GENDER DIFFERENCES IN MATHEMATICS PERFORMANCE AT SECONDARY SCHOOL LEVEL IN KANDARA SUB-COUNTY,
MURANGA COUNTY, KENYA

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E55/CE/23025/2010

A THESIS SUBMITTED TO THE SCHOOL OF EDUCATION IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF EDUCATION, KENYATTA UNIVERSITY

SEPTEMBER, 2017
DECLARATION

I declare that this research thesis is my original work and has not been presented in any other University/institution for consideration. This thesis has been complemented by referenced sources duly acknowledged. Where text, data (including spoken words), graphics, pictures or tables have been borrowed from other sources, including the internet, these are specifically accredited and references cited in accordance in line with anti-plagiarism regulations.

Signature: ........................................... Date: ....................................

Mwalya Samuel Kyavoa
E55/CE/23025/2010

Supervisors
We confirm that the work reported in this thesis was carried out by the candidate and was submitted without our approval as university supervisors

Signature: ........................................... Date: ....................................

DR. MIHESO O'CONNOR, M.K
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Signature: ........................................... Date: ....................................

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Kenyatta University
DEDICATION

This thesis is dedicated to my wife Miriam Njambi and children Sandra, Natasha and Velma without whose support I would not have had the drive and motivation to complete the work
ACKNOWLEDGEMENT

The completion of this work was made possible through assistance of many people to whom I am indebted. I am particularly grateful to Dr. Mihaso O’connor, M.K. my main supervisor who worked with me tirelessly in directing this study to what it is now. Her excellent intellectual guidance, patience and invaluable encouragement were my major drives throughout the research. Her advice, which I took seriously, has made it possible to complete the research.

I am equally indebted to my second supervisor, Dr. David Khatete, who not only pleasantly accepted to supervise this work but skillfully helped in many ways far beyond the call of duty. His assistance towards formulation of objectives and data analysis is worth noting. I wish to appreciate the assistance I got from the principals of the schools where I conducted the research. I am grateful to all the teachers who filled the questionnaires, not forgetting the students who took the Mathematics test and also filled the questionnaires; it was your cooperation that has seen this report completed. Last but not the least; I thank my family members for their material and moral support during the period I was writing the report.
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<tr>
<td>AAUW</td>
<td>The American Association of University Women</td>
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<tr>
<td>ANOVA</td>
<td>Analysis of Variance</td>
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<tr>
<td>BA</td>
<td>Bachelor of Arts</td>
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<tr>
<td>GDI</td>
<td>Gender Related Development Index</td>
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<td>IEA</td>
<td>International Association for the Evaluation of Educational Achievement</td>
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<td>IMO</td>
<td>International Mathematical Olympiad</td>
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<td>K.C.S.E</td>
<td>Kenya Certificate of Secondary Education</td>
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<td>KNEC</td>
<td>Kenya National Examinations Council</td>
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<tr>
<td>M.O.E.</td>
<td>Ministry Of Education</td>
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<tr>
<td>SACMEQ</td>
<td>South African Consortium for Monitoring Educational Quality</td>
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<tr>
<td>SEO</td>
<td>Sub-county Education Officer</td>
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<td>SMPY</td>
<td>Study of Mathematically Precocious Youth</td>
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<td>SMT</td>
<td>Students’ Mathematics Test</td>
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<tr>
<td>SPSS</td>
<td>Statistical Package for the Social Sciences</td>
</tr>
<tr>
<td>TIMSS</td>
<td>Trends in International Mathematics and Science Study</td>
</tr>
<tr>
<td>TQ</td>
<td>Teachers’ Questionnaire</td>
</tr>
<tr>
<td>CBGS</td>
<td>County Boarding Girls School</td>
</tr>
<tr>
<td>CBBS</td>
<td>County Boarding Boys School</td>
</tr>
<tr>
<td>SBBS</td>
<td>Sub-County Boarding Boys School</td>
</tr>
<tr>
<td>SBGS</td>
<td>Sub-county Boarding Girls School</td>
</tr>
<tr>
<td>SBMS</td>
<td>Sub-county Boarding Mixed School</td>
</tr>
<tr>
<td>SDS</td>
<td>Sub-county Day School</td>
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ABSTRACT

The purpose of this study was to investigate gender differences in mathematics performance in secondary schools. The study was carried out in Kandara Sub-county in Murang’a County. The study was guided by four objectives: (1) determine the level of gender differences in mathematics performance in secondary schools. (2) determine students related perspectives about mathematics that contribute to gender differences in mathematics performance in secondary school. (3) determine how school environment contributes to gender difference in mathematics performance in secondary schools. (4) examine mathematics teacher’s opinion towards gender difference in mathematics performance in secondary schools. The variables for the study were mathematics content taught and student’s performance in mathematics. The target population was all the 50 secondary schools in Kandara sub-county. Ten schools which constituted (20%) in the region were sampled using stratified random sampling techniques. Schools were classified into county schools, sub-county boarding schools, and day schools. From sampled schools, simple random sampling technique was used to pick 20 Form Three students per school to make a total of 200 students. Out of the total 74 mathematics teachers in the sub-county, 20 (27%) mathematics teachers were sampled. The study used cross-sectional descriptive survey design. Data was collected using written test items for students, and open ended questionnaires for students and teachers. The study collected both quantitative and qualitative data and analyzed using statistical package for social science (SPSS – Version 21). The descriptive statistics used in this study included mean and percentages. Data was presented using frequencies, bar graphs and charts. Results revealed that there are gender differences in mathematics performance in Kandara sub-county, Murang’a county secondary schools. The student test item results revealed that male students in Kandara sub-county, Murang’a County outperform female students in mathematics. More so, county boarding boys secondary school students are the best performers in mathematics, followed by county boarding girls, Sub-County boarding boys while Sub-County day secondary schools had the poorest performance with female students scoring the lowest on the set test items. Through various statements from teachers and students, the researcher corroborated these results as the findings generally indicated that boys outperformed girls in Mathematics. Further, the study also revealed that though female students trail male students by performance in mathematics, some female students also outperform some male learners in the subject with majority of such girls coming mainly from county boarding girls’ schools. Based on the findings, we recommend that policymakers should target more on the programs that would improve performance of girls in Mathematics especially addressing variables that affect girls negatively. Further, some programs to sensitize various teacher’s opinions on gender differences and their impact on performance in Mathematics should be developed and implemented in schools.
CHAPTER 1: INTRODUCTION

1.0 Introduction

This chapter describes the background of the study, statement of the problem, purpose of the study, objectives, research questions, significance of the study, scope and limitations, assumptions, theoretical and conceptual framework, and the operational definition of terms.

1.1 Background of the Study

Gender issues have been a topic of educational research, particularly in Mathematics. Past studies have shown female students posting poor performance as compared to male students in mathematics achievement. For example, Chipman (1996) found only 24% of Bachelor of Arts (BA) degrees in Mathematics were awarded to women in the United States.

Hanna (2006) summarized gender differences in Mathematics achievement in Trends in International Mathematics and Science Study (TIMSS) based on initial report and found that: the results of TIMSS cross national study encompassing more than 40 countries and about a half a million boys and girls indicate that up to grade eight (8) there are fewer significant gender differences in achievement. The results show that at the level of advanced mathematics (in the last grade of secondary school), five out of the 16 participating countries provide conditions that have led to an almost total disappearance of gender difference in achievement (Hanna, 2006). Hanna (2006) reviewed gender difference in mathematics achievement from international association for the evaluation of educational achievement (IEA) and claimed “the end of gender differences”.

Hanna (2006) elaborated that: gender difference in mathematics decreased considerably over 30 years or so covered by IEA studies and indeed are on the way to disappearance. International comparison of gender studies have revealed that several countries have in effect achieved gender equity in mathematics and this fact presents a challenge to those countries that have not yet done so. Over the past years, a large body of scholarly literature has developed to address gender differences in the developed world, and suggestions for reducing the gender gap are well documented in the literature. However, still lacking in research is why there are gender differences in mathematics education in African schools. (Forgasz & Rivera. 2012).

A closer look at the causes of gender difference reveals that the problem continues in most Africa's educational circles. Several causes have been addressed which include; early childhood environment, family expectations, societal images of women, gender stereotypes, the school environment and gender issues in Africa. Current research provides abundant evidence for the impact of socio-cultural and other environmental factors on the development and nurturing of mathematical skills and talent and the size, if any, of mathematics gender gaps.

In one study by developmental psychologist Eleanor Maccoby, (1966 & 1974) on whether Gender Differences in Mathematics Performance Exist in the General Population in United States, it was concluded that gender differences in Mathematics performance were scientifically well established, with males scoring higher. Boys' skills in Mathematics increased faster than girls' beginning around 12 or 13 years of age, creating a significant gender gap in performance by high school (Richardson et al., 1997).
Results have revealed consistent gender differences in favor of boys in mathematics performance in most countries. However, according to Fennema, (1996); Gray, (1996); and Hanna, (2006), the gender gap in Mathematics has been decreasing in recent decades and is quite small.

The problem of the “gender gap” has reinvented itself as researchers have studied it and found partial explanations and solutions as to why achievement of girls and boys was not at the same level. Benbow and Stanley (1984) favoured the hypotheses of sex differences in achievement and in attitude towards mathematics as a result of superior male mathematical ability. Trying to find out what causes gender differences in mathematics and science education has been the center of attention of much gender research and studies in mathematics education (Shauman et al., 2005).

Gender difference in mathematics has been a great controversy issue in educational domain and research documents show great discrepancies among girls and boys performance in school mathematics (Sprigler & Alsup, 2003). Long history research in this area has shown that male advantage in mathematics achievement is a universal phenomenon while early research (Fennema & Sherman, 1977) indicated that males outperformed females in mathematics achievement at junior high and high school levels (AliReza, 2003).

Girls now equal the performance of boys on standard mathematics assessment tests, probably because girls now match boys in the number and level of mathematics courses they take in elementary and high school, according to a new study by researchers at the University of California, Berkeley, and the University of Wisconsin, Madison.
That wasn't the case 20 years ago, when studies showed nearly identical performance at the elementary school level but girls lagging boys at the high school level. Since then, girls' participation in higher level mathematics classes has risen to the same level as boys', with predictable results (Marcia Linn, 2008).

O’Connor-Petruso, Hayes & Serrano (2004) have shown that gender differences in mathematics achievement become apparent at the secondary level when female students begin to exhibit less confidence in their mathematics ability and perform lower than males on problem solving and higher level Mathematics tasks. There is also evidence that women sometimes perform more poorly on important tests of mathematics achievement than they should, given their ability. That is, their scores on these tests do not reflect their true ability, because of a phenomenon called stereotype threat (Forgasz & Rivera, 2012).

Gender differences in mathematics education in developing countries is one critical area of research that needs further exploration. There is limited information about the status of contextual research on women and girls in those settings in relationship to their mathematical education. As Kitetu (2004:6-7) acknowledges from an African view:

“Unfortunately, while a lot of gender programmes have been carried out, not much research has been done within the classroom in the African continent. Our understanding of gender in classroom practices is most often based on what has been studied in global level and not contextualized from specific classroom environments. I would like to argue that there is always a cultural angle in studies of social practices” Page 9.

Fortunately, there are emerging research efforts in the area of mathematics as the African continent begins to face up to the realities of gender differences in classroom practices.

Cassy (2004:5-6) reported from Mozambique that:

“Although the main aim of the education policy of the country is to promote, among others, gender equity in access to all education levels, there are more
females than males, who do not benefit from this. This gender discrepancy increases over the education levels, being more at the tertiary level and particularly in mathematics and its related fields.”

Cassy (2004) found significant differences between the patterns of attitudes towards mathematics expressed by boys and girls in which boys rated their attitudes more positively than girls did. Boys were more confident in working in mathematics than girls, and girls were more convinced that mathematics was a male domain. Furthermore, girls were reported to believe much more than boys that mathematics is more appropriate for males than for females. Both girls and boys were found to agree that mathematics was useful.

A study by Kaino (2003) addressed the problem of gender differentials in mathematics in Botswana Junior Secondary schools by identifying three themes forming the major areas of concern for investigation; these are “students’ interest in learning mathematics, feelings in mathematics class and interactions in a mathematics class” (Kaino, 2003). With all the emphasis given to mathematics including making it core in the secondary school curriculum, students’ performance in mathematics examinations has registered various inequalities. Mondah (2001) argues that people differ in learning according to how they perceive and process reality. In the line of gender, Eshiwani (1982) in his research with regard to the overall performance in Kenya Certificate of Secondary Education (K.C.S.E) research findings show that, generally girls are lower achievers than boys. In Kenya, performance in mathematics at K.C.S.E level has revealed there have been gender differences in mathematics performance for many years. Table 1.1 presents the Kenya national performance in Mathematics for both genders for four consecutive years (2009 – 2012).
Table 1.1 National performances in mathematics for the years 2009, 2010, 2011 and 2012.

<table>
<thead>
<tr>
<th>Year</th>
<th>M.S for girls $\frac{X}{12}$</th>
<th>M.S for boys $\frac{X}{12}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>2.8422</td>
<td>3.2340</td>
</tr>
<tr>
<td>2010</td>
<td>3.7360</td>
<td>4.1243</td>
</tr>
<tr>
<td>2011</td>
<td>2.8976</td>
<td>3.6471</td>
</tr>
<tr>
<td>2012</td>
<td>3.7864</td>
<td>4.0345</td>
</tr>
</tbody>
</table>

Source: KNEC (2012) results analysis report

From the table above the following observations can be made:

1. The performance of girls in mathematics is not as good as that of boys

2. The performance over the four years from 2009 up to 2012 does not show any evidence of closing the gender gap in mathematics performance.

Kandara sub-county performance in mathematics likewise has been poor with an average mean score of grade D in the last four years. Comparison between boys and girls performance in the sub-county reveals that there is a gender gap in mathematics performance. This is evident as shown on Table 1.2 which reveals the performance of both genders in Kandara sub-county, Murang’a County.
Table 1.2 Kandara sub-county mathematics results analysis for the years 2009, 2010, 2011 and 2012.

<table>
<thead>
<tr>
<th>Year</th>
<th>M.S for girls $\left( \frac{X}{12} \right)$</th>
<th>M.S for boys $\left( \frac{X}{12} \right)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>3.0182</td>
<td>3.7223</td>
</tr>
<tr>
<td>2010</td>
<td>3.2143</td>
<td>4.2740</td>
</tr>
<tr>
<td>2011</td>
<td>2.8627</td>
<td>4.3287</td>
</tr>
<tr>
<td>2012</td>
<td>2.9340</td>
<td>3.8229</td>
</tr>
</tbody>
</table>

Source: sub-county education office, Kandara sub-county (2012)

The results show that gender difference in mathematics performance is very evident and a solution to address the problem is inevitable. This situation led to the current study, to investigate the gender differences in mathematics performance in Kandara secondary schools.

The government of Kenya, through the Ministry of Education (MoE) has tried to address some of these problems though not adequately, by introduction of SMASSE (strengthening of mathematics and science in secondary education) programme in the year 1999. The aim of the programme was to improve teachers teaching methods and improve both teachers and students attitude towards mathematics as they were considered the most critical in determining student’s performance in mathematics.

Despite the efforts made by the government so far, gender differences in mathematics still exists as evidenced by Table 1.1. This necessitated need to investigate on factors related to this problem. Therefore, this study investigated the causes of gender difference...
in mathematics performance in secondary schools within Kandara Sub-county Muranga County, Kenya.

1.2 Statement of the Problem

The question of gender difference in mathematics, achievement, and attitudes is of continuing concern. The greater concern is that girls in particular continue to perform poorly compared to boys in least developing countries. This problem seems to be most prevalent in co-educational schools (Pamela, 2000; Githua, 2002). The main argument is that such classroom instructional environment favour boys at the expense of girls (Pamela, 2000; Githua, 2002). Recently in Kenya, there have been suggestions of separating boys and girls in instructional environments, on the grounds that the learning of mathematics by girls may be inhibited by presence of boys (Pamela, 2000; Githua, 2002). Consequently in the recent past, some co-educational schools have separated boys from girls to teach them in separate classes.

Gender difference in mathematics performance in Kenya has been blamed on several factors such as: poor attitude towards the subject, poor teaching methods, lack of encouragement from home among others. Some of the causes which contribute to gender differences in mathematics performance include: early childhood environment, Family Expectations, Gender Stereotypes, the school environment and gender issues (Asmeng-Boahene, 2006). Situated understanding of gender differences, can help bridge existing gender gap especially in mathematics performance. The purpose of this study was to investigate gender differences in mathematics performance in secondary schools in Kandara sub-county, Murang’a County.
1.2.1 The Purpose of the Study

The purpose of the study was to investigate gender differences in mathematics performance in secondary school in Kandara sub-county in Murang’a County.

1.3 Objectives of the Study

The specific objectives of this study were:

1. To determine the level of gender differences in mathematics performance in secondary schools in different categories.

2. To determine students’ related perspectives about mathematics that contribute to gender differences in mathematics performance in secondary schools.

3. To determine how school environment contributes to gender differences in mathematics performance in secondary schools.


1.4 Research Questions

The study answered the following four questions;

1. What are the students’ perceptions about mathematics that contribute to gender differences in mathematics performance?

2. How does the school environment affect the performance of girls and boys in mathematics in secondary schools?

3. What is the opinion of mathematics teachers towards gender differences in mathematics performance?
1.5 Research Hypothesis

1. Gender differences in students’ mathematics performance exist in different secondary school in Kandara Sub-county.

1.6 Significance of the Study

The findings of this study will be useful to the following:

i. Secondary school mathematics teachers: The results from the study will provide information concerning gender differences in mathematics to teachers of the respective schools in Kandara sub-county, Murang’a County. These results may enable them to implement the various strategies and policies recommended to reduce gender gap in mathematics performance.

ii. The Ministry of Education (M.O.E): The findings of this study will also be of great importance to the Ministry of Education in emphasizing the causes of gender differences in mathematics performances by pushing for implementation of the recommended policies. Besides providing information about the general differences in male and female achievement in the school, specific information concerning gender differences in mathematics performance have been discussed.

iii. Mathematics education department in Kenyatta University: The study will add to the literature which can be adopted and used to compare to other studies done.

iv. Teacher trainers: The study findings will be used by teacher training institution to improve the quality of training. This is because the study recommends possible solutions to deal with causes of gender difference in mathematics performance in secondary schools.
1.7 Scope and Limitations of the Study

1.7.1 Scope
This research was delimited to selected secondary schools in Kandara Sub-County, Murang’a County, Kenya. The study focused only on gender differences in mathematics performance in secondary schools. The proposed study confined itself to students and teachers in public secondary schools since there was no private school in the region. The students included in the sample were randomly selected from those in session in the respective classes by the time of execution of the study. However, adequate schools were sampled for the purpose of this study to make results more generalizable.

1.7.2 Limitations
The study did not cover highly ranked schools, like national schools since there were none in the region. Due to financial constrains, the study did not cover any other Sub-County in the County. The researcher did not cover any other county due to time; therefore the findings of the study may only be generalized to other Sub-Counties in Murang’a County, Kenya. There was lack of local literature for comparability of results since Kandara is a new sub-county, curved from larger Murang’a south sub-county. Lastly, the proposed study did not cover the views of parents and society since tracing them required more time, resources and other logistics.

1.8 Assumptions of the Study
In the study, the following assumptions were made:-

1. The study assumed that gender difference in mathematics performance existed.
2. The schools under study were using the same syllabus at the time of study.
3. All the respondents would be truthful, co-operative and provide reliable responses.
4. Students in all cases had equal opportunities to learn mathematics and any difference in learning is a direct result of classroom interactions.

**1.9 Theoretical Framework**

The study was supported by the theory of social constructivism. According to Vygotsky (1978), Social constructivism is a variety of cognitive constructivism that emphasizes the collaborative nature of much learning. Vygotsky argued that all cognitive functions originate in, and must therefore be explained as products of social interactions and that learning is not simply the assimilation and accommodation of new knowledge by learners; it is the process by which learners are integrated into a knowledge community.

Social constructivism emphasizes the importance of culture and context in understanding what occurs in society and constructing knowledge based on this understanding (Derry, 1999; McMahon, 1997).

Social constructivists view learning as a social process. It does not take place only within an individual, nor is it a passive development of behaviors that are shaped by external forces (McMahon, 1997). Meaningful learning occurs when individuals are engaged in social activities.

Knowledge is derived from interactions between people and their environments and resides within cultures (Shunk, 2000; McMahon, 1997). The construction of knowledge is also influenced by the inter subjectivity formed by cultural and historical factors of the community (Gredler, 1997; Prawat & Floden, 1994). When the members of the
community are aware of their inter-subjective meanings, it is easier for them to understand new information and activities that arise in the community.

The nature of the learner's social interaction with knowledgeable members of the society is important. Without the social interaction with more knowledgeable members, it is impossible to acquire social meaning of important symbol systems and learn how to use them. Young children develop their thinking abilities by interacting with adults. Many schools have traditionally held a transmissionist or direct instructionist model in which a teacher or lecturer ‘transmits’ information to students. In contrast, Vygotsky’s theory promotes learning contexts in which students play an active role in learning. Roles of the teacher and student are therefore shifted, as a teacher should collaborate with his or her students in order to help facilitate meaning construction in students. Learning therefore becomes a reciprocal experience for the students and teacher.

This theory was found relevant for this study because it supported the view that gender differences are created in the learning environment where school contributes greatly. From social perspective, boys and girls are equal in their intellectual abilities, any biological differences between them is vastly outweighed by social pressures. Failure to remove barriers of any nature is likely to cause gender difference in mathematics performance.
1.10 Conceptual Framework

This study was guided by social constructivism theory. Social constructivists view learning as a social process. It does not take place only within an individual, nor is it a passive development of behaviors that are shaped by external forces (McMahon, 1997). Meaningful learning occurs when individuals are engaged in social activities. The mathematical environments that children grow up in vary tremendously and difference in mathematical environment may be a contributor to gender differences in mathematics performance. Students’ performance in Mathematics is seen to be either positively or negatively affected by various factors in their environment in addition to their social interactions. The variables used include mathematics content and student’s performance in mathematics.

<table>
<thead>
<tr>
<th>Dependent variables</th>
<th>Independent Variables</th>
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<tr>
<td>Students Performance in Mathematics</td>
<td>Classroom environment</td>
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<tr>
<td></td>
<td>Teaching methods</td>
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<td></td>
<td>Teachers level of training</td>
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<td>Students perception</td>
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<td>Gender stereotypes</td>
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<td>Peer influence on Mathematics</td>
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Figure 1.1: Conceptual framework: source (self)

From fig 1.1 Mathematics performances is influenced largely by what takes place between the students and the intervening variables which include class room environment, teaching method, teachers level of training, students perception, students confidence, gender stereotypes, Peer influence on mathematics affect mathematics
performance in one way or the other. For instance what takes place in classroom environment can either close or increase the gap because the teacher has a big role to play since in the classroom environment the performance will depend on attitude, level of training and instructional methods of teachers. Perception of the students, the level of confidence, peer influence and mathematical stereotypes also contribute to gender gap in mathematics performance. Performance in mathematics is therefore the reflection of the interaction between the independent variable and the school environment (classroom environment). Discriminations based on gender stereotypes surface severally in the school context. It may occur, for example, through teachers' samples of group placements and activity assignments, the content of compliments and criticism.
1.10 Operational Definition of Terms

**Gender gap**- This refers to difference in performance between boys and girls in mathematics examinations.

**Gender responsive policy**- It is a set of guidelines, which characterize principles on how to address imbalances and inequalities that have resulted from socially and culturally constructed differences between men and women in a given society.

**Gender stereotype**- This refers to the practices of attributing roles, behaviors, and aspirations to individuals or groups solely on the basis of gender.

**Gender**- This is a social-cultural differentiation between men and women. In this study gender refers to the female and male students.

**Mathematics content**- This refers to the type of mathematics covered by students in a classroom as stipulated by the syllabus.

**Mathematics performance**- This is the outcome of any assessment obtained by a student. The grade obtained can either be higher or low depending on the criteria used to gauge the outcome.

**School types**- Categorization of schools as extra County, County, and sub-County.
CHAPTER 2: LITERATURE REVIEW

2.0 Introduction

This chapter reviews literature by considering the following aspects: gender gap in mathematics performance, student’s achievement in mathematics in different school types, school environment and gender differences in mathematics performance, gender related perspectives by students about mathematics, teacher’s opinion towards gender differences in mathematics performance, stereotype about gender and mathematics and factors associated with gender gap in mathematics performance.

2.1 Gender Gap in Mathematics Performance

Gender gaps in mathematics achievement have been widely studied, particularly in USA and Europe (Fennema, Carpenter, Jacobs, Franke & Levi, 1998; Bevan, 2001; VanLeuvan, 2004; Gallagher & Kaufman, 2005; Zhu, 2007; Hyde, 2008; Azar, 2010; Else-Quest, Hyde & Linn, 2010). But this literature is not conclusive and remains both controversial and debatable on whether gender gaps in mathematics achievement really exist and what sources of this difference are. It seems that results vary with context and analytical approach. For example, in USA, Hyde, et al (2008) dismissed the perceived gender gap in mathematics after finding no difference in average performance between girls and boys – based on standardized mathematics assessment involving seven million students of grade two through eleven.

According to Hyde, et al. (2008) the notion that boys do better than girls in mathematics is simply a stereotype that has been around for decades. Other studies in the USA context by Else-Quest, Hyde and Linn (2010), Vanleuvan (2010), Plante, Protzko and Aronson
(2010), and Hyde and Mertz (2009) also found little or no difference in mathematics achievement between boys and girls and continue to conclude that female and male students have nearly equivalent mathematics achievement capacity and levels. Guiso, Monte, Sapienza and Zingales (2008) who, in a cross national study, also found that the gender gap in mathematics performance in favour of boys disappears or is reversed as cultural-related gender differences diminish. This finding is also supported by Azar (2010), who argues that if gender difference in mathematics performance exists, they are small and only affect specific areas of mathematics skills at higher levels.

Gallager and Kaufman (2005) in their study gender gaps in achievement concluded that girls score lower than boys on standardized tests of mathematics. They continue to argue that such gaps are real and very significant and cannot be trivialized as test scores determine entrance to higher training and by extension future success. This argument is supported by the work of Nelson and Brammer (2010) found that in mathematically intensive fields, women’s progress is less dramatic. For example, in the top 100 U.S. universities, women occupy between 9% and 16% of tenure-track positions in mathematics intensive fields.

Contemporary research studies reflect scholars’ maturing view of the complexity of causation of differences between males and females in mathematics education. Fennema (2000) rightly points out, from around 1970, ‘sex differences’ index was used to imply that any differences found were biologically, and thus, genetically determined, immutable and not changeable. During the 1970’s and 1980’s ‘sex-related differences’ criterion was often used to indicate that while the behaviour of concern was clearly related to the sex of the subjects, it was not necessarily genetically determined.
According to Leder (1996) there were probably more research studies published on gender and mathematics than any other area between 1970 and 1990. Fennema (1993, 2000) concluded that while many studies had been poorly analyzed and/or included sexist interpretations, there was evidence to support the existence of differences between girls’ and boys’ learning of mathematics, particularly in activities that required complex reasoning; that the differences increased at about the onset of adolescence and were recognized by many leading mathematics educators. Salmon (1998) concurred with the notion that gender differences increase at secondary school level, particularly in situations that require complex reasoning.

Studies by Fennema and Sherman (1977, 1978) documented sex-related differences in achievement and participation, and found gender differences in the selection of advanced level mathematics courses. They hypothesized that if females participated in advanced mathematics classes at the same rate that males did, gender differences would disappear.

Stanley and Benbow (1980) used interpretations of some of their studies as a refutation of this ‘differential course-taking hypothesis’. They argued that gender differences in mathematics were genetic, a claim which was widely attacked and disapproved, but whose publication had unfortunate repercussions (Jacobs and Eccles, 1985).

Eleanor Maccoby (1966 and 1974) concluded that gender differences in mathematics performance were scientifically well established, with males scoring higher. She documented that boys and girls acquire early number concepts similarly in the pre-school years and that their performance throughout elementary school was similar; however, boys’ skills in mathematics increased faster than girls’ beginning around 12 or 13 years of
age, creating a significant gender gap in performance by the time students reached high school.

The fact that less attention is paid to the gender gap in the upper tail is unfortunate for a couple of reasons. First, upper tail outcomes are potentially relevant to various important topics including the under representation of women in mathematics and science careers. Second, and more importantly, the gender gap in mean scores is sufficiently small so as to be of little practical importance, whereas the gender gap in the upper tail can be quite large. (Glenn & Ashley, 2009).

The debate on gender in Africa is less intense on achievement compared with the literature and debate in the USA. The literature in Africa is mainly concentrated on analysis of gender parity in terms of enrolment, but not in terms of achievement gaps.

However, the few studies done so far seem to support the view that gender gaps in mathematics achievement exist. According to South African consortium for monitoring educational quality (SACMEQ) data for the 15 countries participating in the study, Saito (2010) found that the set of countries where boys performed significantly better than girls in mathematics in 2000 (Tanzania, Kenya, Malawi and Mozambique) were also countries where boys performed better than girls in 2007. Furthermore, Saito asserts that between 2000 and 2007, the directions in gender differences in mathematics achievement were consistent.

Botswana, unlike the USA, the UK, Australia and other advanced countries where gender and mathematics literature is widely reported, is not a highly heterogeneous society. This is not to claim homogeneity, but that the layers, divisions and cultures are fewer and
hence, the pattern of female differences in mathematics varies across fewer layers. That means variables such as socioeconomic status and ethnicity need to be viewed differently by evaluating the prevailing social types.

Most of the literature in Africa is not conclusive and remains both controversial and debatable on whether gender gap really exists and what really causes these differences. The available literature in Africa mainly concentrates on analysis of gender parity in terms of enrolment but not in terms of achievement gaps, this study highlighted gender differences in mathematics performance and also provides analysis on gender differences in mathematics performance in secondary schools in Kandara sub-County.

2.2 Students Achievement in Mathematics in Different School types

The establishment of single-sex classes as a strategy to enhance academic achievement among girls was by and large a reaction to the realization that access to educational experiences via mixed-sex classes did not necessarily result in equity of educational opportunity.

Research such as that published by The American Association of University Women (AAUW) has indicated that even when girls and boys occupy the same classroom space, they sometimes receive quite different educational experiences.

Gender stereotyping and gender bias can be major factors in coeducational classrooms. Girls receive less attention and are given fewer opportunities for learning and problem solving than boys. In addition, girls may feel inhibited and constrained in some mixed-sex classes, thus becoming less motivated to engage in classroom activities and as a result
of this they perform poorly. These findings were particularly evident in mathematics, science, and computer-related subjects.

The usefulness of school types has also been demonstrated. School type’s variables, such as school location or urbanization and school sector, are significantly related to student achievement. Coleman and Hoffer (1987) found that, on average, students’ verbal and mathematics achievement growth in Catholic schools was higher than that in public schools. The sector effect holds even when student characteristics such as academic background and minority status, are held constant (Bryk et al., 1993; Raudenbush & Bryk, 1989).

In a study of mathematics performance in different types of secondary schools in Kenya, it was found that streaming based on gender improved mathematics achievement, and particularly for girls. The study recommended institutionalization of a streaming policy as an intervention for improving girls’ performance in mathematics. (Bosire, 2008).

Since previous research have shown that when girls and boys occupy same classroom, they receive quite different educational experiences. Also streaming based on gender improved mathematics achievement and particularly for girls. The inconsistency of the results indicates that separation of the classes based on gender may not be a viable solution to gender differences in mathematics performance. Since a number of schools had taken up this solution with a view of closing the gender gap, the area was still a rich ground for in-depth studies and investigation.
2.3 School Environment and Gender Differences in Mathematics Performance

Researchers described classroom environment as the relationships between teacher and students, and between students, which include academic support, goal types, teaching methods, instructional materials, teacher beliefs and teaching practices (Church, Elliot, and Gable 2001; Wetzel et al. 2010). Empirical evidence indicated that, in general, teacher and peers support are positively related to learning motivation, academic attitudes, self-efficacy, emotions and achievement (Danielsen et al., 2010).

Researchers found that mathematics performance significantly depends on teaching practices. Specifically, the teacher’s behavior, such as being responsive, helpful and supportive (Ahmed et al. 2010), and having many years of teaching (Bagakas 2011), positively impact on the students’ self-competence and mathematics grades in secondary school. Some studies found that the teacher’s instructional abilities and achievement goals influence academic performance. Students progressed faster if they worked with highly skilled teachers (Taylor, Pressley, and Pearson 2000).

Ahmed et al. 2010; Bagakas 2011; Friedel et al. 2010) Showed that in early adolescence both classroom support and achievement goals are related to academic performance, and these relationships are gender-moderated.

Considering the patterns of relationships between classroom environment and goal orientations, and their effects on achievement, in study to examine the effect of the teacher and peers support on goal orientations and achievement. The results indicated that supportive and mastery-orientated teachers influence the adoption of mastery goals within the classroom and the enhancement of mathematics performance (Church, Elliot,
and Gable 2001; Puklek Levpuscek and Zupancic 2009; Wilkins and Kuperminc 2010). Also, peers acceptance and cooperation increase the level of achievement (Wentzel et al. 2010).

In a second study to examine how achievement goals influence the perception of classroom environment, the results indicated that the students’ motivational profiles determined differences in their preferences for the classroom environment (Tapola and Niemivirta 2008). The third study analyzed if academic motivation mediated the links between classroom environment and achievement. Some studies revealed that competence beliefs mediated the relationship between classroom support and achievement (Ahmed et al. 2010), many studies on mathematics achievement also analyzed the gender differences. The researchers endorse that the differences in the perceptions of classroom environment or achievement goals could explain the gender gap in mathematics performances. Because neither environmental, nor motivational factors alone could fully explain the gender differences in mathematics achievement, further research is needed to explore gender differences in the relationship between environmental and motivational factors.

Some studies found that there are no gender differences in the perception of classroom support (DeWit, Karioja, and Rye 2010). Other studies reported that girls perceived more classroom support (Oelsner, Lippold, and Greenberg 2011), while others found that boys reported more approval, encouragement and corrective feedback especially in mathematics and science (Meece, Glienke, and Burg 2006). Finally, other results endorsed that boys and girls received support for different types of activity; boys receive more opportunities to succeed in science, engineering, computing and mathematics, while
girls have more learning opportunities in literacy, arts and to socially interact with their peers (Wentzel et al. 2010). The current study established the patterns of relationship between school environment and also identified classroom practices that contribute to gender differences in mathematics performance.

2.4 Gender Related Perspectives by Students about Mathematics

Mathematics and Science are stereotyped as male domains (Fennema & Sherman, 1977). Stereotypes about female inferiority in mathematics are prominent among children and adolescents, parents, and teachers. Although young children may view boys and girls as being equal in mathematical ability, they nonetheless view adult men as being better at mathematics than adult women (Steele, 2003). Implicit attitudes that link males and mathematics have been demonstrated repeatedly in studies of college students (e.g., Kiefer & Sekaquaptewa, 2007; Nosek, Banaji, & Greenwald, 2002).

For the girls in Mahlomaholo and Sematle (2004:6-7), mathematics was “too difficult” and they were fed up with the subject and cannot be expected to continue with a subject that they were failing so dismally they did not even have an interest in the subject as it demanded too much work and time to study while the boys saw much value in the discipline. There is no reason at all why some human beings do not have appropriate views regarding the study of mathematics, it is only because the views of a culture that undermines women speak through them and have manifested themselves firmly in their minds.

Campbell (1986) found that girls’ lack of confidence as mathematics learners, their perception of mathematics as difficult, and their view that mathematics is a male activity,
all had impact on girls' attitudes, achievement, and participation in advanced courses. In a longitudinal study of sixth, eighth, tenth, and twelfth grades, Tartre and Fennema (1991) found that, for girls, viewing mathematics as a male domain was correlated to mathematics achievement. Girls in single-sex schools or in out-of-school mathematics projects - who did not see mathematics as an exclusively male domain, tended to have higher mathematics success.

Mahlomaholo and Mathamela (2004) reported the prevalence of a conventional patriarchal approach in the South African society. They argued that it tends to privilege male interests and their privileged positions at the expense of women through the belief that the status quo where males dominate is natural.

In general, studies showed that girls dropped out of mathematics because they perceived classrooms as unattractive, uncomfortable and hostile to them (Muller 2006). The support from academically-oriented peers and female friends who are successful in mathematics, and learning in friendly classroom environments, enhanced the girls’ performance in mathematics. (Meece & Eccles, 2010).

From Mahlomaholo and Mathamela in South Africa, girls were reported to believe much more than boys that mathematics is more appropriate for males than for females. But both girls and boys were found to agree that mathematics was useful. This current study brought out students perspectives about mathematics and related the identified perspectives with mathematics performance between boys and girls in the classroom.
2.5 Teachers Opinion towards Gender Differences in mathematics performance.

According to (Fennema, 1990) teachers have theories and belief systems that influence their perceptions, plans and actions in the classroom which affect and shape classroom dynamics. Since behaviour is guided by a personally held system of beliefs, values and principles (Peterson and Barger, 1985), there are signs that teachers’ sex-related beliefs about children might influence their (teachers’) classroom behaviour (Good and Findley, 1985). This suggests that teachers’ beliefs or expectations might directly influence their classroom behaviour and thus need to continually question how their belief systems affect learners.

In mixed schools, teachers interact more with boys, praise and scold boys more, and call on boys more than girls. However, the impact of this differential treatment is unclear and difficult to ascertain. There was no evidence that all differential teacher treatment of boys and girls is very closely related to gender differences in mathematics (Koehler, 1990).

However, Fennema and Peterson (1986) found that small differences in teacher behaviour combined with the organization of instruction, made up a pattern of classroom organization that appeared to favour males. For instance, competitive activities encouraged boys’ learning and had a negative influence on girls’ learning, while the opposite was true of cooperative learning. Since competitive activities were much more prevalent than cooperative activities, it appeared that classrooms were more often favourable to boys’ than to girls’ learning.

Fennema and Peterson (1985) proposed the Autonomous Learning Behaviours model, which suggested that because of societal influences of which teachers and classrooms were the main components and personal belief systems which include lowered
confidence, attributional style, and belief in usefulness. Females did not participate in learning activities that enabled them to become independent learners of mathematics.

Since teachers’ thoughts from their beliefs and knowledge about girls and boys influence their instructional decisions (Fennema, 2000), an understanding of these concepts from an African perspective is necessary for African research. The differing socioeconomic status and ethnic compositions are important points of contrast between Western and African contexts whose consideration is paramount to social research.

In Pakistan, Halai (2010) found that teachers consider boys to be ‘better mathematicians, arguing that boys are inherently better in mathematics while girls are well behaved and work hard. When such stereotypes find their way into classroom practices, they are likely to be reflected in learning outcomes to the detriment of girls.

As Kitetu (2004) acknowledges from an African view:

“Unfortunately, while a lot of gender programmes have been carried out, not much research has been done within the classroom in the continent. Our understanding of gender in classroom practices is most often based on what has been studied in global level and not contextualized from specific classroom level. I would like to argue that there is always a cultural angle in studies of social practices”.

Considering mathematics performance, teacher and peers support is particularly important for girls. To explore why girls are less confident than boys in their mathematics abilities, University of Georgia psychologist Martha Carr (1986), found that girls use different strategies and have different motivations to do mathematics.

In science and mathematics classes, teachers are more likely to encourage boys than girls to ask questions and to explain (American Association of University Women, 1995). In one study of high school geometry classrooms, teachers directed 61% of their praise comments to boys and 55% of their high-level open questions to boys (Becker, 1981).
Experiences such as these are thought to give children a deeper conceptual knowledge of and more interest in science (Cooney, 1996).

One broad Hypothesis is that male and female teachers have unique biases with respect to how they engage boys and girls in the classroom. For example, there is controversial evidence based on classroom observations that teachers are more likely to offer praise and remediation in response to comments by boys but mere acknowledgement in response to comments by girls (AAUW1992). Similarly, cognitive process theories suggest that teachers may subtly communicate that they have different academic expectations of boys and girls. The biased expectations of teachers may then become self-fulfilling when students respond to them (Jonesanddindia, 2004).

In this study the researcher identified mathematics teachers’ opinion towards gender differences in mathematics. The research also reveals how sex related beliefs by teachers affect classroom behaviour. Lastly the research identified how these classroom practices by teachers were reflected in learning outcomes.

2.6 Stereotypes about Gender and Mathematics

Mathematics and Science are stereotyped as male domains (Fennema & Sherman, 1977; Hyde, Fennema, Ryan, Frost, & Hopp, 1990b, Nosek, et al, 2009). Stereotypes about female inferiority in mathematics are prominent among children and adolescents, parents, and teachers. Although children may view boys and girls as being equal in mathematical ability, they nonetheless view adult men as being better at mathematics than adult women (Steele, 2003). Parents believe that their sons’ mathematical ability is higher than their daughters'. In one study, fathers estimated their sons' mathematical “IQ” at 110 on
average, and their daughters' at 98; mothers estimated 110 for sons and 104 for daughters (Furnham et al., 2002; Frome & Eccles, 1998).

These stereotypes are of concern for several reasons. First, in the language of cognitive social learning theory, stereotypes can influence competency beliefs or self-efficacy; correlational research does indeed show that parents' and teachers' stereotypes about gender and mathematics predict children's perceptions of their own abilities, even with actual mathematics performance controlled (Bouchey & Harter, 2005; Frome & Eccles, 1998; Keller, 2001; Tiedemann, 2000). Competency beliefs are important because of their profound effect on individuals' selection of activities and environments (Bandura, 1997; Bussey & Bandura, 1999).

A second concern is that stereotypes can have a deleterious effect on actual performance. Stereotype threat effects (Steele, 1997; Steele & Aronson, 1995) have been found for women in mathematics. In the standard paradigm, half the participants (talented college students) are told that the mathematics test they are about to take typically shows gender differences (threat condition), and the other half is told that the mathematics test is gender fair and does not show gender differences (control). Studies find that college women underperform compared with men in the threat condition but perform equal to men in the control condition, indicating that priming for gender differences in mathematics indeed impairs girls' mathematics performance (e.g., Janet Hyde, a psychology professor at UW-Madison, noted that, despite the fact that girls now take just as many advanced high school mathematics courses as boys, and women earn 48 percent of all mathematics bachelor's degrees, the stereotype that, girls struggle with mathematics persists. Linn and Hyde have long collaborated on studies of gender differences in mathematics and science.
learning, including an analysis that appeared in Science in 2006 that showed that differences in mathematics performance were far greater between different cultures than between men and women. For example, Japanese and Taiwanese children perform far better on mathematics tests than do American children, irrespective of gender. Some critics argue, however, that even when average performance is equal, gender discrepancies may still exist at the highest levels of mathematical ability.

2.7 Factors Associated with Gender Gap in Mathematics Performance

If gender gap in mathematics achievement does indeed exist, what are the factors that explain it? Zhu (2007) assert that gender differences in Mathematics are not solely biologically determined but result from a combination of factors including, psychological and environmental. This means that instructional practices can play a role in shaping problem solving abilities among boys and girls. Educationists have argued that the differences emerge as a result of attitude, influence of role model and stereotyping. From the above, four main factors have been mentioned: attitudes, stereotyping, teaching and learning styles, and spatial ability.

According to Bevan (2001) the main factors that explain pupil’s perceptions of mathematics include: expectations; type of activities included in the mathematics curriculum; and the prevailing stereotypes.

Studies have shown that perceptions of mathematics can partly explain gender gaps in mathematics achievement. One of the contributing factors to gender stereotypes on girls’ mathematics performance is their female teacher’s own mathematics anxiety. Plante’s
study showed girls’ mathematics performance decreased as a function of their female teacher’s mathematics anxiety; boy’s mathematics performance remained unaffected.

According to Muthukrishna, the main factors associated with the gender gaps in math included the issue of masculinities, classroom practice and attitudes to learning mathematics. (Ngware Moses et al, 2006). Mahlomaholo and Mathamela in South Africa were convinced that social contextual factors and intra-psychic motivational factors as responsible for enabling female learners of mathematics to either excel or fail at the subject.

Cassy (2004) reported that in Mozambique there were significant differences between the patterns of attitudes towards mathematics expressed by boys and girls in which boys rated their attitudes more positively than girls did. Boys were more confident in working in mathematics than girls.

Studies done in Botswana “indicated that cultural expectations of society could give rise to differences in performance between girls and boys in school subjects” and that “such expectations could influence occupational choices between the two sexes” (Kaino, 2003). Kaino (2003) found that about a quarter of the students of both sexes had some problems when studying with students of opposite sexes. More girls than boys laugh at the opposite sex when one fails to answer the question correctly in class. The girls accused the boys of resorting to intimacy, harassment and intimidation in class. The boys complained of lack of concentration as they admired girls and kept looking at their faces.

Those factors that are common include: gender biased curriculum and other education materials, poor teaching methods and classroom practices and hence pointing to
teacher training, lack of appropriate guidance and counseling of students, particularly girls, and the lack of encouragement and motivation of the girls to pursue studies in these fields.

The hypothesis that females cannot do mathematics strongly affects females’ self-confidence. Females, for example, are more likely to attribute success in mathematics to luck, rather than ability, while males attribute their success to ability (Sanders, 1997).

A second hypothesis affecting the gender issue in mathematics, as outlined by Gray (1996), is that women do mathematics differently. In reply to the claim that females perform better on rote skills while males perform better on problems requiring a variation of a set problem-solving procedure Gray (1996,) states, “There is no real evidence that females are inherently inclined to such a limited way of mathematics.” Some feminists believe that different ways of learning exist, and they promote a segregation perspective of mathematics education. The segregation Perspective calls for single gender classrooms for the study of mathematics. According to psychologist Janet Hyde, PhD University of Wisconsin, One factor inhibiting girls is self-confidence, “Even when girls are getting better grades, boys are more confident in mathematics. This research confirms that the factors listed above are true for the current study area and level of study (secondary schools). The researcher also found out other factors which were not mentioned under the subtopic factors associated with gender gap in mathematics performance.
2.8 Summary

From the literature reviewed gender differences in Mathematics is clearly an area that remains controversial, debatable and requiring further research. This is particularly so because no single factor can be attributed to gender differences in Mathematics performance. Nonetheless the available literature, mainly from developed countries, has provided avenues that if further investigated could shed more light on the genesis of the difference. It is clear from this literature review that gender gap in mathematics is the impact of many different factors that have environmental, psychological and cultural origins. Though some studies insist that there are no gender differences in Mathematics performance, others show that such differences exist. It is, therefore, important to continue to engage in debate that explores ways to deepen our understanding of how equity in mathematics performance can be achieved, particularly in mathematics domains in geographical regions where little is known like Kandara sub-county.

This calls for further research to find out why girls are not progressing as well as boys in further mathematics education. The aim of this research was to add to this literature based on study undertaken in schools in Kenya.
CHAPTER 3: RESEARCH METHODOLOGY

3.0 Introduction

This chapter describes methodological details appropriate to the study which include the following: study design, variables, location of the study, target population, sampling techniques, research instruments, pilot study, data collection, an outline of methods used to collect data from field, analysis and presentation of data, and finally ethical considerations.

3.1 Design of the Study

The study adopted a cross-sectional descriptive survey design, which involves taking a cross-section of the population and finding out the prevalence of a phenomenon, problem, attitudes or issues, in order to answer questions regarding gender differences in mathematics performance in secondary schools in Kandara sub-county, Muranga County, Kenya.

According to Glass and Hopkins, (1984), descriptive research involves gathering data that describe events and then organizes, tabulates, depicts, and describes the data collection. It often uses visual aids such as graphs and charts to aid the reader in understanding the data distribution. Because the human mind cannot extract the full importance of a large mass of raw data, descriptive statistics are very important in reducing the data to manageable form.

According to Luck and Ruben (1992) descriptive survey designs are used in the preliminary studies. The design was appropriate because it enabled the researcher to obtain students and teachers’ opinion about gender difference in mathematics
performance in secondary schools. Descriptive survey also enabled the researcher to obtain quantitative data regarding to gender differences in mathematics performance in secondary schools. The researcher used primary data which was obtained using, a written test, questionnaires, observation and interviews.

3.1.1 Variables
The following were considered the main variables of the study

**Dependent Variable**
The dependent variable in this case was **Student performance in mathematics** which depends on other several factors such as classroom environment, teaching methods, students’ perception towards mathematics, gender stereotypes, and classroom motivation.

**Independent Variable**
The independent variables were the mathematics content taught, classroom environment, teaching methods, teacher’s level of training, student’s perception, students confidence, gender stereotypes and peer influence on mathematics since the aim was to investigate gender difference in mathematics performance in secondary school level in Kandara sub-county, Murang’a County, Kenya.

3.2 Location of the Study.
The study was carried out in Kandara Sub-County, Murang’a County, Kenya. Kandara Sub-County, in the entire Murang’a County, had the widest gender gap in mathematics performance (see table 1.2). Familiarity of the locality, which made it easier to develop immediate rapport with respondents, hence making data collection less cumbersome motivated the researcher to pick the sub-county as an area of study.
High discrepancy in mathematics performance made the researcher choose Kandara (see table 1.2). The researcher had taught in the Sub-County for more than 7 years and had noted with a lot of concern the gender gap in mathematics performance. Kandara Sub-County has all types of schools. This provided a wider scope of data for comparison. Lastly the study on gender difference in mathematics performance had not been carried out in Kandara.

3.3 Target Population

The study targeted 50 secondary schools in Kandara Sub-County which are classified as county, Sub-County boarding and day based on physical facilities. None of the schools in the region is both day and boarding (see appendix F). The 50 schools in Kandara sub-County are all public schools. These schools follow a common syllabus developed by Kenya Institute for curriculum development (KICD) and use same textbooks as recommended by Ministry of Education (MOEST). The enrollment of Form three is 4769 students’ with 2176 boys’ and 2593 girls. There were also 74 mathematics teachers in Kandara sub-county secondary schools in Muranga county Kenya.

The distribution of schools by type and Form Three enrollment is shown in table 3.1
Table 3.1: Distribution of schools by type and form three enrolment in Kandara sub-county

<table>
<thead>
<tr>
<th>School type</th>
<th>Number of schools</th>
<th>Form3 enrolment</th>
</tr>
</thead>
<tbody>
<tr>
<td>County</td>
<td>4</td>
<td>736</td>
</tr>
<tr>
<td>sub-county boarding</td>
<td>22</td>
<td>2213</td>
</tr>
<tr>
<td>sub-county day</td>
<td>24</td>
<td>1820</td>
</tr>
<tr>
<td>Total</td>
<td>50</td>
<td>4769</td>
</tr>
</tbody>
</table>

Source: sub-county Education Office, Kandara (2012)

3.4 Sampling Technique and Sample Size

Kandara Sub-County was purposively selected because the gender gap in mathematics performance was wider compared to other neighbouring sub-counties and the sub-county posts the least mean score in mathematics performance in Muranga County. The mean score for mathematics in the seven sub-counties which make Kandara Sub-County, Murang’a County together with respective mean scores for boys and girls are shown in table 3.2.
Table 3.2 Sub-county mean scores for mathematics in K.C.S.E, year 2012

<table>
<thead>
<tr>
<th>Sub-county</th>
<th>Sub-county mean score in math</th>
<th>Sub-county mean score for boys</th>
<th>Sub-county mean score for girls</th>
<th>Gender gap</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gatanga</td>
<td>3.7432</td>
<td>3.8641</td>
<td>3.6223</td>
<td>0.2418</td>
</tr>
<tr>
<td>Kandara</td>
<td>3.3520</td>
<td>4.8347</td>
<td>1.8693</td>
<td>2.9654</td>
</tr>
<tr>
<td>Kigumo</td>
<td>4.3941</td>
<td>5.2403</td>
<td>3.5479</td>
<td>1.6924</td>
</tr>
<tr>
<td>Maragua</td>
<td>5.2214</td>
<td>5.7880</td>
<td>4.6548</td>
<td>1.1332</td>
</tr>
<tr>
<td>Kiharu</td>
<td>4.6520</td>
<td>5.2564</td>
<td>4.0476</td>
<td>1.2088</td>
</tr>
<tr>
<td>Makuyu</td>
<td>3.9672</td>
<td>4.1504</td>
<td>3.7840</td>
<td>0.3664</td>
</tr>
<tr>
<td>Kangema</td>
<td>5.1693</td>
<td>5.4755</td>
<td>4.8631</td>
<td>0.6124</td>
</tr>
</tbody>
</table>

Source county education office Muranga K.C.S.E analysis 2013

In this study, stratified random sampling was used to select schools in Kandara sub-county. This sampling technique was preferred since it was able to reduce the biases associated with sampling therefore ensuring that there was no over representation or under representation of the schools selected. This technique was used because it guaranteed desired representation of all the sub groups. Thus increasing the efficiency of the population estimates (Gay, 1992:129).

Sampling is the process of selecting individuals from a population such that the chosen groups are representative of the whole target population. In Kandara there are 4 county, 22 sub-county boarding and 24 sub-county day schools. The groupings consisted of single sex schools which included boys and girls schools and mixed schools. The selection was done using simple random sampling by assigning each school a number. The numbers were written in small pieces of paper and folded. Out of the 50 schools in
the region, 10 schools were picked at random in equal ratios as follows, 2 county, 4 sub-county boarding and 4 sub-county day schools. This represented 20% which was more than the 10% recommended by Gay (1992).

See sampling Table 3.3.

Table 3.3. Sampling table for schools in different category and gender

<table>
<thead>
<tr>
<th>School category</th>
<th>Number of schools</th>
<th>Girls school</th>
<th>Boys schools</th>
<th>Mixed schools</th>
</tr>
</thead>
<tbody>
<tr>
<td>County</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Sub-county boarding</td>
<td>22</td>
<td>4</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Sub-county day</td>
<td>24</td>
<td>N/A(mixed)</td>
<td>N/A(mixed)</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>50</td>
<td>10</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Stratified sampling was used to pick trained Mathematics teachers, four (4) from county, 8 from sub-county boarding and eight (8) from sub-county day respectively. A sample of 20 teachers, which represents 27% of the population of teachers under study, was also selected. This was more than the 10% recommended by Gay (1992).
Table 3.4 sampling table for teachers in different school category

<table>
<thead>
<tr>
<th>School category</th>
<th>Trained mathematics teachers</th>
<th>Sample of teachers selected</th>
</tr>
</thead>
<tbody>
<tr>
<td>County</td>
<td>20</td>
<td>4</td>
</tr>
<tr>
<td>Sub-county boarding</td>
<td>28</td>
<td>8</td>
</tr>
<tr>
<td>Sub-county day</td>
<td>26</td>
<td>8</td>
</tr>
<tr>
<td>Total</td>
<td>74</td>
<td>20</td>
</tr>
</tbody>
</table>

The study was carried out among Form three mathematics students since Form four was a candidate class preparing for K.C.S.E. Since the content to be covered in the test item were from Form one(1) and two( 2) mathematics syllabus, only Form three students participated in the study as form1 and 2 would not have completed the syllabus by the time of the study. The students were selected using simple random sampling (Gay, 1992:126 noted that it ensures a representative sample is obtained).

From each stream or form, 20 students were selected randomly. In schools where there was more than one stream, the researcher randomly selected one stream by lottery method. This makes a total of 200 students, which represented the entire population.

In mixed schools an equal number of boys and girls were selected to ensure that both sexes were equally represented for comparison. Sampling grid for students in term of gender is shown in table 3.5
Table 3.5 proportional sampling for students by gender in different school category

<table>
<thead>
<tr>
<th>School type</th>
<th>Enrollment</th>
<th>Sampling of form three students</th>
<th>Girls</th>
<th>Boys</th>
</tr>
</thead>
<tbody>
<tr>
<td>County</td>
<td>1236</td>
<td>40</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Sub-county</td>
<td>2512</td>
<td>80</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>Sub-county day</td>
<td>1021</td>
<td>80</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>4769</strong></td>
<td><strong>200</strong></td>
<td><strong>100</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

The researchers sample, therefore, consisted of 10 (20%) secondary schools. The respondents included 20 (27%) mathematics teachers both male and female, 20 students per school to make a total of 200 (41%) of total population. This formed a sufficient sample to statistically provide reliable results.

3.5 Construction of Research Instruments

Four survey instruments and one assessment tool were developed and pre-tested to improve validity and reliability. The four survey instruments included: (1) A questionnaire for teachers and students; mathematics teachers’ questionnaire that solicited information from teachers on each of the study objectives; Students’ questionnaire were used to collect information on existence of gender difference in mathematics performance, school environment influencing gender differences in mathematics and student related perspectives influencing gender differences in mathematics performance.
(2) Written test for students which covered Form one (1) and Form two (2) syllabus which had all the mathematical strands (number operations, measurement, algebra, geometry and data handling) in and wanted to establish whether gender vary by strands.

3.6 Pilot Study.

Five schools were selected for piloting according to their category in the ratio 1:2:2. In each school four students were randomly selected. For mixed school two boys and two girls were selected for piloting. In total twenty form three students were requested to do the test and answer the questionnaires. This helped the researcher to verify time allocated to students test, appropriateness of the language used, unclear directions, insufficient space to write the responses and wrong phases of questions in the questionnaire. Three teachers, one from each school category were requested to respond to the questionnaire as well. This determined the best way to administer and restructure the questionnaire in order to enhance reliability and gather relevant data that adequately addressed the research questions. Those students sampled for the pilot study were not involved in the actual survey. The selected sample was 10%. Roscoe (1975) recommends 10% as a ‘rule of thumb’ acceptable level.

3.6.1 Validity of the research instruments

According to Fraenkel and Wallen (2000) validity is quality attributed to proposition or measure to the degree to which they conform to establish knowledge or truth. Also according to Mugenda et al (1999) validity is the accuracy and meaningfulness of inferences which are based on research results. Most of the students’ test items were validated by experts in the field. This helped to strengthen both content and construct
validity. The relevance of the questionnaires was assessed by two professionals who were competent in the area and their feedback and suggestions were taken into account in the final questionnaire which was used for data collection. Piloting of instruments also helped increase both content and construct validity.

3.6.2 Reliability of the Research Instruments.

According to Mugenda and Mugenda (1999), the reliability of an instrument is the measure of the degree to which a research instrument yields consistent results or data after repeated trials.

In order to test reliability of the instruments, test-retest method was used. The developed questionnaires were administered twice within an interval of two weeks to the same respondents to determine the level of correlation.

The responses to the questionnaires were scored manually. A comparison between the answers got in the first and the second administration of the questionnaires was made.

The reliability of non-dichotomous score tools,(TQ and SQ) was determined using the Cronbach coefficient formula adapted from Sattler(1988:27)

\[
\alpha = \left( \frac{n}{n-1} \right) \left( 1 - \frac{\sum S_i^2}{S^2_t} \right)
\]

Where \( n \) and \( s^2t \) are number of items and variance of the total test respectively. \( \alpha \) is coefficient alpha reliability estimates.

\( \sum S_i^2 \) Is sum of variance of individual items. Using the SPSS computer software programme, coefficient alpha reliability estimates \( \alpha = 0.7864 \) for TQ and \( \alpha = 0.7936 \) for SQ
were obtained. This implied that the information from both questionnaires could be relied upon for data collection and analysis.

Since students’ mathematics test items had varied levels of difficult, its reliability was determined by use of Kuder-Richardson (K-R) formula 20 estimates. This was determined using the formula adapted from Sattler (1988:27).

\[
    r_{\text{tt}} = \left( \frac{n}{n-1} \right) \left( \frac{S^2_t - \sum p q}{S^2_t} \right).
\]

Where, \( r_{\text{tt}} \)-----------------reliability estimates.

\( n \)------------------number of items in the test

\( s^2_t \)------------------variance of the total test

\( p \)------------------proportion of the respondents getting an item correct

\( q \)------------------proportion of the respondents getting an item wrong

\( \sum p q \)------------------sum of the product of p and q for each item

Using the above formulae, the pilot findings showed a reliability estimate of 0.8578 which was high and therefore the test item could be relied upon for data collection.

3.7 Data Collection Procedure

Before administering the research instruments, the researcher wrote and visited the sampled schools to make arrangements for the study. The researcher discussed with mathematics teachers and made arrangements on administration and collection of the test items and questionnaires for students. The questionnaires, for teachers were administered by the researcher himself. Questionnaires were used to collect data from teachers and
students. The test was given after explaining to learners the objective and importance of the research. The entire process took two weeks.

3.8 Data Analysis.

After completing field work, quantitative data were analyzed by first grouping questionnaires by respondents categories, in each group the researcher cleaned and code the data (into 1, 2, 3…), then the codes were used to tally the results by grouping similar responses per question to get frequencies of responses for each question. The coded information were then fed into the statistical package for social sciences (SPSS) software version 21.0 to generate results in frequencies which were presented in figure generated through the use of SPSS and Microsoft excel version 2013. Likert scale statements and responses indicating whether they strongly agree, agree, neither agree nor disagree, disagree and strongly disagree were also coded, tallied and fed into SPSS to generate results in the form of frequencies. Information fed into SPSS were then cross-tabulated in order to show frequencies of responses by different respondent group by school categories and gender.

3.9. Logistical and Ethical Consideration

The researcher obtained a research permit and 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 Kandara Sub-County Education Office. The researcher also wrote an Introductory letters to all the schools sampled explaining the purpose of the research and requesting the school administration to allow students to do SMT, fill questionnaires and
teachers to fill the questionnaire on behalf of the researcher. The respondents were assured of the confidentiality of the research results.
CHAPTER 4: DATA ANALYSIS, INTERPRETATION AND DISCUSSION

4.1 Introduction

In this chapter, the researcher presents analyzed data in tables and figures. Percentages have been used to present the data gathered from students’ and mathematic teachers’. The analyzed data are presented in figures with data from students presented first followed by those from mathematics teachers. Figures are presented first followed by their interpretation. Information in this section is arranged as follows:

- Distribution of participants by demographic characteristics
- Existence of gender difference in mathematics performance
- Students’ perspectives and gender difference in mathematics performance
- School environment and gender difference in mathematics performance
- Teachers’ opinion and gender difference in mathematics performance
- Relationship between type of school and gender difference in mathematics performance

4.2 Distribution of Participants by Demographic Characteristics

The study first sought to establish the demographic characteristics of the studied respondents to ensure conclusive information was obtained through various questions. Findings on study respondents’ demographic characteristics are presented below. Figure 4.2.1: presents the distribution (frequency) of students and teachers’ by school category.
The study revealed that most of the student participants, representing 40% (80 students) were from Sub-County day schools (SDS) while 20% (40 students) were from Sub-County mixed boarding schools (SBMS). Findings on other school categories of students’ are as presented in figure 4.2.1 above. Similarly, as results presented in figure 4.2.1 indicates, a proportion of 40% (8 teachers) teachers’ came from Sub-County day schools whereas 20% (4 teachers) came from Sub-County mixed boarding schools.

Figure 4.2.2 presents the findings on distribution of students by gender in each school category. Percentage was used to present the findings. Results indicates that in Sub-County mixed boarding schools, 45%were girls’ while 55% were boys. Lastly, in Sub-County day schools, a slight majority of 51% were boys while 49% were girls’. All these findings are presented in Figure 4.2.2
Figure 4.2.2: Distribution of students’ by gender

Figure 4.2.3 presents the findings on distribution of teachers by gender in each school category. For teachers’, the research revealed that similar number of male respondents were achieved in County boarding boys’ and girls’ as well as Sub-County day school while in Sub-County boarding boys (SBBS), all (100%) teachers were male and in Sub-County boarding girls (SBGS)’ all the teachers’ (100%) were female. However, in Sub-County mixed boarding secondary school, 50% of the teachers’ who participated in this study were male while 50%, were females as results presented in Figure 4.2.3 indicates.
Figure 4.2.3: Distribution of teachers’ by gender

Figure 4.2.4 presents the findings on distribution of students by age in each school category. Distribution of students by age was also looked into and the findings are as shown in Figure 4.2.4. Results revealed that in County boys boarding school (CBBS), a majority of 55% were aged 17 years, in County boarding girls schools (CBGS), 45% were aged 17 while 45% were aged 16 years, in Sub-County boarding boys, a majority of 40% were aged 17, in Sub-County boarding girls’, a majority of 75% were aged 16, in Sub-County boarding mixed school, a majority of 48% were aged 17 while in Sub-County day school, 40% aged 17 years. Therefore, from the results presented in figure 4.2.4, it is clear that the age of students’ in all the schools ranged from 16 to 19 years and above as shown in the figure 4.2.4.
Figure 4.2.4: Distribution of students’ by age

Figure 4.2.5 presents the findings on distribution of teachers by academic qualification in each school category. The researcher also sought information on teachers’ academic qualifications and findings in Figure 4.2.5 indicate that majority (100%) of teachers in the County boarding boys’ schools had master level of education. In County boarding girls’ school, 50%, had bachelors degree in education while 50%, had master degree in education. More results on teachers’ academic qualifications are as presented in Figure 4.2.5. The results therefore show that the most qualified mathematics teachers’ academically are found in County boarding schools while Sub-County day schools have mathematics teachers’ with low academic credentials.
Figure 4.2.6 presents the findings on distribution of teachers by area of specialization in each school category. In Figure 4.2.6, study findings show that in Sub-County day secondary schools, 38% have specialized in mathematics as a subject. However, 25% and 25% teachers’ had specialized in mathematics and geography and mathematics and physics, respectively. The findings on teachers’ area of specialization in other different category of secondary schools in Kandara Sub-County, Murang’a County are as presented in Figure 4.2.6.
Figure 4.2.6: Distribution of teachers’ by area of specialization

Figure 4.2.7 presents the findings on distribution of teachers by teaching experience in each school category. Based on the finding from teachers’ in Kandara Sub-County, Murang’a County, 38% Sub-County day secondary school mathematics teachers had taught for less than 5 years, while majority (75%) of Sub-County boarding mixed secondary school mathematics teachers had also taught for less than 5 years as findings in Figure 4.2.7 indicate.
Figure 4.2.8 presents the findings on distribution of teachers’ by schools that they would prefer to teach. Further, the study findings showed, teachers’ preferences of schools in which to teach varied across the Sub-County preferring to teach mathematics in a boys’ school. As the findings in Figure 4.2.8 show, all (100%) teachers in County boarding boys school prefer teaching boys school, 50%, of teachers in County boarding girls’ school prefer teaching boys school, all (100%) teachers’ in Sub-County boarding boys’ and girls’ schools, would prefer teaching mathematics in boys school while a majority (75%) of teachers in Sub-County mixed boarding schools, would prefer teaching mixed schools. These findings of the study on teachers’ preferences of schools to teach are as in Figure 4.2.8.
4.3 Existence of Gender Difference in Mathematics Performance

Another area of concern for the researcher was the existence of gender differences in mathematics performance within secondary schools in Kandara Sub-County, Murang’a County. The researcher therefore administered a Mathematics test to a selected sample of students in order to find out their actual performance. Table 4.1 present the findings on students’ mean score in Kandara Sub-County secondary schools by gender and school categories.
Table 4.1 students’ mean score in Kandara Sub-County secondary schools by gender and school categories.

<table>
<thead>
<tr>
<th>School Category</th>
<th>Mean Score (X/15)</th>
</tr>
</thead>
<tbody>
<tr>
<td>County Boarding girls</td>
<td>13.6</td>
</tr>
<tr>
<td>County Boarding boys</td>
<td>14.5</td>
</tr>
<tr>
<td>Sub county Boarding Boys</td>
<td>10.95</td>
</tr>
<tr>
<td>Sub county Boarding Girls</td>
<td>8.25</td>
</tr>
<tr>
<td>Sub county Mixed Boarding(Boys)</td>
<td>10.63</td>
</tr>
<tr>
<td>Sub county Mixed Boarding(Girls)</td>
<td>8.35</td>
</tr>
<tr>
<td>Sub county Day Boys</td>
<td>5.18</td>
</tr>
<tr>
<td>Sub county Day Girls</td>
<td>3.33</td>
</tr>
</tbody>
</table>

*Source, Own Computation.*

Based on the results, the best performing schools in the entire County were the County boarding boys ‘schools who scored a mean of 14.5, followed by County boarding girls’ schools with a mean of 13.6 while the least performing schools belonged to Sub-County day schools with girls’ recording the lowest mean of 3.33. These findings on mean score of students’ by school category and gender are as presented in Table 4.1. After administering the test and evaluating, it was clear that there is a gender difference in mathematics performance in secondary schools. The above results were supported by information gathered from students’ through questionnaires as all County boarding boys and , County boarding girls’ 100%, Sub-County boarding boys 100%, Sub-County boarding girls’ 100%, Sub-County mixed boarding 100% and Sub-County day secondary school student respondents 100% agreed that there was gender difference in mathematics
performance among them. Similarly, findings from all the mathematics teachers from these schools 100% revealed all of them agreed that gender difference in mathematics performance was a reality in Kandara Sub-County, Murang’a County public secondary schools.

Figure 4.3.1 presents the findings on students’ rating of their performance in mathematics. The researcher was also interested in students’ ratings of their own performance in mathematics and findings in Figure 4.3.1 indicate that majority (68%) of students’ in Sub-County day secondary schools performed below average in mathematics while majority (75%) of students’ in County boarding schools for County boarding boys and 45% for County boarding girls’ perform above average in Mathematics. This is also supported by the test item results as presented earlier. These and more findings are presented in the figure 4.3.1.

![Bar Chart](image)

**Figure 4.3.1 Students’ rating of their performance in mathematics**
Figure 4.3.2 presents teachers’ responses on student gender that performs well on average. On gender, the study revealed that male students perform well in Mathematics compared to female students’. Generally, data from all (100%) the students revealed that on average, male students’ perform better in Mathematics. As findings in Figure 4.3.2 show, in Sub-County day secondary schools of Kandara Sub-County, Murang’a County, a majority (63%) of the teachers ‘mentioned that boys performed better, in Sub-County mixed boarding 75% gave similar response and in County boarding boys, all (100%) the teachers’ said male students’ performed well on average compared to girls’ as findings in figure 4.3.2 indicate. These and more results from the teachers’ are presented above. Other researchers have also supported these findings. According to South African consortium for monitoring educational quality (SACMEQ) data for the 15 countries participating in the study, Saito (2010) found that the set of countries where boys performed significantly better than girls in mathematics in 2000 (Tanzania, Kenya, Malawi and Mozambique) were also countries where boys performed better than girls in the previous year (2007).
Figure 4.3.2: Teachers’ responses on student gender that performs well on average

Figure 4.3.3 presents the findings on students’ responses on how often some girls’ outperform boys in mathematics. Results from the students’ indicated that they all (100%), agreed that there were instances when girls’ outperformed boys in mathematics. The study also revealed that all the school teachers’ 100%, agreed that within public secondary schools in Kandara Sub-County, Murang’a County, there are times when girls’ and or some girls’ outperform male students’ in mathematics exams. Such instances based on the study results are very common as a majority of students’ from County boarding boys 55%, County boarding girls’ 50%, Sub-County boarding boys 65% and Sub-County boarding girls’ 80% all mentioned that girls’ often outperform boys in mathematics achievement within public secondary schools in Kandara Sub-County, Murang’a County. More of these results are as presented in figure 4.3.3.
Figure 4.3.3: students’ responses on how often some girls’ outperform boys in mathematics.

Figure 4.3.4: presents the findings on Mathematics teachers’ responses on how often some girls’ outperform boys in mathematics. Results from all (100%) the mathematics teachers’ in County boys boarding revealed that occasions where girls’ outperformed boys in mathematics in the County was often, in County boarding girls’ all (100%) the teachers’ agreed that it was very often for girls’ to outperform boys in mathematics. These and other findings from mathematics teachers’ in Kandara Sub-County, Kandara Sub-County, Murang’a County secondary schools are presented in Figure 4.3.4.
Figure 4.3.4: Mathematics teachers’ responses on how often some girls’ outperform boys in mathematics

Figure 4.3.5 presents the findings on school categories that mainly produce girls’ who outperform boys in Mathematics according to teachers. The girls’ that sometimes outperform boys in either internal or external mathematics exams come from various County’s secondary schools. For instance, majority of such girls’ come from County boarding girls’ schools as majority of County boarding boys school teachers’100% as well as 100% County boarding girls’ school teachers revealed. These findings are presented in figure 4.3.5. Similarly, a study by ACER (2008) revealed that girls attending single sex schools performed well in mathematics than their counterparts and even male learners in mixed schools.
Figure 4.3.5 school categories that mainly produce girls’ who outperform boys in Mathematics according to teachers.

Figure 4.3.6 presents the findings on students’ responses on whether most girls’ from County schools outperform boys in Mathematics. The results of the study from the students’ further revealed that most girls’ from the County schools in Kandara Sub-County, Murang’a County do not outperform boys in mathematics. This is based on the fact that a majority of 65% County boarding students’ strongly agreed with the statement that most girls’ from County schools outperform boys in mathematics while 67% Sub-County day secondary school students’ who similarly strongly disagreed with the statement as these and more findings presented in figure 4.3.6 indicates. Other studies also support these findings as a study by ACER (2008) found out that girls attending single sex schools produced higher tertiary entrance scores than those in coeducational schools. In a study of mathematics performance in different types of secondary schools in Kenya, it was found that streaming based on gender improved mathematics achievement, and particularly for girls (Bosire, 2008).
Figure 4.3.6: Students’ responses on whether most girls’ from County schools outperform boys in Mathematics

Figure 4.3.7 presents the findings teachers’ views on whether most county boarding school girls’ schools outperform boys in mathematics. Similarly, findings from mathematics teachers’ also support students’ views as a majority (74%) of teachers’ from Sub-County day secondary schools strongly disagreed with the statement that most girls’ from County schools outperform boys in mathematics while 100% from County boys also strongly disagreed with the statement. More results from the teachers’ across the County are presented in figure 4.3.7. Eisenkopf et al., (2012) when analyzing the impact of female-only classes on mathematic achievement, exploiting random assignment of girls into single-sex and coeducational classes in Switzerland secondary schools revealed that single sex classes improve the performance of female students in Mathematics.
Figure 4.3.7: Teachers’ views on whether most county boarding school girls’ schools outperform boys in mathematics

Figure 4.3.8 presents students’ responses on whether they perform well in mathematics. All (100%) the students representing and all (100%) the teachers strongly disagreed with the statement that all boys generally outperform girls’ in mathematics in Kandara Sub-County, Murang’a County public secondary schools. Students’ were asked to rate their individual performance in mathematics and the study results revealed that in County boarding boys secondary schools, majority of the respondents (65%) strongly agreed that they perform well in the subject, 40% County boarding school girls’ also strongly agreed with the statement. More findings from students’ on this subject are presented in figure 4.3.8.
6.6

4.4 Students’ Related Perspective about Mathematics that Contributes to Gender Differences in Mathematics Performance

The researcher was at the same time interested in assessing student related perspectives/aspects that influence gender differences in mathematics performance within public secondary schools in Kandara Sub-County, Murang’a County Kenya. Figure 4.4.1 presents the findings on students’ response on time spent discussing mathematics with other student on each school category.

Figure 4.3.8: Students’ responses on whether they perform well in mathematics
Figure 4.4.1: Students’ response on time spend discussing mathematics with other students’

With respect to time spent in discussing mathematics, results from the students reveal that students in County boarding boys schools 15% spend over 3 hours discussing mathematics with colleagues, 5% in County boarding girls’ spend similar amount of time doing the same while in Sub-County day schools, a majority of the learners 89% of the students spend less than an hour discussing mathematics with colleagues. These and more findings are presented in figure 4.4.1.

Figure 4.4.2 presents the findings students’ response on time they spend solving mathematics with teachers’ in each school category. The study revealed that learners in County boarding boys school 35% and another 35% spend 1-2 hours and 2-3 hours respectively discussing mathematics with their teachers’ while 30% take more than 3 hours doing the same. In County boarding girls’ schools, a majority of 45% spend less than an hour while 15% spend over 3 hours, in Sub-County boarding boys schools, 5%
spend over 3 hours while none in Sub-County boarding girls’ spends similar amount of time discussing mathematics with teachers’. These and more findings from the students’ are presented in figure 4.4.2.

**Figure 4.4.2: Students’ response on time they spend solving mathematics with teachers’**

Figure 4.4.3 presents students’ ratings on whether their underachievement arise from difficulty in remembering mathematical formulas in each school category. The study aimed at identifying as to whether students’ under achievement in Mathematics was influenced by difficulties of mathematics formulas, most students’ most County boarding boys 65% strongly disagreed, majority of County boarding girls’ disagreed while a majority of 65% Sub-County day school students’ strongly agreed with the statement as findings in figure 4.4.3 shows. Findings from the learners are presented above.
Figure 4.4.3: Students’ ratings on whether their underachievement arise from difficulty in remembering mathematical formulas

Figure 4.4.4 presents the findings on Mathematics teachers’ view on whether boys participate actively in mathematics lessons than girls’ in the Sub-County. More data was gathered from Mathematics teachers’ in order to rate boys’ and girls’ participation in mathematics and results presented in Figure 4.4.4 indicate that 100% County boarding boys secondary school teachers’ strongly agreed, 100% County boarding school girls’ teachers’ disagreed, 100% Sub-County mixed boarding school teachers’ strongly agreed and 62% Sub-County day secondary school teachers’ also strongly agreed. Findings from the teachers’ are presented by the researcher in Figure 4.4.4. The results however indicate that boys in this County actively participate in mathematics more that girls’. In support of the current research findings, Halai (2010) also revealed that in Indian secondary schools, male students participated more actively in mathematical lessons than girls.
Figure 4.4.4: Mathematics teachers’ view on whether boys participate actively in mathematics lessons than girls’ in the Sub-County

Figure 4.4.5 presents the findings on Mathematics teachers’ view on whether boys are more confident in solving mathematical problems than girls’ in the Sub-County. Findings from mathematics teachers’ across school categories in Kandara Sub-County, Murang’a County revealed that boys are generally more confident in solving mathematical problems than girls’. This is because, the entire County boarding boys’ secondary school teachers’ 100%, Sub-County mixed boarding 100% and 50% Sub-County day secondary school teachers’ strongly agreed with the statement that boys were more confident about solving mathematical problems than girls’. These findings from the teachers’ are presented in figure 4.4.5.
Figure 4.4.5: Mathematics teachers’ view on whether boys are more confident in solving mathematical problems than girls’ in the Sub-County

Figure 4.4.6 presents the findings on Mathematics teachers’ view on whether male students’ are more interested in mathematics than female students’. According to findings presented in Figure 4.4.6, the results generally show that male students in Kandara Sub-County, Murang’a County secondary schools have more interest in mathematics as a subject than girls. This is because all (100%) the teachers in County boarding boy’s secondary school, 100% teachers’ in Sub-County mixed boarding secondary schools and a majority of 50% Sub-County day secondary schools strongly agreed with the statement. These results echo those of Jonesanddindia, (2004) who showed that male learners have greater interest in mathematics compared to their female counterparts.
Figure 4.4.6: Mathematics teachers’ view on whether male students’ are more interested in mathematics than female students’

Figure 4.4.7 presents the findings on Mathematics teachers’ view on participation of boys in mathematics on each category. Mathematics teachers’ in Kandara Sub-County, Murang’a County public secondary schools were asked to rate the participation of male students’ in mathematics and results presented in figure 4.4.6 indicates that a majority of teachers’ from County boarding boy schools 100% rated it as above average, 75% Sub-County mixed boarding school teachers’ rated it as above average while majority of 62% Sub-County day secondary school teachers’ rated male students’ participation in mathematics as average. Other findings from the teachers’ in this subject are as presented in figure 4.4.7. Similarly, a study by Kiefer & Sekaquaptewa (2007) further showed that male learners participate more actively in mathematics lessons than girls.
Figure 4.4.7: Mathematics teachers’ view on participation of boys in mathematics

Figure 4.4.8 presents the finding on Mathematics teachers’ view on participation of girls’ in mathematics on each school category. While 100% County boarding school girls’ teachers’ rated girls’ participation in mathematics as above average, a majority (100%), Sub-County secondary school teachers’ rated it as below average, 75% Sub-County mixed boarding secondary school teachers’ also found it to be below average while 62% Sub-County day secondary school teachers’ also rated it as below average. These and other findings from mathematics teachers’ are as presented in figure 4.4.8. A study by Fennema and Sherman (1978) and Kiefer and Sekaquaptewa (2007) also revealed that female learners are less confident in their mathematical abilities, findings which are in agreement with those of the current study.
Figure 4.4.8: Mathematics teachers’ view on participation of girls’ in mathematics

Figure 4.4.9 presents the findings on Mathematics teachers’ view on male students’ confidence in mathematics on each school category. With respect to students’ confidence in mathematics, the study generally revealed that the confidence of male students’ in mathematics was generally above average as a majority of 100% County boarding boys secondary school teachers’ revealed and 50% of teachers from sub-county day secondary schools also revealed that boys had above average confidence in mathematics. These and other results are presented in figure 4.4.9. Fennema and Sherman (1978) in their study revealed that male students were more confident in mathematics within the secondary schools in the study. This also supports the current study’s result which shows that male learners are generally confident in solving mathematics problems.
Figure 4.4.9: Mathematics teachers view on male students’ confidence in mathematics

Figure 4.4.10 presents findings on Mathematics teachers’ view on female student’s confidence in mathematics on each school category. For girls, the study revealed that 100% of teachers’ in Sub-County boarding boys secondary schools, 50% in Sub-County boarding girls’, 75% in Sub-County mixed boarding boys and 62% from Sub-County day secondary schools all felt that girls’ confidence in mathematics within secondary schools was below average. These findings are supported by Fennema and Sherman (1978) who revealed that male learners provided evidence that they were more confident about learning mathematics and believed that mathematics was useful to them than to females.
4.5 School Environment and Gender Difference in Mathematics Performance among Students.

Figure 4.5.1 presents the findings on school environment and gender difference in Mathematics performance among students on each school category. The researcher sought to establish the school environment factors contributing to gender differences in mathematics performance within Kandara Sub-County, Murang’a County public secondary schools. Results revealed that various school environmental factors influenced gender differences in mathematics performance, for instance, 45% of the students from County boarding boys secondary schools, mentioned availability of mathematics teaching and learning resources, as the main school environmental factor influencing gender difference by students’ in mathematics performance in the County while a majority of 57% students in Sub-County day secondary school also felt the same.
4.5.1: Students’ responses on school environment aspect that mainly influence gender difference in mathematics performance

On the other hand, findings from mathematics teachers’ indicate that the main school environment factor influencing gender difference in mathematics performance is also
availability of mathematics teaching and learning materials in public secondary schools of Kandara Sub-County, Murang’a County. This is because teachers from Sub-County day secondary schools 37% and 100% teachers’ from County boarding boys’ secondary school teachers’ mentioned this.

Figure 4.5.2: Teachers’ responses on aspects of school environment that influence gender differences in mathematics performance

Figure 4.5.3 presents the findings on teachers’ responses on how school environment influence gender differences in mathematics performance on each school category. Results from the teachers’ mostly indicate that school environment in this County has negative influence on gender difference. This is because majority (62%) of teachers representing Sub-County day secondary schools mentioned that it had negative influence on gender differences in mathematics performance while 100% teachers’ from County boarding boys secondary schools gave the same observation. On a similar note, Pakistan, Halai (2010), Ahmed et al., (2010), Puklek Levpuscek and Zupancic (2009) and Wilkins
and Kuperminc (2010) all agree that school environment can significantly affect learners academic achievement. The authors all argue that positive school environment positively influence learners achievement while negative school environment negatively affect learners academic performance.

**Figure 4.5.3: Teachers’ responses on how school environment influence gender differences in Mathematics performance**

<table>
<thead>
<tr>
<th>Percentage</th>
<th>CBBS</th>
<th>CBGS</th>
<th>SBBS</th>
<th>SBGS</th>
<th>SBMS</th>
<th>SDS</th>
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<td>0</td>
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</tr>
</tbody>
</table>

**School Category:**
- CBBS: County Boarding Boys School
- CBGS: County Boarding Girls School
- SBBS: Sub-County Boarding Boys School
- SBGS: Sub-County Boarding Girls School
- SBMS: Sub-County Mixed School
- SDS: Sub-County Day School

Figure 4.5.4 presents the findings on students’ responses on teaching methodology that had improved their performance in mathematics on each school category. On teaching methodologies that had the most positive contribution on students’ performance, results from the students indicate that in County boarding boys schools 55% mentioned that problem based teaching was most effective, 65% Sub-County boarding girl schools, students mentioned that lecture method was effective while 44% Sub-County day students’ mentioned that chalk and board has been used to improve their performance in mathematics. In a similar light, Fennema and Peterson (1986) found that small differences in Teacher behaviour combined with the organization of instruction, made up
a pattern of classroom organization that appeared to favour males. For instance, competitive activities encouraged boys’ learning and had a negative influence on girls’ learning, while the opposite was true of cooperative learning. Since competitive activities were much more prevalent than cooperative activities, it appeared that classrooms were more often favorable to boys’ than to girls’ learning.

Figure 4.5.4: Students’ responses on teaching methodology that had improved their performance in mathematics

Figure 4.5.5 presents findings on Mathematics teachers’ responses on the main teaching methodology they employ in teaching mathematics on each school category. Various teaching methodologies were found by the study to be used by teachers in teaching mathematics in public secondary schools in the study area. As findings in figure 4.5.6 indicates, 100% of the teachers in County boarding boys schools mentioned that they
mainly used problem based teaching to instruct students, in Sub-County mixed boarding, 75% mentioned that they used chalk and board while a majority of teachers representing 62% in Sub-County day school teachers’ also used chalk and boarding teaching methodology while teaching mathematics.

Figure 4.5.5: Mathematics teachers’ responses on the main teaching methodology they employ in teaching mathematics

Figure 4.5.6 presents the findings on Mathematics teachers’ responses on how their chosen teaching methodology influence students’ performance on each school category. The study put into consideration on how the mentioned methodologies (lecture method, chalk and board, group discussion, differentiated teaching and problem based teaching) influence gender differences in mathematics performance within public secondary schools, a majority of Sub-County day secondary school teachers representing 62% felt that it had a moderate improvement on performance while a majority of 100% County boarding girls’ secondary school teachers’ mentioned that it had greatly improved
students’ performance. Fennema and Peterson (1986) asserts that teachers chosen teaching methodologies favoured male learners more which positively influenced male learners’ academic performance and influenced female learners’ performance negatively.

**Figure 4.5.6: Mathematics teachers’ responses on how their chosen teaching methodology influence students’ performance**

Figure 4.5.7 presents the findings on Students’ responses on whether classroom management practices employed had positive influence on their performance on each school category. According to results from students, 50% of students from Sub-County day secondary school disagreed with the statement that classroom management practices had a positive on their performance in mathematics, 48% Sub-County mixed boarding students’ also disagreed while a majority of 50 County boarding school girls’ strongly agreed that classroom management practices employed in their school positively influence their performance in mathematics.
Figure 4.5.7: Students’ responses on whether classroom management practices employed had positive influence on their performance

Figure 4.5.8 presents findings on Mathematics teachers’ responses on whether classroom management practices positively influenced students’ performance irrespective of gender on each school category. A further analysis of the data revealed that County boarding boys secondary school teachers’ 100% strongly agreed with the statement that the classroom management practice they employed positively influenced students’ performance irrespective of gender while a slight majority of 50% Sub-County day school teachers’ neither agreed nor disagreed with the statement. These and additional results are as presented in figure 4.5.8 Ahmed et al., (2010), observed that in early adolescence both classroom support and achievement goals are related to academic performance and these relationships are gender-moderated. Considering the patterns of relationships between classroom environment, goal orientation and their effects on achievement, in study to examine the effect of the teacher and peers support on goal orientations and achievement, the results indicated that supportive and mastery-orientated
teachers influence the adoption of mastery goals within the classroom and the enhancement of mathematics performance.

**Figure 4.5.8: Mathematics teachers’ responses on whether classroom management practices positively influenced students’ performance irrespective of gender**

Figure 4.5.9 presents the findings on students’ responses on whether availability of mathematics teaching and learning materials had positively influenced their performance on each school category. Findings from students’ revealed that in County and Sub-County schools, mathematics teaching and learning materials were generally available while there was extreme shortage of these resources in Sub-County day secondary schools in Kandara Sub-County, Murang’a County. As results in figure 4.5.9 show, a majority of students representing 57% from sub-county day secondary schools strongly disagreed that availability of mathematics teaching and learning materials had positive influence on their performance as a majority of 75% students’ from County boarding boys strongly agreed that availability of these resources in their school had positively influenced their performance in the subject. Similarly, Ahmed et al., (2010) in their study
revealed that availing required teaching and learning resources for learners in school and within the classroom enhancement of mathematics performance

![Students response on whether availability of mathematics and learning materials influence performance](image)

**Figure 4.5.9: Students’ responses on whether availability of mathematics teaching and learning materials had positively influenced their performance**

Figure 4.5.10 presents the findings on Mathematics teachers’ responses on whether availability of mathematics teaching and learning materials had influenced all students’ performance on each school category. Similar responses were also obtained from the teachers as all them from County boarding boys 100% strongly agreed that availability of mathematics teaching and learning resources influenced students’ performance irrespective of gender while on the other hand, a majority of teachers’ 62% from Sub-County day secondary schools strongly disagree with the statement. Teachers from County boarding girls schools and Sub County boarding schools, 50% strongly agreed while in Sub County mixed schools 75% of teachers disagreed
Figure 4.5.10: Mathematics teachers’ responses on whether availability of mathematics teaching and learning materials had positively influenced all students’ performance.

Figure 4.5.11 presents the findings on students’ responses on whether school discipline had positively influenced their performance on each school category. Results revealed school discipline had positive influence on students’ performance in mathematics, in others it had negative influence. Results from students’ indicate that a majority of 90% County boarding boys strongly agreed that school discipline played a big role in improving their performance in mathematics while in Sub-County day secondary schools 46% strongly disagreed with this position.
Figure 4.5.11: Students’ responses on whether school discipline had positively influenced their performance

Figure 4.5.12 presents the findings on Mathematics teachers’ response on influence of school discipline on students’ performance on each school category. Results from the teachers’ on the same subject revealed that a majority of 75% Sub-County day mathematics teachers’ strongly disagreed that school discipline had improved students’ performance irrespective of gender, 75% Sub-County mixed boarding secondary school teachers’ also strongly disagreed while a majority of 100% County boarding girls’ mathematics teachers’ strongly agreed that school discipline had improved mathematics performance. Wilkins and Kuperminc (2010) argued that classroom and school discipline play important roles in influencing learners achievement as school which are disciplined record better academic outcomes among learners than schools riddled with indiscipline cases.
Figure 4.5.12: Mathematics teachers’ response on influence of school discipline on students’ performance

Figure 4.5.13 presents the findings on students’ responses on whether school climate positively influenced their performance on each school category. As to whether school climate positively influence learners performance in mathematics, results revealed that 60% of the students from Sub-County day secondary school students’ strongly disagreed, 90% County boarding boys school learners strongly agreed and 45% Sub-County girls’ boarding students’ agreed with the statement.
Figure 4.5.13: Students’ responses on whether school climate positively influenced their performance

Figure 4.5.14 presents the findings on Mathematics teachers’ responses on whether school climate influenced all students’ performance on each school category. Findings from mathematics teachers revealed that 75% of the teachers from Sub-County day secondary schools also strongly disagreed with the statement that school climate positively influenced learners mathematics achievement irrespective of gender, 100% County boarding boys school teachers’ strongly agreed with the statement while 100% teachers from Sub-County mixed boarding secondary schools strongly disagreed with the statement as findings in figure 4.5.14 indicate. Puklek Levpuscek and Zupancic (2009) also noted that a positive learning environment bred positive academic achievement among learners while negative climates negatively affected learners’ performance in all subjects.
Figure 4.5.14: Mathematics teachers’ responses on whether school climate had positively influenced all students’ performance

Figure 4.5.15 presents the findings on students’ responses on whether teaching methodology employed had greatly improved their performance in mathematics on each school category. Research results from the students’ revealed that a majority of 90% from County boarding boys school strongly agreed that teaching methodology improved their performance in mathematics, 85% County boarding girls’ also strongly agreed while 45% students from Sub-County day secondary’s disagreed with this statement. Fennema and Peterson (1986) found that small differences in teacher behaviour combined with the organization of instruction, made up a pattern of classroom organization that appeared to favour males. For instance, competitive activities encouraged boys learning and had a negative influence on girls’ learning, while the opposite was true of cooperative learning. Since competitive activities were much more prevalent than cooperative activities, it appeared that classrooms were more often favourable to boys’ than to girls’ learning.
Figure 4.5.15: Students’ responses on whether teaching methodology employed had greatly improved their performance in mathematics

Figure 4.5.16 presents the findings on students’ responses on whether leadership styles employed greatly improved their performance in mathematics on each category. School leadership style was also shown to influence performance of students’ in mathematics. Results from students’ as presented in figure 4.5.16 show that 57% of students’ from Sub-County day secondary schools strongly disagreed with the statement that leadership styles employed improved their performance in mathematics, 70% Sub-County boarding girls’ disagreed while 60% County boys strongly agreed with the statements.
On the other hand, as findings in figure 4.5.17 indicates, a majority of 75% Sub-County day secondary school teachers’ strongly disagreed that leadership styles in school improved students’ performance in mathematics, 100% Sub-County boarding boys secondary school teachers’ agreed with the stamen while a majority of 100% strongly agreed. Studies by Ahmed et al. (2010) and Bagakas (2011) also lend weight to the current study outcome as the authors established that teacher’s behavior, such as being responsive, helpful and supportive, positively impact students’ mathematics grades in secondary school.
Figure 4.5.17: Mathematics teachers’ views on whether leadership styles employed greatly improved students’ performance in mathematics

Figure 4.5.18 presents the findings on students’ responses on whether mathematics teachers’ qualifications positively influenced their performance on each school category. Teacher’s qualifications were found to positively influence students’ performance in mathematics in county barding boy’s school. According to information that students provided, 44% of Sub-County day secondary students’ disagreed with this, 33% Sub-County mixed secondary also agreed and 85% Sub-County boarding girls’ agreed. However, there was unanimous response from mathematics teachers as all 100% strongly agreed that their qualifications were positively related to improvements in students’ performance in mathematics. Findings from Wilkins and Kuperminc (2010) also support the current study’s results as the authors revealed that teachers qualifications were positively related to learners academic performance in national examinations.
Figure 4.5.18: Students’ responses on whether mathematics teachers’ qualifications positively influenced their performance

Figure 4.5.19 presents the findings on students’ responses on whether mathematics teachers’ teaching experience was positively related to their performance in Mathematics in each school category. In some school categories, mathematics teachers’ teaching experience was found to be positively related to improvements in students’ mathematics performance while in others there was no relationship with improved performance as findings from students presented in figure 4.5.19 show. The findings indicate that mainly in County boarding boys’ schools majority of 75% students’ strongly agree that teacher teaching experience positively influence their mathematics performance while in Sub-County day secondary a majority of 36% disagree.
Findings from teachers also support those of students as they show that the teachers’ either agreed or strongly agreed with the statement. Also 62% from Sub-County day secondary agreed while 100% from County boarding girls’ strongly agreed. These results are presented in figure 4.5.20. On a similar note, a study by Bagakas (2011) revealed that teachers teaching experience positively influenced students’ self-competence and mathematics grades in secondary school. This outcome, therefore, supports the findings of the current study that teachers experience played a great role on all students’ performance in mathematics.
4.6 Teachers’ Opinion and Gender Difference in Mathematics Performance

In the last section of the analysis, the researcher assessed the influence of teachers’ opinion on mathematics performance through various queries. Figure 4.6.1: presents the suitability of the teachers’ with regards to mathematics and gender of students’. Findings from mathematics teachers’ as presented in figure 4.6.1 indicate that a majority of 100% from Sub-County day secondary believe that the subject is more suited for boys while 100% from County boarding girls’ mentioned that mathematics was suitable for all students’ irrespective of gender. These and other results are as presented above. As Jones and Dindia, (2004) observed, some teachers believe that mathematics if best suited for boys than girls. Such beliefs have different effects on achievement with male learners performing better than their female counterparts.
Figure 4.6.1: Suitability of the teachers’ with regards to mathematics and gender of students’

Figure 4.6.2 presents the findings on influence of teachers’ held opinions on gender differences in mathematics performance. All teachers 100% from County boarding schools and Sub County boarding girls mentioned that teachers’ opinions negatively influence gender difference in mathematics performance. 100% Sub-County boarding boys teachers’ mentioned that the held opinions by teachers’ greatly increased gender difference in mathematics performance while 25% Sub-County mixed boarding teacher mentioned the opinions moderated influenced gender differences as findings in figure 4.6.2 shows. In Pakistan, Halai (2010) also found that teachers consider boys to be ‘better mathematicians, arguing that boys are inherently better in mathematics while girls are well behaved and work hard. These opinions were found to negatively influence female students’ academic achievement while improving male students’ achievement in the subject.
Figure 4.6.2: Influence of teachers’ held opinions on gender differences in mathematics performance

Figure 4.6.3 presents the findings on negative opinion held by teachers’ about girls’ and mathematics influences gender differences in mathematics performance on each school category. According to the teachers, majority of Sub-County day secondary school teachers representing 75% strongly agreed that negative opinion held by teachers’ about girls’ and mathematics causes teachers’ to give boys more mathematical assistance which improves their performance at the expense of the girl child while only 25% of the teachers’ agreed with the statement. Similarly, these findings are supported by cognitive process theorists who suggest that teachers may subtly communicate that they have different academic expectations of boys and girls. The biased expectations of teachers may then become self-fulfilling when students respond to them affecting female students’ performance negatively (Jonesanddindia, 2004).
Figure 4.6.3: Negative opinion held by teachers’ about girls’ and mathematics influences gender differences in mathematics performance

Figure 4.6.4 presents the findings on teachers’ belief that mathematics is central to careers of all students encourages their participation in the subject and improves their performance on each school category. The research findings revealed that while some teachers strongly agree that mathematics is central to careers of both boys’ and girls’ and encourages all students’ participation in the subject improves their performance; others disagree while the rest agree. As findings in figure 4.6.4 show, in County boarding schools, all the teachers’ 100% strongly agree with the statement while 62% teachers’ from Sub-County day secondary disagree with this. All results from the teachers’ are as presented below. Similarly, cognitive process theories suggest that teachers may subtly communicate that they have different career expectations for boys and girls. The biased expectations of teachers may then become self-fulfilling when students respond to them affecting students’ performance either positively or negatively (Jones and Dindia, 2004).
Figure 4.6.4: Teachers’ belief that mathematics is central to careers of all students encourages their participation in the subject and improves their performance

Figure 4.6.5 presents the findings on teachers’ opinion that girls’ are slow in mathematics subject uptake influences gender difference in mathematics performance on each school category. The study findings further reveal that teachers’ opinion that girls’ are slow in mathematics uptake discourages girls from participating in lessons, this leads to their underachievement in Mathematics as 75% of teachers from Sub-County day secondary school teachers strongly agreed while only 25% agreed as findings in figure 4.6.5 show. Halai (2010) also found that teachers consider boys to be ‘better mathematicians, arguing that boys are inherently better in mathematics while girls are well behaved and work hard. The author observes that such opinions have positive influence on male learners performance in the subject while at times negatively affects female students performance.
Figure 4.6.5: Teachers’ opinion that girls’ are slow in mathematics subject uptake influences gender difference in mathematics performance

Figure 4.6.6 presents the findings on teachers’ perception that it is a waste of time teaching girl’s mathematics on each school category. The study revealed that 75% of sub-county day secondary school teachers strongly agreed that teachers’ perception that it is a waste of time teaching girls’ mathematics influence gender differences in engagement in the subject by girls leading to underperformance while 25% agreed with the statement that teachers perception that it is a waste of time teaching girls mathematics influence gender difference in mathematics engagement and performance. As results presented in figure 4.6.6 shows. The current study has generally established that teacher’s opinion on gender and mathematics favour boys at the expense of girls. These opinions have been shown by the study to increase gender differences in mathematics performance in the study area.
Figure 4.6.7: Teachers’ perception that it is a waste of time teaching girls mathematics
CHAPTER 5:
SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

In this chapter, the researcher summarizes the study findings guided by objectives and or research question, draws conclusions from the results and gives recommendations guided by the study finding. The summary is as follows;

5.2 Summary

5.2.1 Existence of Gender Difference in Mathematics Performance

The study finding proves that there are gender differences in mathematics performance in the secondary schools in Kandara Sub-County, Murang’a County secondary schools. The student test item results revealed that male students Outperform female students in mathematics. More so, County boarding boys secondary school students’ are the best performers in mathematics, followed by County boarding girls’, Sub-County boarding boys while Sub-County day secondary schools are the poorest performance with female students scoring the lowest on set test items. Through various statements from teachers’ and students’, the researcher corroborated these results as the findings generally indicated that boys outperformed girls in Mathematics as a subject. Further, the study also discovered that though female students trail male students’ in performance in mathematics, some female students’ also outperform some male learners in the subject with majority of such girls’ coming mainly from County boarding girls schools.
5.2.2 Students’ Related Perspectives about Mathematics that Contributes to Gender Differences in Mathematics Performance

Results further showed that various student related factors and or perspectives influenced the mentioned gender differences in mathematics performance. Mainly, male students’ have the highest interest in mathematics, are more involved in mathematics lessons, participates the most, spend more time discussing and solving mathematics with fellow students’ and teachers’, are less affected by mathematics formula difficulties, are more confident about solving mathematics problems than female students’ in the County. However, in some instances the differences are not big depending on the variables in question as the findings showed.

5.2.3 School Environment and Gender Difference in Mathematics Performance among Students

The researcher also sought to establish the school environment factors contributing to gender differences in mathematics performance within Kandara Sub-County, Murang’a County public secondary schools. The study revealed that various school environmental factors influenced gender differences in mathematics performance, these included, availability of mathematics teaching and learning resources, classroom management practices, teaching methodologies used, teacher quality, teaching experience, school climate, school leadership and even school leadership styles. The general influence of these school related variables varied from positive to negative. However, based on the findings, in most schools County schools felt that school environment positively influenced their performance while Sub-County day school mainly felt no influence. Most importantly, findings from teachers’ mostly indicate that school environment in this
County has negative influence on gender difference. Specific school related variables mentioned had different influence on gender difference in performance in different categories of schools as well with most being positively related to positive performance among boys while for girls’ the led mainly to negative performance in the subject.

5.2.4 Teachers’ Opinion and Gender Difference in Mathematics Performance

Teachers in this County held different opinions on gender and mathematics with some believing it only suited male students while others held the view that it was suitable for all learners irrespective of gender as the findings showed. These views and or opinions are informed mainly by the continued underperformance of female students in the subject. Teachers’ opinions were found to influence gender differences in performance in mathematics with the main effect being negative as the negative opinions causes teachers’ to give boys more mathematical assistance which improves their knowledge of the subject content and overall performance while neglecting to offer the same assistance to female students.

5.3 Conclusions

Based on the findings, the researcher draws various conclusions. First, there is gender difference in mathematics performance in Kandara Sub-County, Murang’a County secondary schools with male students’ generally outperforming girls in almost every school category. However, there are instances where female students outperform boys in mathematics as a subject in the same schools. Second, the researcher also concludes that various student related perspectives influence gender difference in performance with all the studied perspective positively favoring boys performance and not girls. However, in some cases the differences are not significant depending on the variables in question as
the findings showed. Thirdly, the researcher also concludes that in most schools in the County, school related variables affect girls’ performance negatively while favoring positive performance among male students’. Lastly, the researcher concludes that teachers’ opinions especially in mixed schools have negative influence on girls’ performance and positive influence on boys’ performance in mathematics. Only in single gender schools and more particularly in County boarding schools are such opinions having positive influence on performance.

5.4 Recommendations

From the results and summary of findings, the researcher draws the following recommendations:

1. First, the existing gender difference in mathematics performance is more alarming as this means that the girl child is continuously trailing boys in a subject that is very crucial for better careers in the future. Therefore, there needs to be a concerted effort between various stakeholders to find ways of improving girl child’s performance in secondary schools within Kandara Sub-County, Murang’a County. It is important to closely monitor best performing girls’ in mathematics within the County in order to gain insight on what drives them to perform well and use the information to assist poor performing female students’.

2. Given that the school environment impacted negatively on gender differences in mathematics performance, as it improve male students’ performance at the expense of female students’ performance, Secondary schools in Kandara sub-county need to find ways of ensuring that the school environment is suited for both girls’ and boys’ if the environment is to have similar impact on female
students’ performance. Schools need to begin by identifying specific school environment issues that the female students’ are finding problems with and that are negatively affecting their performance if these are to be effectively addressed.

3. Lastly, as the study revealed that teachers’ opinion regarding to mathematics and gender also have negative influence on gender differences in mathematics performance. The researcher recommends sensitization training for mathematics teachers’ in order to change the mentioned negative opinions they hold. Stiffer penalties should also be enforced on teachers’ found to discriminate on students’ based on gender while teaching in order to deter the development of negative opinions that have consistently influence gender differences in mathematics performance.
REFERENCES


Irby, B. & Brown, G. (2011).*Gender and Early Learning Environment*. Information Age Publisher


Lakeman, P. (1975).*Sex Related Differences in Mathematics Achievement & Attitude in Gifted High School Students.* University of Southalabama.


This study seeks to establish facts behind gender differences in mathematics performance with an aim of coming up with remedies to close the gender gap. Your school is one of the few that have been selected for this study. Your honest response to this questionnaire will make this study a success. Information given will be treated with utmost confidentiality.

**Instructions: tick (✓) or complete where appropriate.**

**SECTION A: TEACHERS PERSONAL INFORMATION.**

1. Gender: Male [ ] Female [ ]
2. Academic qualification.
   
   (i) M.Ed. [ ]
   (ii) B.Ed. [ ]
   (iii) Dip. Ed. [ ]
   (iv) Others [ ]
   
   For others specify……………………………………………………………………

3. Subject trained to teach  i)……………………………ii)…………………………
4. Teaching experience…………………………………………years
5. Indicate School category where you are teaching with a tick (√)
   
   County Boarding boys [ ], county boarding girls [ ], county mixed boarding [ ],
   Sub-county boarding boys [ ], sub county boarding girls [ ],
   Sub county mixed boarding [ ] Sub-county day [ ]
6. Do you prefer teaching in  a) Boys school [ ], b) Girls school [ ], c) Mixed school [ ]
SECTION B: EXISTENCE OF GENDER DIFFERENCES IN MATHEMATICS PERFORMANCE

7. Is there gender difference in mathematics performance?
   a. Yes
   b. No

8. If yes, on average, which gender performs better in mathematics?
   a. Male students
   b. Female students
   c. The performance changes between the genders

9. If boys outperform girls in mathematics, are there occasions when girls outperform boys in the subject?
   a. Yes
   b. No

10. If yes, how often does this happen?
    a. Very often
    b. Often
    c. Moderately
    d. Rarely
    e. Very rarely
    f. Not applicable

11. In which category of school do such girls come from mostly?
    a. County girls boarding
    b. County mixed boarding
c. Sub-county girls boarding  
d. Sub-county mixed boarding  
e. Mixed day school  
f. None  

12. Rate as strongly agree (SA), agree (A), neutral (N), disagree (D) and strongly disagree (SD) the following statement on gender differences in mathematics performance in this school.

<table>
<thead>
<tr>
<th>Statement</th>
<th>SD</th>
<th>D</th>
<th>N/S</th>
<th>A</th>
<th>SA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Most girls from county schools outperform boys in mathematics</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>All boys generally outperform girls in mathematics in this county</td>
<td></td>
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</tr>
<tr>
<td>Boys in county schools are always the best performers compared to girls in mathematics in the entire county</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Boys participate actively in mathematics lessons than girls in the county</td>
<td></td>
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<tr>
<td>Boys are more confident about solving mathematical problems than girls in the county</td>
<td></td>
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</tr>
<tr>
<td>Male students have more interest in mathematics as a subject than female students</td>
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</tr>
</tbody>
</table>

13. How can you rate the performance of students by gender in this school
SECTION C: INFLUENCE OF SCHOOL ENVIRONMENT ON GENDER DIFFERENCES IN MATHEMATICS PERFORMANCE

14. Which aspects of the school environment mainly influence gender differences on mathematics performance?

   a. Availability of mathematics teaching and learning resource
   b. Classroom management practices by teachers
   c. School discipline
   d. Mathematics teachers qualifications
   e. Mathematics teachers teaching experience
   f. School climate
   g. School leadership style
   h. Mathematics teachers teaching methodology
15. What kind of influence has the chosen school environmental factor had on students performance in mathematics?
   a. It has positively influenced girls performance
   b. It has had moderate improvement on girls performance
   c. It has had no influence on girls performance
   d. It has had negative influence on girls performance
   e. Not applicable

16. Which teaching methodology do you employ while teaching mathematics the most?
   a. Lecture method
   b. Group discussion
   c. Problem based method
   d. Chalk and board method
   e. Differentiated teaching methodology
   f. Cooperative teaching method
   g. Integrated teaching method
   h. Any other kindly state .................................................................

17. How has the mentioned approach influenced learners’ performance in mathematics by gender?
   a. It has greatly improved performance rate the following statements as
   b. It has improved performance
   c. It has had moderate improvement on performance
d. It has had negative impact on performance

e. It has had no effect on performance

18. Based on the influence of school environment on the performance of students in mathematics by gender in your school, kindly rate the following statements as strongly agree (SA), agree (A), neutral (N), disagree (D) and strongly disagree (SD).

<table>
<thead>
<tr>
<th>Statement</th>
<th>SD</th>
<th>D</th>
<th>N</th>
<th>A</th>
<th>SA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classroom management practices employed in this school has had positive influence on students performance in this school</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Availability of mathematics teaching and learning materials has positively influenced students performance in this school</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>School discipline has positively influenced students performance in this school</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>School climate has positively influenced students performance in this school</td>
<td></td>
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</tr>
<tr>
<td>Teaching methodology employed in teaching mathematics has greatly improved students performance in mathematics in this school</td>
<td></td>
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</tr>
<tr>
<td>Leadership styles employed in the school has greatly improved students performance in mathematics in this school</td>
<td></td>
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</tr>
</tbody>
</table>
Mathematics teachers qualifications in this school positively influence students performance in the subject

Mathematics teachers teaching experience in this school is positively related to students positive performance in the subject

SECTION D: MATHEMATICS TEACHER’S OPINION TOWARDS GENDER DIFFERENCE IN MATHEMATICS.

17. With regards to mathematics as a subject, what is your opinion on gender differences?
   a. The subject is more suited for boys
   b. Girls are more suited for the subject
   c. Both genders are suited for the subject
   d. Though students of all gender struggle with the subject girls fair worse in it
   e. Girls always require extra push in order to perform in mathematics compared to boys

18. What informs your held opinion (above) on gender difference in mathematics performance?
   a. They have continually underperformed in the subject compared to boys
   b. They have low focus when solving problems
   c. They are not active during lessons
   d. They often offer wrong answers during discussions
e. Girls rarely do their mathematics homework
f. Girls always require extra push in order to perform in mathematics compared to boys
g. Not applicable

19. How does your held opinion influence performance of male and female students (depending on school category you teach) in your school?

a. Greatly improves their performance
b. Improves their performance
c. Moderately influences on their performance
d. Has negative influence on their performance
e. Has had no effect on their performance

20. Please rate the following statements based on how your honest opinion influence gender difference in mathematics performance in your school. Tick ( √ ) the appropriate area. **Key:** SD - strongly disagree, D - disagree, N/S - not sure, A - agree, SA - strongly agree

<table>
<thead>
<tr>
<th>Statement</th>
<th>SD</th>
<th>D</th>
<th>N/S</th>
<th>A</th>
<th>SA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative opinion held by teachers about girls and mathematics causes them to give boys receive more mathematical Instructional time which improves boys performance in the subject and vice versa for the girls</td>
<td></td>
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</tr>
<tr>
<td>Teacher belief that mathematics if a man’s subject influences girls attitude towards the subject negatively</td>
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</tr>
</tbody>
</table>
leading to poor performance

Girls poor performance in mathematics is influenced by lack of commitment by teachers in ensuring that the girl child understands the lessons as they believe

Performance in mathematics of girls in pure girls’ school is the same as those of girls in mixed secondary schools?

Performance in mathematics of boys in pure boys’ school is the same as that of boys in mixed schools?

Performance in mathematics of girls in pure girls school is the same as that of boys in a pure boys schools

---

Thank you very much for the time and effort you have put in to responding to this questionnaire

SAMUEL K. MWALYA (RESEARCHER)
APPENDIX B: STUDENTS QUESTIONNAIRE (SQ)

This study seeks to establish facts behind gender differences in mathematics performance with an aim of coming up with remedies to close the gender gap. Your school is one of the few that have been selected for this study. Your honest response to this questionnaire will make this study a success. Information given will be treated with utmost confidentiality.

Instructions: tick ( √ ) or complete where appropriate.

SECTION A: STUDENTS INFORMATION

1. Gender: Boy [ ] Girl [ ]

2. Indicate School category where your school lies with a tick (√)
   i. county [ ]
   ii. Sub-county boarding [ ]
   iii. Sub-county day [ ]

SECTION B: EXISTENCE OF GENDER DIFFERENCES IN MATHEMATICS PERFORMANCE

3. Do you like mathematics? Yes [ ] No [ ]

4. How can you rate your performance in mathematics?
   a. Above average
   b. Average
   c. Below average
   d. Poor
5. Which of the following reasons best describes your above performance in the subject? Respond by stating whether you strongly agree (SA), agree (A), not applicable (NA), disagree (D) and strongly disagree (SD).

<table>
<thead>
<tr>
<th>STATEMENT</th>
<th>SD</th>
<th>D</th>
<th>N</th>
<th>A</th>
<th>SA</th>
</tr>
</thead>
<tbody>
<tr>
<td>I receive more mathematical instructional time</td>
<td></td>
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</tr>
<tr>
<td>I have less confidence in my ability to learn mathematics.</td>
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</tr>
<tr>
<td>Am asked more thought-provoking questions in mathematics by the teacher</td>
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</tr>
<tr>
<td>Am more confidence with the subject</td>
<td></td>
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</tr>
<tr>
<td>I am uncomfortable learning in Mixed classrooms</td>
<td></td>
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</tr>
<tr>
<td>I participate in lessons more as am always asked questions</td>
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</tr>
</tbody>
</table>

6. Given your answer above, which of the following statement

7. How much time do you spent in a day to?
   a) Solving mathematics problem?.....................................................................hrs
   b) Discussing mathematics problems with students.........................hrs
   c) Discussing mathematics problems with your teachers...........hrs

8. Is the performance in mathematics of boys and girls the same in secondary schools?
   Yes [    ] No [    ]

9. If No, on average, which gender performs better in mathematics?
   a. Male students
   b. Female students
c. The performance changes between the genders

10. If boys outperform girls in mathematics, are there occasions when girls outperform boys in the subject?
   a. Yes
   b. No

11. If yes, how often does this happen?
   a. Very often
   b. Often
   c. Moderately
   d. Rarely
   e. Very rarely
   f. Not applicable

12. In which category of school do such girls come from mostly?
   a. County girls boarding
   b. County mixed boarding
   c. Sub-county girls boarding
   d. Sub-county mixed boarding
   e. Mixed day school
   f. None

13. Is the performance of boys and girls in mathematics the same in the following school categories?
   (a) County school    yes [   ] No [   ]
   (b) Sub-county boarding schools    yes [   ] No [   ]
(c) Sub-county day schools  yes [ ] No [ ]

14. Rate as strongly agree (SA), agree (A), not applicable (NA), disagree (D) and strongly disagree (SD) the following statement on gender differences in mathematics performance in this school.

<table>
<thead>
<tr>
<th>Statement</th>
<th>SD</th>
<th>D</th>
<th>NA</th>
<th>A</th>
<th>SA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Most girls from county schools outperform boys in mathematics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All boys generally outperform girls in mathematics in this county</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boys in county schools are always the best performers compared to girls in mathematics in the entire county</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boys generally participate actively in mathematics lessons compared to girls in the county</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I personally perform well in mathematics</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Am very accurate while solving any mathematical questions</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>I struggle a lot while solving numerous mathematical problems</td>
<td></td>
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</tr>
<tr>
<td>I find mathematical formulas hard to remember leading to my underachievement in the subject</td>
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<td></td>
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</tr>
</tbody>
</table>
SECTION C: SCHOOL ENVIRONMENT AND PERFORMANCE IN MATHEMATICS

21. Which school environmental factor mainly influences your performance in mathematics?
   a. Teacher quality
   b. Teaching methodology
   c. Teacher classroom management practices
   d. Availability of teaching and learning resources for mathematics

19. What kind of influence has the chosen school environmental factor had on your performance in mathematics?
   a. It has positively influenced my performance
   b. It has had moderate improvement on my performance
   c. It has had no influence on my performance
   d. It has had negative influence on my performance
   e. Not applicable

20. Which teaching methodology has more positive influence on your performance in mathematics?
   a. Lecture method
   b. Group discussion
   c. Problem based method
   d. Chalk and board method
   e. Differentiated teaching methodology
   f. Cooperative teaching method
g. Integrated teaching method

h. Any other kindly state ........................................................................................................

21. Which teachers’ quality characteristics positively influence your performance in mathematics by gender?

a. Teachers experience teaching mathematics

b. Teachers positive interest in the subject

c. Teachers ability to chose the best teaching methodology

d. Teachers level of education

e. Teachers gender

f. Teachers chosen leadership style during lessons

22. How fair is your mathematics teacher when it comes to distribution of questions in classroom between boys and girls? Fairly distributed [ ] Not fair [ ]

23. If the answer for the question above is (Not fair) which group receives more attentions?

Boys [ ] Girls [ ].

24. Based on the influence of school environment on the performance of students in mathematics by gender in your school, kindly rate the following statements as strongly agree (SA), agree (A), neutral (N), disagree (D) and strongly disagree (SD).

<table>
<thead>
<tr>
<th>Statement</th>
<th>SD</th>
<th>D</th>
<th>NA</th>
<th>A</th>
<th>SA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classroom management practices employed in this school has had</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>positive influence on my performance</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Availability of mathematics teaching and learning materials</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
has positively influenced my performance

School discipline has positively influenced my performance

School climate has positively influenced my performance

Teaching methodology employed in teaching mathematics has greatly improved my performance in mathematics

Leadership styles employed in the school has greatly improved my performance in mathematics

Mathematics teachers qualifications in this school positively influence my performance in the subject

Mathematics teachers teaching experience in this school is positively related to my positive performance in the subject

Thank you very much for the time and effort you have put in to responding to this questionnaire
APPENDIX C: STUDENTS MATHEMATICS TEST (SMT)

Form three mathematics test

Instructions: Attempt all the questions in the spaces provided

Time 30 minutes

1. Without using a calculator, evaluate \[ \frac{-8 + (-5) \times (-8) - (-6)}{-3 + (-8) \div 2 \times 4} \] (2mks)

2. Using a pair of ruler and a compass construct an angle of 60° (3mks)

3. The data below represents marks scored by 10 students in a test. Find the mean, the mode and the median of the marks

7, 8, 9, 14, 13, 5, 10, 9, 11, 6

(3mks)

4. The wiper of a bus is 40cm long. It sweeps out through an angle of 120° on a flat windscreen. Calculate the distance moved by the tip of the wiper in one sweep (3mks)

5. A perpendicular to the line \( y - 4x + 3 = 0 \) passes through the point (-8,5) determine its equation (2mks)

6. Factorize completely \( 3x^2 - 2xy - y^2 \) (2mks)
### APPENDIX D: KANDARA SUB-COUNTY SCHOOLS LIST

<p>| S/NO | SCHOOL           | TYPE | 19  | 20  | 21  | 22  | 23  | 24  | 25  | 26  | 27  | 28  | 29  | 30  | 31  | 32  | 33  | 34  | 35  | 36  | 37  |
|------|------------------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 1    | GITHUGURI GIRLS  | C    |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 2    | GAICHANJIRU BOYS | C    |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 3    | ST CHARLES LWANGA| C    |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 4    | NAARO HIGH       | SCB  |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 5    | NGARARIA GIRL    | C    |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 6    | ST. PETERS BOYS  | SCB  |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 7    | GITURU SEC       | SCB  |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 8    | GITHUMU HIGH     | SCB  |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 9    | KIRANGA SEC      | SCB  |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 10   | GITHUMU MIXED    | SCB  |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 11   | KIHURUINI SEC    | SCB  |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 12   | MUKURIA SEC      | SCB  |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 13   | NGURUE-INI SEC   | SCB  |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 14   | KIANGARI SEC     | SCB  |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 15   | KIRIRWA SEC      | SCB  |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 16   | MUKERENJU SEC    | SCB  |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 17   | KANGUI SEC       | SCB  |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 18   | WANGAI SEC       | SCB  |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 19   | KIGUOYA SEC      | SCB  |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 20   | MOTHERU SEC      | SCB  |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 21   | GAKUI SEC        | SCB  |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 22   | MURUKA SEC       | SCB  |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 23   | KENYOHO SEC      | SCB  |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 24   | KARITI SEC       | SCB  |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 25   | GITHUNGURI       | SCB  |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 26   | GATHAGE SEC      | SCB  |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 27   | KIHURU-INI SEC   | SCD  |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 28   | NAARO MIXED SEC  | SCD  |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 29   | NGARARIA MIXED   | SCD  |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 30   | KIRONGORU        | SCD  |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 31   | MUNGARIA MIXED   | SCD  |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 32   | GATHAGE SEC      | SCD  |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 33   | KARIGU-INI SEC   | SCD  |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 34   | MAHUTIA SEC      | SCD  |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 35   | GICHAGI-INI SEC  | SCD  |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 36   | KARUGIA SEC      | SCD  |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 37   | KAGUTHI SEC      | SCD  |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |</p>
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**KEY:**
- C - COUNTY SCHOOLS.
- SCB - SUB-COUNTY BOARDING SCHOOLS.
- SCD - SUB-COUNTY DAY SCHOOLS.

*Source: Kandara sub-county education office (2012).*
APPENDIX E: AUTHORIZATION LETTER

KENYATTA UNIVERSITY
GRADUATE SCHOOL

E-mail: kubps@yahoo.com
       dean-graduate@ku.ac.ke
Website: www.ku.ac.ke

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

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Our Ref: E55/CE/23025/10

Date: 17th March, 2015

Dear Sir/Madam,

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

RE: RESEARCH AUTHORIZATION FOR MR. MWALYA S. KYAVOA—REG. NO. E55/CE/23025/10

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

Mr. Kyavoa intends to conduct research for a thesis Proposal entitled, “Gender Differences Performance in Mathematics at Secondary School Level in Kandara Sub-County, Muranga County, Kenya”.

Any assistance given will be highly appreciated.

Yours faithfully,

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

JMO/cao
APPENDIX F: RESEARCH AUTHORIZATION FROM NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

Telephone: +254-20-2213471, 2241349, 310571, 2219420
Fax: +254-20-318245, 318249
Email: secretary@nacosti.go.ke
Website: www.nacosti.go.ke
When replying please quote

Ref: No. 2

Date:
2nd April, 2015

NACOSTI/P/15/7687/5531

Samuel Kyavoa Mwalya
Kenyatta University
P.O. Box 43844-00100
NAIROBI.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on “Gender differences performance in mathematics at secondary school level in Kandara Sub-County, Muranga County, Kenya,” I am pleased to inform you that you have been authorized to undertake research in Murang’a County for a period ending 31st July, 2015.

You are advised to report to the County Commissioner and the County Director of Education, Murang’a County before embarking on the research project.

On completion of the research, you are required to submit two hard copies and one soft copy in pdf of the research report/thesis to our office.

DR. S. K. LANGAT, OGW FOR: DIRECTOR-GENERAL/CEO

Copy to:

The County Commissioner
Murang’a County.

The County Director of Education
Murang’a County.
APPENDIX G: RESEARCH PERMIT

THIS IS TO CERTIFY THAT:
MR. SAMUEL KYAVOA MWALYA
of KENYATTA UNIVERSITY, 784-1000 Thika, has been permitted to conduct research in Muranga County

on the topic: GENDER DIFFERENCES PERFORMANCE IN MATHEMATICS AT SECONDARY SCHOOL LEVEL IN KANDARA SUB-COUNTY, MURANGA COUNTY, KENYA.

for the period ending: 31st July, 2015

Applicant's Signature

Director General
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.

RESEARCH CLEARANCE PERMIT

Serial No. A 4784

CONDITIONS: see back page