I do mathematics for the sake of it	18.0	25.9	11.5	11.8	32.8
<b>N=139</b>					

From the information shown in table 4.4, half of the respondents gave a positive response that they enjoyed learning mathematics as a subject. The main reason for studying mathematics to an advanced level is that it is interesting and enjoyable. People like its challenge, its clarity, and the fact that you know when you are right.

Only one third of the respondents believed that among the subjects taught, mathematics was their favourite. In addition, up to two-thirds of the respondents strongly disagreed that mathematics was impossible to learn. Below half however, negatively responded that they did mathematics for the sake of it. Slightly above half of the girls thought that the best way to learn mathematics was to discover a concept by oneself. Three quarters among girls were not for the idea that learning is just remembering what the teacher says and he or she does while in class .When asked whether mathematics should not be a compulsory subject up to two-thirds gave a positive response that mathematics should be compulsory subject. This result implies that students are aware that to pass mathematics examination, one needs to practice and do self-testing regularly so as to discover certain concepts by themselves. The findings agree with Murray (1999), who observed that females have demonstrated that they are equally capable of learning mastering mathematical concepts and knowledge as their male counterparts. This opinion is supported by the self-motivated students who have positive attitude towards the subject. On the other hand, those disagreeing are those who have given up in mathematics and are just doing the subject as a mere formality.

From the results confidence among students can be said to be average when it comes to mathematics. The study also revealed that a negligible percentage from girls school agreed that they felt extremely anxious and fearful when mathematics examinations were mentioned or brought while the majority disagreed. Small percentage of the respondents either strongly agreed or agreed with the statement. These findings discounted the results by Dénes Szűcs (2012) who concluded that girls showed higher levels of MA (Mathematics Anxiety) than boys and high levels of MA were related to poorer levels of performance in mathematics. However, there are students who are still anxious at the mentioned of mathematics examination. These groups of students have fixed minds on mathematics such that they do it just as a fulfillment because it is compulsory otherwise they would have dropped the subject. Teachers must work on building the confidence of such students to be able to do mathematics effectively.

**Table 4.5: Students' attitude towards learning and performance in mathematics in mixed secondary schools**

<b>Students' Feelings /opinions</b>	<b>SA</b>	<b>A</b>	<b>U</b>	<b>D</b>	<b>SD</b>
I enjoy learning mathematics	18	37	16.8	13.9	14.3
Among the subjects taught, mathematics is my favourite	20.7	18.2	11.4	17.1	32.6
I feel extremely anxious and fearful, when mathematics examinations are mentioned or brought	7.2	6.2	16.5	30.1	40.0
Mathematics should not be a compulsory subject	8.9	15.6	22.5	32.2	20.8
Mathematics is impossible to learn	9.2	7.9	14.5	24.6	43.8
Learning mathematics is just remembering what the teacher says and does while in class	11.0	9.0	16.0	16.0	48
The best way to learn mathematics is to discover a concept by oneself	31.3	32.1	18.7	6.0	9.7
I do mathematics for the sake of it	17.0	24.6	12.0	8.5	37.9

**N=135**

Findings indicated that more than half of the respondents gave positive responses that they enjoyed learning mathematics as a subject. Only less than half of the respondents believed that among the subjects taught, mathematics was their favourite. Cumulatively above two-thirds of the respondents were negative towards the statement that mathematics was impossible to learn. Less than half, however, responded negatively that they did mathematics for the sake of it. Majority of the students from mixed school thought that the best way to learn mathematics was to discover a concept by oneself. A good percentage of the respondents were not for the idea that learning is just remembering what the teacher says and does while in class. When asked whether mathematics should not be a compulsory subject up to slightly above half of the respondents gave a negative response to the statement that mathematics should not be a compulsory subject. This implies that students from mixed schools understand the importance of mathematics.

#### **4.5.2 Factors Influencing Attitude Towards Students Learning and Performance in Mathematics**

The study also sought to establish the contributing factors which influence formation of attitudes by students towards learning and performance in mathematics. The respondents were asked to indicate on a five Likert type scale (strongly agree, agree undecided, disagree and strongly disagree). The researcher's measure of positive response is Strongly Agree and Agree, while the negative response is Strongly Disagree and Disagree.

**Table 4.6: Factors influencing attitude towards learning and performance in mathematics in boys schools only**

Students' Feelings	SA	A	U	D	SD
I think it is the teacher who can make mathematics learning easier	61.8	19.4	9.7	2.8	6.2
I am given a lot of unnecessary mathematics assignments	12.5	10.4	12.5	18.1	45.1
I am well provided with mathematics textbooks and other learning resources	11.1	13.2	12.5	33.3	29.9
I do a lot of mathematics exercises on my own or with a friend	5.6	9.7	15.3	29.9	39.6
My friends don't like learning mathematics	34.7	20.8	17.4	10.4	2.1
My parents and siblings encourage me to learn mathematics and to perform well in the subject	10.4	17.4	16.0	9.7	46.7
<b>N=144</b>					

From the results represented in table 4.6, majority of the respondents agree that the teacher can make mathematics learning easier, while negligible percentage disagreed. On the issue of mathematics assignments, less than half of the students were positive

towards mathematics assignments. On whether they are well provided with mathematics textbooks and other learning resources two thirds of the boys gave a negative response while a small percentage were not sure. On the other hand, less than one third was negative towards mathematics assignment given while two thirds is positive. The last set of items in this section endeavoured to determine whether the respondent was influenced by either peers or choice of the subject was made independently. On whether it was out of the influence of parents and siblings that they chose to specialise in mathematics, more than half of the boys studied gave a negative response. It was only 18.2% of the respondents who agreed that peers don't like learning mathematics and the remaining 36.1% strongly agreed to the same statement.

**Table 4.7: Factors influencing attitudes towards learning and performance in mathematics in girls schools only**

<b>Students' Feelings</b>	<b>SA</b>	<b>A</b>	<b>U</b>	<b>D</b>	<b>SD</b>
I think it is the teacher who can make mathematics learning easier	54.3	30.4	7.7	2.6	5.2
I am given a lot of unnecessary mathematics assignments	4.3	6.5	15.9	26.2	46.8
I am well provided with mathematics textbooks and other learning resources	15.2	14.8	13.4	38.1	18.5
I do a lot of mathematics exercises on my own or with a friend	4	6.4	17.8	29.8	4.2
My friends don't like learning mathematics	36.1	18.2	17.8	10.2	15.2
My parents and siblings encourage me to learn mathematics and to perform well in the subject	6.3	20.1	20.2	9.7	44.7
<b>N=139</b>					

From the results presented in table 4.7, majority of the respondents agree that the teacher can make mathematics learning easier. On the issue of mathematics assignments, nearly three quarters are positive towards the mathematics assignments

given. On whether they are well provided with mathematics textbooks and other learning resources more than half of the respondents gave a negative response. On the other hand, a small percentage agreed to being given a lot of unnecessary mathematics assignments. On whether it was out of the parental influence and siblings that they chose to specialize in mathematics, more than half of the respondents gave a negative response while less than one third were non-committal. It was only 18.2 % of the respondents who agreed that peers don't like learning mathematics and the remaining 36.1% strongly agreed to the same statement. This implies that girls still have negative attitude towards mathematics and they are influenced by what their peers do. It has been noted that peers can also influence attitude in mathematics. Most students who cited lack interest in mathematics also mentioned that most of the friends at a time discouraged them from doing mathematics. On seeking views whether girls practiced solving mathematics problems on their own or with a friend, high percentage of the responses given disagreed with the statement. It was indicative from above statements that the girls had formed negative attitudes towards the subject and they therefore did not have any interest for it. Johnson and Rising (1972) indicated that all attitudes are fundamental to the dynamics of behaviour. Thus, the attitudes formed greatly influence learning of a subject.

**Table 4.8: Factors influencing attitudes towards learning and performance in mathematics in mixed schools only**

Students' Feelings	SA	A	U	D	SD
I think it is the teacher who can make mathematics learning easier	37.3	24.6	16.4	12.7	9.0
I am given a lot of unnecessary mathematics assignments	4.8	10.2	13.2	24.7	47.1
I am well provided with mathematics textbooks and other learning resources	2.5	12.6	14	51.2	29.7
I do a lot of mathematics exercises on my own or with a friend	3.6	10.1	15.3	28	43
My friends don't like learning mathematics	40.1	10.2	17.0	12.2	20.8
My parents and siblings encourage me to learn mathematics and to perform well in the subject	7.2	25.1	11.7	36.8	19.2
<b>N=135</b>					

The findings presented in table 4.8 show that cumulatively, more than half of the respondents mentioned that their friends don't like learning mathematics. On whether

they are well provided-with mathematics textbooks and other learning resources, majority gave a negative response. On the other hand, almost three quarters are positive towards the assignment they are given. The statement on whether it was out of the influence of parents and siblings that they chose to specialise in mathematics, more than half of the respondents were negative towards the statement. More than half of the respondents from mixed schools felt that the teacher is the core in learning mathematics. This result shows that for mathematics to be taken seriously by students, teachers should come up with better methods of instruction to simplify mathematics concepts for students to understand. Good rapport with students and dedicated time for personal attention is something that cannot be ignored.

Students' understanding of mathematics, their ability to use it to solve problems, and their confidence in, and disposition towards mathematics are mainly shaped by the teaching they encounter in school (National Council of Teachers of Mathematics, 2000). It is clear from the result that the role of the teacher in learning mathematics cannot be downplayed. Learning resources and textbooks availability in mixed schools, girls only school and boys only schools is still below the expected standard. It seems to be the main cause of poor performance in mathematics as seen from the results above. A majority of respondents disagreed that there are enough learning material in schools. Textbooks at school library are motivators for students to engage in personal study and hence improved outcomes in subjects such as mathematics (UNESCO, 2009).

Due to a large number of students in secondary schools as a result of free primary education and subsidized secondary education, schools are over-stretched in terms of resources as they try to put up more buildings. This has left very little resources to go towards equipping the libraries. Parents on the other hand are also struggling with fee payment. This has left students with nowhere to turn to as they are forced to share one book among 10 students against the recommended one book per two students.

Peer influence also has an effect on students' attitude towards mathematics. Most students who cited low interest in mathematics also mentioned that most of the friends at a time discouraged them from doing mathematics. Teachers also cited cases where those who are poor in mathematics tend to be in a group of students who have no interest in the subject leading to poor performance.

Parents support is still limited. More than half feel there is lack of parental support in boys only schools, mixed schools and girls only school. A small percentage agreed that they receive support from parents and siblings in learning mathematics. This is a worry considering that some research such as by Ying and Ching (1991) revealed that the parental expectations and students' achievement in mathematics had a strong correlation.

This result implies that the role parents play in developing strong attitude in mathematics has been ignored by many. Students are not constantly encouraged and given support in terms of adequate time at home to revise and complete the assignments. Books are not provided which has led to laxity on the students part.

However, in some cases it could be due to the economic status of most families in Bureti.

#### **4.6 Relationship Between Student's Career Aspiration and Their Attitude Towards Mathematics in Learning**

Research question sought to find out whether secondary school students aspired to study mathematics beyond high school. To address this, two statements were given to each respondent. The attitudinal and inspirational expressions by boys and girls towards learning school mathematics is shown in table 4.9.

**Table 4.9: Relationship between student's career aspiration and their attitude towards mathematics in learning**

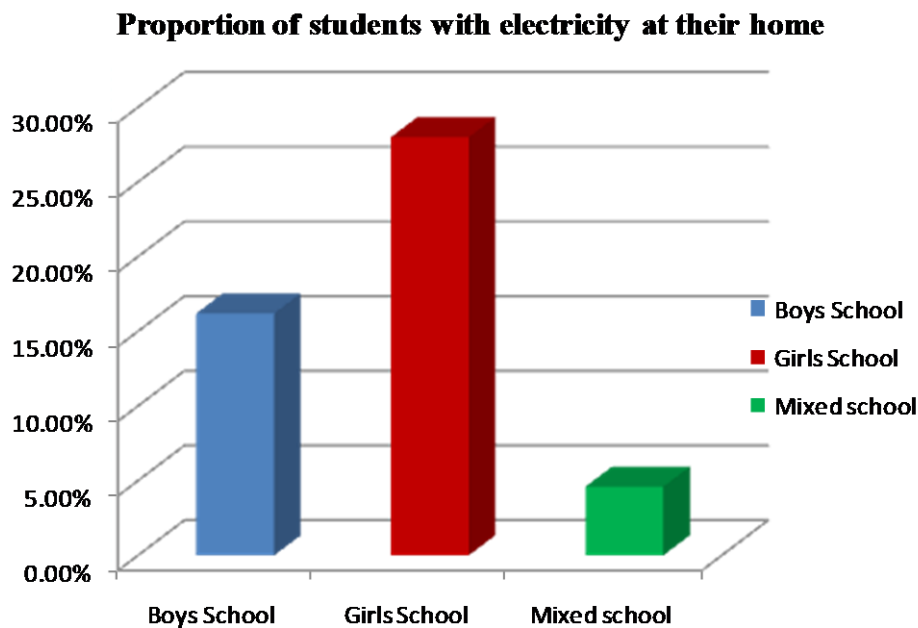
<b>BOYS SCHOOL</b>	<b>n= 144 (Responses (%))</b>				
<b>Students' feelings</b>	<b>SA</b>	<b>A</b>	<b>U</b>	<b>D</b>	<b>SD</b>
I would like to continue doing mathematics after completing secondary school education	29.2	11.8	21.5	35.4	1.4
Mathematics help me make decisions on my future (prospective career)	11.8	39.9	23.0	12.1	13.2
<b>GIRLS SCHOOL</b>	<b>n= 139 (Responses (%))</b>				
<b>Students' feelings</b>	<b>SA</b>	<b>A</b>	<b>U</b>	<b>D</b>	<b>SD</b>
I would like to continue doing mathematics after completing secondary school education	4.8	12.9	20.2	32.9	29.2
Mathematics help me make decisions on my future (prospective career)	5.4	34.3	26.4	14	12.2
<b>MIXED SCHOOL</b>	<b>n=135</b>				
I would like to continue doing mathematics after completing secondary school education	1.6	10.4	24.4	36.4	27.2
Mathematics help me make decisions on my future (prospective career)	13.8	26.9	30.0	16.1	13.2
<b>N=418</b>					

Table 4.9 shows that less than half of the boys agreed that they would like to continue doing mathematics after secondary school citing reasons such as mathematics was easy to study and that it was a logical subject (and that it needed no cramming). Some students have already decided at this level of education what they would like to pursue in future and this has been influenced by among others interest in mathematics. Those with poor performance in the subject are looking forward to doing a course that is free of mathematics. The few who are willing are those who find mathematics easy and therefore, see themselves excelling if they are to do related courses that require mathematics. Less than one third of girls and students in mixed school agreed that they would like to continue doing mathematics after secondary school.

A negligible percentage strongly agreed that mathematics helps them make decisions on their future career. This agrees with the findings that girls are under-represented in mathematics classrooms and in mathematics-related courses at Kenya's tertiary institutions (Eshiwani, 1984; Mureithi, 2000; Mwathi, 2000). An analysis of enrolment of 1999 second year Calculus, a core-mathematics course, students in a Kenyan public university showed that 18.3% of the students were females compared to 81.7% males (Mureithi, 2000). Furthermore, out of 157 mathematics lecturers in Kenya's public universities, only nine (5.7%) were females compared to 148 (94.3%) males (Mwathi, 2000). 51.7% among boys, 39.7% from girls and 40.7% from mixed schools agreed that mathematics helps them make decisions on future career.

#### 4.7 Influence of Social Economic Status on Students' Mathematics Performance

The researcher sought to identify the students' family economic status, thus students were asked whether they have electricity at their home. The responses are indicated in Figure 4.3.



**Figure 4.3: Proportion of students with electricity at their homes**

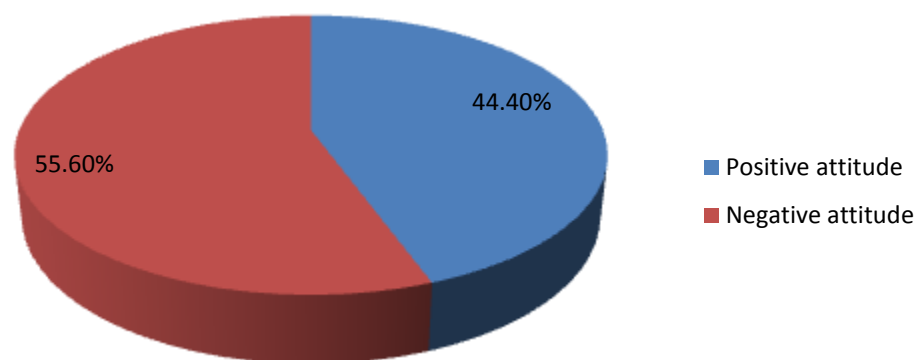
**Source: Researcher**

Using electricity as a parameter for determining the student's economic status, the findings indicated that, the highest percentage of the respondents came from either a low or average economic status families. This could be a contributing factor to disparities in mathematics performance. Students are bound to fail mathematics if the education and economic status of their parents are poor, or if the home environment is insecure and non-supportive due to for instance, early marriages, female genital mutilation (Mbugua, Kiber, Muthaa & Nkonke, 2012). Considine and Zappala (2002)

argue that families where the parents are advantaged socially, educationally and economically foster a high level of achievement in their children.

#### 4.8 Teacher and Instructional Practices in Mathematics

A teacher questionnaire was used to gather information from teachers about their attitudes towards mathematics on various aspects of the subject. This section provides the results and analysis of the qualitative data gathered during the research. On the question “Do you enjoy teaching mathematics?” Only 10 teachers out of 18 who participated in the research gave a negative response, (Figure 4.4)



**Figure 4.4: Teachers Attitude towards teaching mathematics**

**Source: Researcher**

Of those who indicated they don't enjoy teaching mathematics cited abstract nature of the subject as the main reason why they don't like teaching the subject. Those who said they enjoy teaching the subject said they do because it is simple, enjoyable and interesting. When asked about when they find it easier to teach mathematics topic, several teachers said it is easy when teaching aids and learning materials are available

and used in class. On the question likely to make students lose interest in mathematics, majority were of the opinion that abstract exploration of the topic can make look complex and therefore, discourage students from learning mathematics.

Other reasons cited are lack of instruments especially for constructing graphs, verbal explanation by teachers without physical demonstration, poor method of introducing the topic before joining secondary school among others. From the study, there has no evidence that teachers were aware of student's mathematical knowledge or by the way they responded to mathematics questions. It has been accepted that teachers' need to know how children acquire knowledge and develop self-positive image (Miheo, 2009).

It seems that teachers displayed limited content knowledge and found difficulties in bridging the activities to mathematical concept. Some teachers tend to use instrumental learning approach because of the large amount of abstract content. This is evidenced from the suggestions they gave. This study supports research on proficiency in pedagogical content knowledge in mathematics (Miheo, 2011) which encourages teachers to be current in their knowledge of modern ways of presenting concepts to the present day learners.

Teachers' gender does not seem to have obvious influence on the performance of students in mathematics according to the teachers interviewed. What is needed is more of demystifying mathematics through positive attitude, suitable instructional approaches and availability of teaching resources.

#### 4.9 Student Gender Differences in Performance in Mathematics

This section presents the analysis of the data obtained from the Students' Mathematics Achievement Test (SMAT). The test was used to find out the differences in problem solving between boys and girls on problem tasks. Problem solving is the foundation of much mathematical activity (Reys, Lindquist, Lambdin, Smith, & Suydam, 2004).

##### 4.9.1 Differences Between Boys and Girls in Mathematics Performance

The study involved 225 boys and 205 girls. Table 4.10 shows the scores, frequencies and means obtained in the MT in probability and statistics by gender. The test item contained six probability and statistics questions, testing on mathematics problem solving and computational skills. Statistics is a branch of mathematics involving the study of data presentation, measures of central tendency, measures of dispersion, graphical presentation of data and probability (Federal Ministry of Education, 2007). Statistics and probability are an indispensable aspect of mathematics that affects every facet of human endeavour (National Teachers Institute, 2009).

**Table 4.10: Performance in mathematics**

	Gender	Test	Scores and Frequency							Mean	SD
			M	0-2	3-5	6-8	9-11	12-14	15-17		
Single Sex school	Boys	F	1	20	18	26	27	18	40	12.44	5.292
	Girls	F	4	15	12	42	20	30	22	11.90	4.92
Mixed school	Boys	F	5	12	24	10	6	8	10	9.56	5.404
	Girls	F	10	13	17	5	8	4	3	7.6	5.073

M=Marks, F= Frequency, SD=Standard deviation

**Source: Researcher**

The maximum possible score on the test was 20. Results show that in mixed schools, male students (boys) performed better (mean=9.56) than female students (girls) (mean=7.6); in single sex schools, male students performed better (mean=12.44) than female students (mean=11.90). In general, the male students had a mean of 11.48 with a standard deviation of 3.67 while female students had a mean of 10.81 with a standard deviation of 3.33 as shown in table 4.11. The overall picture is that boys outperformed girls in the test as they had a higher mean score (12.44) in statistics and probability test, compared to girls who had a mean score of 11.90. Therefore, a t-test was carried out to determine if this difference was significant.

**Table 4.11: Students' t-value for the Mathematics (Probability and statistics)**

**Test.**

Gender	N	Mean	SD	Std.Error mean	Mean Diff	t- value	Df	2-tail significant
Boys	224	12.44	3.703	0.263	0.54	4.843	427	.001
Girls	203	11.90	3.331	0.413				

The research question under investigation was whether students' gender influences performance significantly or not. The t-test revealed that there was significant difference in performance based on gender as shown in table 4.11. Students t-test for equality of means showed significant variation in achievement by gender of the student ( $t=4.843$ ,  $p<0.05$  at 95% confidence level). In these findings, boys perform better than girls in statistics and probability in Bureti Sub-County. Despite the importance of mathematics to students and society at large, the general achievement

in school mathematics has more often than not been affected by students' poor performance in the statistics section of secondary mathematics examinations over the years in Kenya. The Kenya National Examinations Council Annual Report (KNEC, 2002 and 2007) has indicated that achievement in the statistics section of the secondary mathematics paper was low among the secondary school students. The research findings agree with the findings of Rukangu (2000) that boys tend to perform better than girls in mathematics. But differ from findings by Miheso (2002), who observed that girls performed better than boys in Nairobi region.

#### **4.10 Chapter Summary**

In this chapter, data collected through questionnaires, achievement test results in mathematics (probability and statistics) have been presented, analyzed and interpreted with reference to the research objectives. The study results take out the myth that mathematics is a male domain. In these findings, boys perform better than girls in statistics and probability in Bureti Sub-county. Availability of text books, mathematics learning resources and student's gender were found to influence students' performance. Chapter five provides the summary of these research findings, conclusions, recommendations of the study and suggestions for further research.

## CHAPTER FIVE

### SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

#### 5.1 Introduction

This chapter gives a summary of the findings after which conclusions, recommendations and suggestions for further additional research are made. These are based on the findings in this thesis which looked at gender differences in learning and performance in mathematics.

#### 5.2 Summary of the Research Findings

The findings were summarized in an effort to achieve the study objectives. The study revealed the following findings that are summarized as per the research objectives.

##### a) Gender-related factors that influence performance in mathematics

Consistent and sizeable gender differences were detected across the five attitude scales examined. It was the boys who voiced a stronger acceptance of mathematics. Boys were more interested in mathematics, found learning mathematics related tasks easier, showed a more pronounced interest in starting a career in mathematics. On average; boys had a stronger affinity and interest towards mathematics and rated mathematics to be more beneficial than their female classmates. It would, therefore, appear justified to summarize that on average, boys had a stronger affinity and interest towards mathematics. Teacher's gender had little effect on mathematics performance. Language used in instructing mathematics affected boys more than it did to girls.

**b) Relationship between student's career aspiration and their attitude towards mathematics in learning**

More than one third of the boys and a negligible percentage of students from both girls and mixed schools are for the idea that they would like to continue doing mathematics after secondary school. Half of the boys, slightly above one third of girls and below half of the students from mixed school, agreed that mathematics help, them make decisions on future career.

**c) Teachers' perceptions about boys and girls' ability to grasp mathematics concepts**

Teachers had the impression that both boys and girls have equal ability to do mathematics. There were instances when girls performed well in mathematics topics such as statistics and probability than boys and vice versa. The study found that the teachers try to give equal opportunity to both sexes when handling mathematics without gender-related bias. This aspect is encouraging and likely to lift performance in mathematics. Teachers cited the following reasons as being strongly associated with girl's poor performance in mathematics. They include; girls' fear mathematics, girls do not have enough time for homework in mathematics and other subjects due to household duties.

**d) Best practices adopted by teachers to motivate and encourage boys and girls towards improvement of mathematics performance in secondary schools**

Teachers apply various methods in motivating students. These vary from teacher to teacher within the same school or different schools. Such actions like clapping, recognizing good performance, letting good students to help other students with

problem solving in mathematics as well as giving cash, books, mathematics equipment are encouraging.

#### **e) Performance in Mathematics**

Gender had a remarkably intense effect on mathematics achievement with gender differences favouring boys (mean of boys = 11.48 and mean of girls = 10.81). As a result, gender was strongly associated with mathematics achievement ( $r = 0.9880$ ,  $p < 0.05$ ). The finding that gender differences in mathematics achievement were, in general, always in favour of boys or male – dominated classes. There was a significant difference between gender and students' performance in mathematics.

There was a significant difference in the performance of mathematics achievement test (MAT) between school types. Boys schools performed better than girls schools. This generally fits the pattern according to the findings from most studies.

### **5.3 Conclusions from the Study**

The following conclusions were drawn from the study:

The present research findings have provided sufficient evidence that girls had formed negative attitudes towards the subject and they did not have any interest for it. Boys have a positive attitude towards learning of mathematics. While there are differences among individuals in learning mathematics, little is based on gender as most differences cut across all gender. It is, therefore, possible to lift the performance of girls and reduce the gap by moderating the few areas responsible.

The school administration has not prioritized learning of mathematics by purchasing the relevant resources to equip teaching of mathematics. Mathematics is not so

demanding in resources and all that is required are the key simple resources like mathematics textbooks, mathematics model and mathematical instruments.

Majority of the secondary school boys and girls in Bureti Sub-County indicated that:

(a) Mathematics helps them make decisions in their future career.

(b) Careers they are likely to pursue require mathematics. This is indicative that they realise the role of mathematics.

It was concluded that there exist gender differences in statistics and probability in mathematics in Bureti Sub-County, Kenya. Girls were seen to be performing lower than boys in statistics and probability in mathematics in secondary schools.

Parental influence was important influencing the participation of girls in mathematics. However, they do not play their roles effectively since they are not conversant with school programmes. Finally the larger society still perceives mathematics to be a male domain and hence does not strongly encourage girls' participation in mathematics.

#### **5.4 Recommendations for Action**

The study therefore recommends that:

- i. Since gender differences exist in mathematics, remedial activities which focus on differences in mathematics performance to be enhanced. Mathematics teaching and evaluation strategies should be gender bias free. This will make males and females to see themselves as equal, capable of competing and collaborating in school activities.
- ii. Since student's career influences performance, career guidance is necessary to help students get a better understanding of the importance of mathematics beyond secondary school.

iii. Mathematics textbooks and learning resources are very important and a necessary components in mathematics classrooms. They are essential for both students and teachers, as a possible regulator of what teachers know and are able to present to students, good quality textbooks with correct description of concepts should be made available to both teachers and students to reduce abstractness and misconception of the subject.

iv. Recommendations should focus on higher performance hence best methods and approaches of teaching mathematics should be embraced.

### **5.5 Suggestions for Further Research**

- 1) The study was carried out on gender and mathematics performance in some selected secondary schools in Bureti Sub-County, Kericho County. Hence, the findings may not be representative of all secondary schools in Kenya. Thus, this study needs to be replicated in other parts of Kenya to enable greater generalization.
- 2) The researcher used descriptive survey design in the study, therefore, other researchers are recommended to use experimental design.
- 3) The study evaluated the aspect of gender differences in students' performance in mathematics, focusing on statistics and probability. Another study can be carried out to investigate gender differences in specific mathematical strands.
- 4) Research should be carried out to determine the policy in terms of time allocation and balanced content.

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**APPENDICES**

**APPENDIX A: MATHEMATICS STUDENTS' QUESTIONNAIRE (MSQ)**

*(Completed by form three students)*

The following are some statements regarding mathematics. Answer the questions by ticking in the appropriate boxes the level of agreement with the statement. Note that this is not a test and there are no wrong answers. The information will be treated as confidential and no other person will have access to it.

Section A: General information about the student and school

- 1. Type of school: Boys [ ] Girls [ ] Mixed [ ]
- 2. Gender: Male [ ] Female [ ]
- 3. Which of the following problems do you think affect you most when learning mathematics?
  - (i) Lack of interest in mathematics [ ]
  - (ii) Inadequate mathematics textbooks and learning resources [ ]
  - (iii) Language used by the teacher is difficult to understand [ ]
  - (iv) Lack of confidence [ ]

Any other, specify

.....  
.....

Suggest possible solutions to your problem:

.....  
.....  
.....

### Section B: Your feelings towards learning and performance in mathematics

(1) **Instructions:** This section has statements that you are to decide carefully whether you strongly agree (SA), Agree (A), Unsure (U), Disagree (D), or Strongly Disagree (SD). Put a tick [ $\checkmark$ ] against each statement depending on your feelings. If you make a mistake, cross by putting (X) through the tick [ $\checkmark$ ] and then tick in the appropriate box in the table below

Students' Feelings	SA	A	U	D	SD
I enjoy learning mathematics					
I would like to continue doing mathematics after completing secondary school education					
mathematics help me make decisions on my future (prospective career)					
I think it is the teacher who can make mathematics learning easier					
Among the subjects taught, mathematics is my favourite					
I am given a lot of unnecessary mathematics assignments					
I am well-provided with mathematics textbooks and other learning resources					
I feel extremely anxious and fearful, when mathematics examinations are mentioned or brought					
Mathematics should not be a compulsory subject					
I do a lot of mathematics exercises on my own or with a friend					

Mathematics is impossible to learn					
Learning mathematics is just remembering what the teacher says and does while in class					
The best way to learn mathematics is to discover a concept by oneself					
I do mathematics for the sake of it					
My friends don't like learning mathematics					
My parents and siblings encourage me to learn Mathematics and to perform well in the subject					
Being a girl or a boy interferes with my learning and my performance of mathematics					
I learn mathematics well regardless of the gender of my teacher					

2. What according to you can make learning of mathematics interesting and easier to Understand?-----

(3) What other comment do you have in regard to mathematics learning? -----  
-----

3. Is there an electricity in your home?

(a) Yes..... (b) No.....

THANK YOU

**APPENDIX B: QUESTIONNAIRE FOR MATHEMATICS TEACHER(MTQ)**

Students' achievement in mathematics is a serious problem for mathematics educators and mathematics teachers. Mathematics is one of the key subjects used for selective advancement in the education system in Kenya. Unfortunately, there seems to be a gender gap in participation and performance in Mathematics. This study hopes to identify some of those factors, which influence achievement in school Mathematics with a view to suggesting intervention strategies where they warrant. To help in doing this, I request you to fill in this questionnaire as honestly as you can.

Name of school.....

Do you enjoy teaching mathematics? Why?

Yes ..... No.....

Reasons.....

When do you find it easier to teach mathematics?

When teaching aid models are available and used in class.....

When using physical environment around the class.....

Which of the following can make students lose interest in learning mathematics

Choose as many options as possible

Abstract exploration of some mathematics topics

.....

.....

Lack of instrument especially for constructing graphs and three Dimension diagrams.....

.....

Verbal explanation by teachers without physical demonstration .....

.....

Examination demands (challenges) of some mathematics topics.....

.....

Different styles of exposing the pupils to the concepts before joining secondary school.....

.....

Do you think that teacher's gender influences pupils? Learning of mathematics? Tick

(√)

Yes

No

Why

.....

.....

.....

**APPENDIX C: STUDENTS MATHEMATICS ACHIEVEMENT TEST (SMAT)**

Name..... Adm No.....

School.....

**FORM THREE MATHEMATICS TEST**

Time: 40 min Total Marks: 20

**Statistics and Probability**

A bag contains 8 black marbles and a number of white ones .The probability of drawing on the black ones is  $\frac{1}{6}$ .How many white marbles are there in the box?

(3marks)

2. A test given to 40 students produced the following results:

5 students got grade A

12 students got grade B

15 students got grade C

5 students got grade D

3 students got grade E

Show the above information on a pie chart

(4marks)

3. The following table shows the number of trees planted in certain farm:

Year	1998	1999	2000	2001	2002
No. of trees	7400	11200	10700	5600	9800

Find the percentage which represents the numbers of trees planted in the year 2000.

(4marks)

4. In a bakery, the mass of 20 loaves taken at random is 10.03kg. If the mean mass of the first 13 loaves is 505g, find the mean mass of the other 7 loaves.

(4marks)

5. A boy throws a fair coin and regular tetrahedron with its four faces marked, 1, 2, 3,

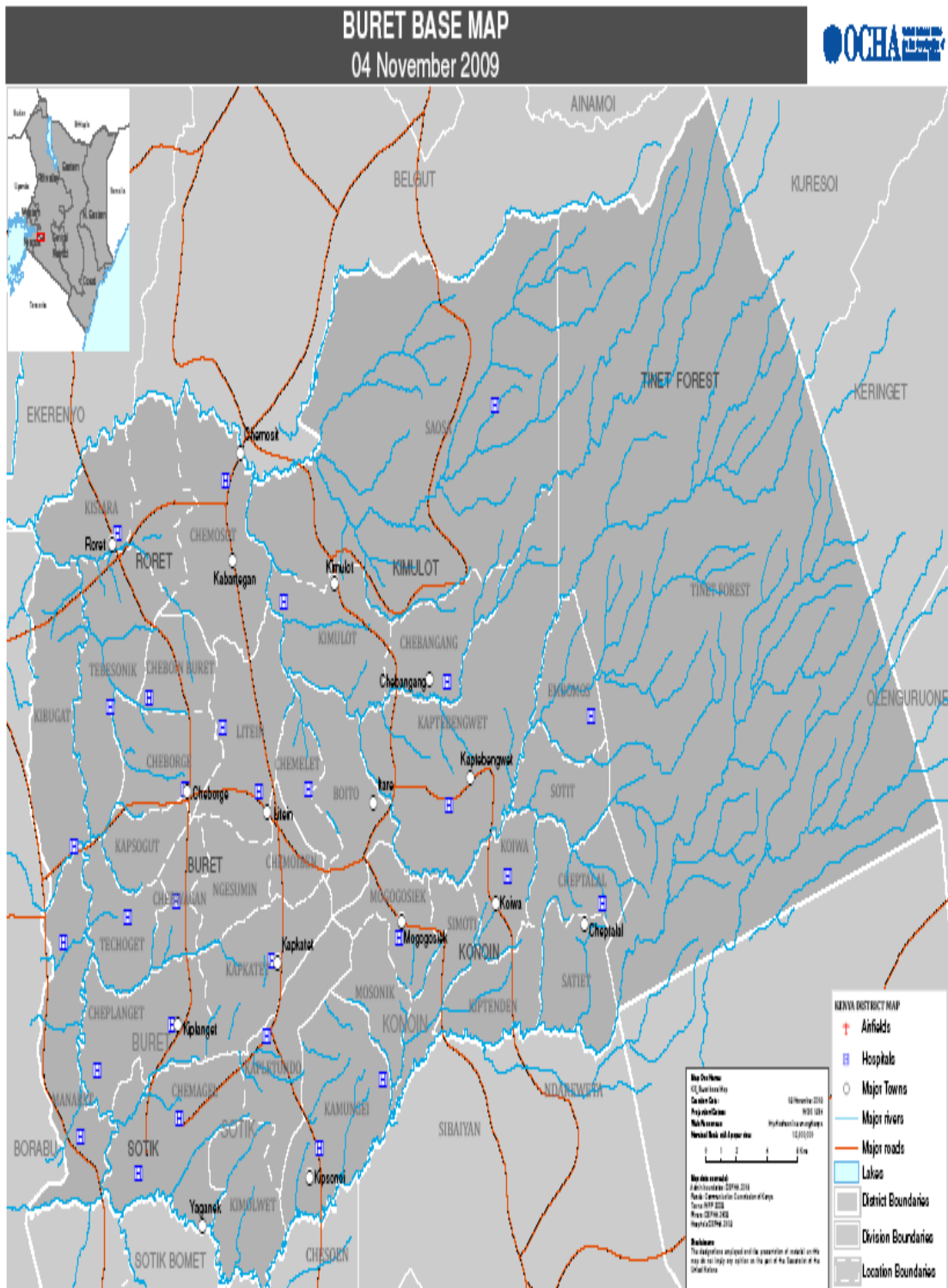
4. Find the probability that he gets a 3 on the tetrahedron and a head on the coin.

(3 marks)

6. An urn contains red and green marbles. The probability of picking a green marble is  $\frac{2}{7}$ . What is the probability of picking a red marble?


(2 marks)

APPENDIX D: STUDY LOCATION



### APPENDIX E: RESEARCH PERMIT


**THIS IS TO CERTIFY THAT:** **Permit No : NACOSTI/P/15/5887/4775**  
**MS. CHEBET CATHERINE MUTAI** **Date Of Issue : 3rd March,2015**  
**of KENYATTA UNIVERSITY , 388-20406** **Fee Received :Ksh 1,000**  
**Sotik, has been permitted to conduct**  
**research in Kericho County**  
**on the topic: GENDER DIFFERENCES IN**  
**PERFORMANCE IN MATHEMATICS AMONG**  
**SECONDARY SCHOOL STUDENTS IN**  
**BURETI SUB-COUNTY, KERICHO COUNTY**  
**KENYA.**  
**for the period ending:**  
**17th April,2015**



*[Signature]*  
**Secretary**  
**National Commission for Science,**  
**Technology & Innovation**

**CONDITIONS**

- 1. You must report to the County Commissioner and the County Education Officer of the area before embarking on your research. Failure to do that may lead to the cancellation of your permit**
- 2. Government Officers will not be interviewed without prior appointment.**
- 3. No questionnaire will be used unless it has been approved.**
- 4. Excavation, filming and collection of biological specimens are subject to further permission from the relevant Government Ministries.**
- 5. You are required to submit at least two(2) hard copies and one(1) soft copy of your final report.**
- 6. The Government of Kenya reserves the right to modify the conditions of this permit including its cancellation without notice.**

**REPUBLIC OF KENYA**  
  
**NACOSTI**  
**National Commission for Science,**  
**Technology and Innovation**

**RESEARCH CLEARANCE**  
**PERMIT**  
**Serial No. A 4329**  
**CONDITIONS: see back page**

**APPENDIX F: LETTER OF AUTHORIZATION**



**KENYATTA UNIVERSITY  
GRADUATE SCHOOL**

E-mail: [kubps@yahoo.com](mailto:kubps@yahoo.com)  
[dean-graduate@ku.ac.ke](mailto:dean-graduate@ku.ac.ke)  
Website: [www.ku.ac.ke](http://www.ku.ac.ke)

P.O. Box 43844, 00100  
NAIROBI, KENYA  
Tel. 8710901 Ext. 57530

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Our Ref: E55/CE/25871/11

Date: 13<sup>th</sup> January, 2015

The Principal Secretary,  
Higher Education, Science & Technology,  
P.O. Box 30040,  
**NAIROBI**

Dear Sir/Madam,

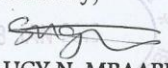
RE: RESEARCH AUTHORIZATION FOR MS.CHEBET C. MUTAI - REG. NO. E55/CE/25871/11

I write to introduce Ms. Mutai who is a Postgraduate Student of this University. She is registered for a M.Ed. degree programme in the Department of Educational Communication & Technology in the School of Education.

Ms. Mutai intends to conduct research for a thesis Proposal entitled, "Gender Differences in Performance in Mathematics among Secondary School Students in Bureti Sub-County, Kericho County Kenya".

Any assistance given will be highly appreciated.

Yours faithfully,

  
For: **MRS. LUCY N. MBAABU**  
**FOR: DEAN, GRADUATE SCHOOL**

ST/cao